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SAVANNAH HARBOR EXPANSION PROJECT CHATMAN COUNTY, GEORGIA AND JASPER COUNTY, SOUTH CAROLINA: FINAL GENERAL RE-EVALUATION REPORT AND ENVIRONMENTAL IMPACT STATEMENT JANUARY 2012

COMMUNICATION

FROM

THE ASSISTANT SECRETARY OF THE ARMY, CIVIL WORKS, THE DEPARTMENT OF DEFENSE

TRANSMITTING

THE CORPS' FINAL GENERAL RE-EVALUATION REPORT AND ENVIRONMENTAL IMPACT STATEMENT

PART 1 OF 15

NOVEMBER 9, 2012.—Referred to the Committee on Transportation and Infrastructure and ordered to be printed

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DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
CIVIL WORKS
108 ARMY PENTAGON
WASHINGTON DC 20310-0108

OCT 26 2012

Honorable John Boehner
Speaker of the House
of Representatives
U.S. Capitol Building, Room H-232
Washington, D.C. 20515-0001

Dear Mr. Speaker:

In response to section 101(b)(9) of the Water Resources Development Act (WRDA) of 1999, the Secretary of the Army recommends the Savannah Harbor Expansion Project (SHEP), Georgia and South Carolina, described in the supplemental report of the Chief of Engineers, dated August 17, 2012, for authorization. The Final General Re-evaluation Report (GRR) and Environmental Impact Statement (FEIS), dated January 2012 (updated July 2012), are submitted in fulfillment of the conditions in WRDA 1999, to provide detailed information on project features including mitigation, and support a statutory modification to increase the authorized total project cost. WRDA 1999 authorized construction subject to completion of a Chief's report, which was signed on October 21, 1999. Section 101(b)(9) stated that the project could only be carried out after:

> *(i) the Secretary, in consultation with affected Federal, State of Georgia, State of South Carolina, regional, and local entities, reviews and approves an environmental impact statement for the project that includes—*
> *(I) an analysis of the impacts of project depth alternatives ranging from 42 feet through 48 feet; and*
> *(II) a selected plan for navigation and an associated mitigation plan as required under section 906(a) of the Water Resources Development Act of 1986 (33 U.S.C. 2283(a)); and*
> *(ii) the Secretary of the Interior, the Secretary of Commerce, the Administrator of the Environmental Protection Agency, and the Secretary approve the selected plan and determine that the associated mitigation plan adequately addresses the potential environmental impacts of the project.*

The enclosed GRR and FEIS for the SHEP meet these requirements. Letters were received, in July 2012, from the Department of the Interior, the Department of Commerce and the Environmental Protection Agency approving the selected plan and the mitigation plan. The project would reduce the navigational and economic inefficiencies of light loading and tidal delays at Savannah Harbor by deepening the channel from its current depth of -42 feet to a depth of -47 feet Mean Lower Low Water (MLLW). The deeper channel would increase marine transportation savings by

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improving cargo loading efficiency for all commercial vessels and by allowing larger containerships with more capacity to call at the port.

The recommended plan would require dredging and subsequent placement of about 24 million cubic yards of new work sediments. Approximately 54 percent of this material would be deposited in existing upland dredged material containment areas (DMCAs) and about 46 percent would be deposited in the Environmental Protection Agency-approved Ocean Dredged Material Disposal Site or existing DMCAs. The selected plan for navigation improvements consists primarily of the following:

a. Extending the existing entrance channel 7.1 miles from Stations -60+000B to -97+680B and deepening to -49 feet MLLW from the new ocean terminus to Station -14B+000B, then deepening to -47 feet MLLW from Stations –14B+000B to 0+000 and, deepening the inner harbor to -47 feet MLLW from Stations 0+000 to 103+000;

b. Widening bends on the entrance channel at one location (Stations -23+000B to -14+000B) and in the inner harbor channel at two locations; (Stations 27+700 to 31+500, and Stations 52+250 to 55+000);

c. Constructing two meeting areas (Stations 14+000 to 22+000 and Stations 55+000 to 59+000);

d. Deepening and enlarging the Kings Island Turning Basin to a width of 1,600 feet; and

e. Restoring dredged material volumetric capacity in existing DMCAs.

A mitigation plan to address the environmental impacts is also included in the recommendation. The features of this plan include:

a. Construction of a fish bypass around the New Savannah Bluff Lock and Dam in Augusta, Georgia. Construction of this feature would compensate for loss of shortnose and Atlantic sturgeon habitats in the estuary by allowing the endangered shortnose sturgeon and the endangered Atlantic sturgeon access to historic spawning grounds at the Augusta Shoals that are currently inaccessible;

b. Construction of a series of flow re-routing features in the estuary to include a diversion structure, cut closures, removal of a tidegate structure, and construction of a rock sill and submerged sediment berm to minimize impacts to ecologically unique tidal freshwater wetlands;

c. Acquisition and preservation of 2,245 acres of freshwater wetlands;

d. Restoration of approximately 29 acres of tidal brackish marsh;

e. Construction of an oxygen injection system, to compensate for adverse effects on dissolved oxygen levels in the Savannah River estuary;

f. Construction of a raw water storage impoundment for the City of Savannah's industrial and domestic water treatment facility to offset increased chloride levels at the intake on Abercorn Creek during periods of low flow and high tide;

g. Construction of a boat ramp on Hutchinson Island to restore access to areas in Back River made inaccessible due to construction of the flow re-routing features;

h. One-time payment to Georgia Department of Natural Resources for a striped bass stocking program, to compensate for loss of striped bass habitat;

i. Recovery, documentation and curation of the items of historic significance of a Civil War ironclad (*CSS Georgia*), listed on the National Register of Historic Places;

j. Monitoring to ensure that (1) the impacts described in the FEIS are not exceeded, and (2) the dissolved oxygen and wetland mitigation features function as intended. Monitoring will occur prior to construction, during construction, and up to 10 years post-construction; and

k. Adaptive management would be implemented as outlined in the FEIS if monitoring indicates modification to the mitigation plan features is warranted. In accordance with the FEIS, an Adaptive Management Team would be established, with the active participation of the cooperating agencies, for the purpose of effectively implementing the mitigation plan.

The Georgia Department of Transportation will act as the non-Federal sponsor for the implementation of the project. Based on October 2011 (FY12) price levels, the estimated project first cost is $652,000,000, which includes the cost of constructing the General Navigation Features (GNFs) and the value of lands, easements, rights of-way and relocations (LERRs) estimated as follows: $257,000,000 for channel modification and dredged material placement; $311,000,000 for environmental and other mitigation; $84,000,000 for pre-construction engineering and design and construction management, and $163,000 for the value of LERRs (except utility relocations, of which there are none) provided by the non-Federal sponsor. Included within the environmental mitigation costs are $35,600,000 for monitoring and $24,600,000 for adaptive management. The estimated Federal and non-Federal shares of the project first cost are $454,000,000 and $198,000,000, respectively, as apportioned in accordance with the cost sharing provisions of section 101(a)(1) of WRDA 1986, as amended (33 U.S.C. 2211(a)(1)).

The additional annual costs of operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) for the recommended plan are estimated to be $5,100,000. In accordance with section 101(b)(1) of WRDA 1986, as amended (33 U.S.C. 2211(b)(1)), the non-Federal sponsor and the Federal government would each be responsible for 50 percent of the costs of OMRR&R for that portion of the project that exceeds a depth of -45 feet MLLW. This cost is estimated at $303,000, with the non-Federal sponsor's share being $152,000 and the Federal government's share being the remaining $152,000. As specified in the 1999 Chief's report, the costs of OMRR&R for the raw water storage impoundment would remain a City of Savannah responsibility and would

not be operated or maintained as a project GNF. The OMRR&R would be considered separate from the GNF related OMRR&R and there is no Federal cost sharing requirement for this feature. Similarly, the boat ramp on Hutchinson Island would be transferred to a local entity upon completion of construction and the local entity would be responsible for the OMRR&R. Lands acquired for wetland preservation would be transferred to the Savannah National Wildlife Refuge and the OMRR&R costs would be borne by the Department of the Interior, with no Federal Corps cost sharing requirement.

The recommended project is expected to significantly increase navigational transportation efficiencies. Based on October 2011 price levels, a 4 percent discount rate, and a 50-year period of analysis, the total equivalent average annual costs of the -47 foot depth project are estimated to be $38,900,000. The average annual equivalent benefits are estimated to be $213,100,000. Average annual net benefits are $174,200,000 and the benefit cost ratio for the recommended plan is 5.5 to 1.

The FEIS contains a Clean Water Act (CWA) subsection 404(b)(1) evaluation and documents that the recommended plan is in compliance with the CWA requirement for a CWA section 401 water quality certificate from any State whose waters would be affected by the discharge of dredged or fill material. The Corps obtained water quality certificates from the States of Georgia and South Carolina on February 16, 2011 and November 15, 2011, respectively. The Corps will comply with all of the applicable conditions outlined in each of these certificates. However, one of the certificates has become the subject of litigation within the state of issuance. Consequently, I am seeking a CWA subsection 404(r) exemption in order to prevent inappropriate delays to this project due to pending litigation. Therefore, when the Congress authorizes this project or next appropriates funds for construction after receipt of this FEIS, it would be providing an exemption from Section 401 of the CWA.

The Office of Management and Budget (OMB) advises that there is no objection to the submission of the report to Congress and concludes that the report recommendation is consistent with the policy and programs of the President. OMB also advises that should Congress authorize this project for construction, the project would need to compete with other proposed investments in future budgets. A copy of OMB's letter, dated October 23, 2012, is enclosed. I am also providing a copy of this letter and a complete report package to the Authorization and Appropriations Committees of both the House and the Senate, because of the CWA subsection 404(r) exemption request. I am also sending an identical letter to the President of the Senate.

Very truly yours,

Jo-Ellen Darcy
Assistant Secretary of the Army
(Civil Works)

Enclosures

8 Enclosures

1. Record of Decision
2. Letter, OMB, Oct 23, 2012
3. Report of the Chief of Engineers, Aug 17, 2012
4. Letter, GA DOT, Feb 9, 2012
5. Approval letter, DOC Jul 5, 2012
6. Approval letter, DOI, Jul 9, 2012
7. Approval letter, EPA, Jul 11, 2012
8. Savannah Harbor Report Savannah Harbor Extension Project Final GRR and EIS (CD), January 2012 (Revised July 2012)

RECORD OF DECISION
SAVANNAH HARBOR EXPANSION PROJECT
Georgia and South Carolina

The Final General Re-Evaluation Report (GRR) and the Final Environmental Impact Statement (FEIS) for the Savannah Harbor Expansion Project, both of which are dated January 2012 and were revised in July 2012, address the need for navigation improvements to the existing Savannah Harbor Navigation Project, Georgia and South Carolina. The final recommendation is contained in the report of the Chief of Engineers, dated August 17, 2012. Based on these reports, the reviews of State and local agencies, the approval of other Federal agencies, input from the public, and the review by my staff, I find the plan recommended by the Chief of Engineers to be technically feasible, economically justified, cost effective, in accordance with applicable environmental statutes, and in the public interest. Thus, I approve the Savannah Harbor Expansion Project for construction.

The selected plan is the National Economic Development plan, which consists of deepening the harbor to an authorized depth of -47 feet Mean Lower Low Water (MLLW) in the inner harbor and to -49 feet MLLW in a portion of the ocean channel.

Specific General Navigation Features include:

a. Extending the existing entrance channel 7.1 miles from Station -60+000B to Station -97+680B and deepening to -49 feet MLLW from the new ocean terminus to Station -14+000B, then deepening to -47 feet MLLW from Station –14+000B to Station 0+000, and deepening the inner harbor to -47 feet MLLW from Station 0+000 to Station 103+000;
b. Widening bends on the entrance channel at one location (Stations -23+000B to -14+000B) and in the inner harbor channel at two locations: (Stations 27+700 to 31+500, and Stations 52+250 to 55+000);
c. Construction of two meeting areas (Stations 14+000 to 22+000 and Stations 55+000 to 59+000);
d. Deepening and enlarging the Kings Island Turning Basin to a width of 1,600 feet; and
e. Replacing dredged material storage capacity in existing dredged material containment areas.

Compensatory mitigation features include:

a. Construction of a fish bypass around the New Savannah Bluff Lock and Dam in Augusta, Georgia;
b. Construction of a series of flow re-routing features in the estuary to include a diversion structure, cut closures, removal of a tidegate structure, and construction of a rock berm and submerged sill;

Encl 1

c. Acquisition and preservation of 2,245 acres of freshwater wetlands (bottomland hardwoods;
d. Restoration of 28.75 acres of tidal brackish marsh;
e. Installation of an oxygen injection system;
f. Construction of a raw water storage pond for the City of Savannah's industrial and domestic water treatment facility;
g. Construction of a boat ramp;
h. One-time payment to the Georgia Department of Natural Resources Striped Bass Stocking Program;
i. Recovery, documentation and curation of items of historic significance of a Civil War ironclad;
j. Monitoring to ensure that (1) the impacts described in the FEIS are not exceeded, and (2) the mitigation features function as intended; and
k. Adaptive management to modify mitigation features, if necessary.

Operation and maintenance of these mitigation features will continue to be a project responsibility except for the following: the preserved lands will be transferred to the U.S. Fish and Wildlife Service and become part of the Savannah National Wildlife Refuge; the raw water storage pond will be transferred to the City of Savannah; and the boat ramp will be transferred to Chatham County, Georgia. The payment to the Striped Bass Stocking Program is a one-time payment and does not involve any operation or maintenance.

The GRR and the FEIS incrementally evaluated various structural and non-structural alternatives, including alternative terminal locations, to address navigational problems and inefficiencies in Savannah Harbor due to the existing -42-foot MLLW channel depth. All of the alternatives from the GRR and the FEIS are hereby incorporated by reference in this Record of Decision (ROD). Only structural methods within the existing harbor were carried into the detailed planning phase. In addition to the "No Action" plan, the environmental effects of 5 depth alternatives were examined in detail: -44, -45, -46, -47, and -48 feet MLLW. The FEIS assessed the impacts expected to wetlands, fisheries, benthic communities, birds, marine mammals, endangered species, water quality, cultural resources, historic properties, and other environmental factors for each depth alternative. Based upon the findings of the FEIS, the No Action plan is considered to be the environmentally preferable alternative, but it does not address the project purpose and need. After full consideration of the environmental, engineering, and economic analyses, the U.S. Army Corps of Engineers (Corps) identified the -47-foot MLLW depth alternative as the plan that maximizes net economic benefits to the Nation and fully complies with Army policy.

All practicable means to avoid and/or minimize adverse impacts to environmental resources were analyzed and incorporated into the selected plan. After avoiding and minimizing impacts where possible, mitigation of significant adverse impacts to natural resources that could not be avoided was included in the mitigation plan. The mitigation plan included in the FEIS was designed in part to address direct impacts to tidal brackish marshes that would occur as a result of dredging. Also, mitigation is included

for unavoidable indirect impacts such as loss of shortnose and Atlantic sturgeon habitats, loss of striped bass habitats, conversion of tidal freshwater and salt marsh, reduction in dissolved oxygen levels in the inner harbor, and increased chloride levels at the City of Savannah's industrial and domestic water supply intake. The impact analyses, alternatives considered, and mitigation planning procedures are addressed in detail in the FEIS. All mitigation features will be implemented in accordance with the mitigation plan described in the FEIS. The Corps will install, operate and maintain the dissolved oxygen system in accordance with the project mitigation plan, subject to Congressional appropriation of funds for the project.

A cultural resource mitigation plan is included for the *CSS Georgia* that is listed on the National Register of Historic Places. The *CSS Georgia* is a Confederate ironclad resting on the bottom of the Savannah River inside the navigation channel dredging prism. In recognition of the project's impacts on the vessel, the project would recover and document the site's items of historic significance. A Programmatic Agreement is included in the FEIS that describes how cultural and historic resources will be addressed during implementation of the project. Execution and implementation of the Agreement is a feature of the project and will ensure compliance with the Federal laws protecting these resources.

The Draft GRR and EIS were circulated for public review for 45 days starting November 15, 2010. The comment period was extended for 15 days and officially closed on January 25, 2011. In addition to comments from the Federal and State natural resource agencies, over 1,100 respondents submitted comments on the draft reports. Some Federal agencies expressed several environmental concerns, including the length of the post-construction monitoring period, the proposed mitigation for impacts to wetlands and shortnose sturgeon habitat, and funding assurance for the mitigation monitoring and adaptive management. Numerous coordination meetings were held to address agency and public comments, the detailed responses to which are included in the FEIS.

The Final GRR and FEIS were circulated for public review starting April 20, 2012. After receiving extension requests, the comment period was extended for 15 days and officially closed on June 5, 2012. Approximately 45 respondents submitted National Environmental Policy Act (NEPA) review comments. Minor revisions were made to the reports to correct errors or omissions identified by the respondents.

The FEIS contains a Clean Water Act (CWA) subsection 404(b)(1) evaluation and documents that the recommended plan is in compliance with the CWA requirement for a CWA section 401 water quality certificate from any State whose waters would be affected by the discharge of dredged or fill material. The Corps obtained water quality certificates from the States of Georgia and South Carolina on February 16, 2011 and November 15, 2011, respectively. The Corps will comply with all of the applicable conditions outlined in each of these certificates. However, one of the certificates has become the subject of litigation within the state of issuance. Consequently, I am seeking a CWA subsection 404(r) exemption in order to prevent inappropriate delays to

this project due to pending litigation. Therefore, when the Congress authorizes this project or next appropriates funds for construction after receipt of this FEIS, it would be providing an exemption from section 401 of the CWA.

Congress conditionally authorized deepening Savannah Harbor up to an additional 6 feet in section 101(b)(9) of Water Resources Development Act (WRDA) of 1999 if a favorable Chief's report was completed no later than December 31, 1999. The Chief's report was completed on October 21, 1999. Section 101(b)(9) also mandated that the project could only be carried out after: (1) completion of an environmental impact statement, including an analysis of impacts of project depth alternatives and a recommended plan for navigation and associated mitigation; (2) approval of the selected plan by the Secretary of the Interior, the Secretary of Commerce, the Secretary of the Army, and the Administrator of the Environmental Protection Agency; and (3) a determination by those Secretaries and the Administrator that the associated mitigation plan adequately addressed the potential environmental impacts of the project. In addition to these statutory requirements, the Chief's report imposed further study requirements. The GRR and the FEIS satisfy all of the WRDA 1999 statutory provisions, NEPA, and the direction in the 1999 Chief's report.

Technical and economic criteria specified in the Water Resource Council's Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies were used in the formulation of alternative plans. All applicable laws, executive orders, regulations, and local government plans as detailed in the FEIS were considered in the evaluation of alternatives. This ROD completes the NEPA compliance process for the project.

October 26, 2012
Date

Jo-Ellen Darcy
Assistant Secretary of the Army
(Civil Works)

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

October 23, 2012

The Honorable Jo-Ellen Darcy
Assistant Secretary of the Army (Civil Works)
108 Army Pentagon
Washington, DC 20310-0108

Dear Ms. Darcy:

As required by Executive Order 12322, the Office of Management and Budget has reviewed a January 2012 Army Corps of Engineers General Re-evaluation Report (report) that proposes to deepen the main channel of the Port of Savannah to 47 feet and construct certain other improvements, at a first cost of $652 million (October 2011 prices). Based on our review, we conclude that your recommendation for authorization of construction of this project is consistent with the policy and programs of the President

The report bases its recommendations on an evaluation of a range of possible depths for this port's main navigation channel. We are interested in continuing discussions with you about the relationship between an analysis of this kind, which considers the effects of the further development of one port, and a broader systems-based approach, which could inform decisions on a series of such investments in the same geographic area.

The Office of Management and Budget does not object to your submitting the report for this project to the Congress. When you do so, please advise the Congress that should the Congress authorize the project, the project would need to compete with other proposed investments in future Budgets.

Sincerely,

Paul Shawcross
Acting Deputy Associate Director
Energy, Science, and Water

Encl 2

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20314-1000

CECW-PC (1105-2-10a) AUG 17 2012

SUBJECT: Savannah Harbor Expansion Project, Georgia and South Carolina

THE SECRETARY OF THE ARMY

1. I submit for transmission to Congress my report on the Savannah Harbor Expansion Project, Georgia and South Carolina, which describes navigation improvements to the existing Savannah Harbor Navigation Project. It is accompanied by the report of the district and division engineers. The General Re-Evaluation Report and Final Environmental Impact Statement (GRR/FEIS) evaluate the advisability of increasing the channel depth, providing environmental mitigation to offset project impacts and making other improvements to Savannah Harbor in the interest of navigation and related purposes. Both the GRR and the FEIS are in response to Section 101(b)(9) of the Water Resources Development Act (WRDA) of 1999. This provision authorized construction substantially in accordance with a Chief's Report to be completed no later than December 31, 1999. The required Chief's Report was signed on October 21, 1999. Section 101(b)(9) also mandated that before the project could be carried out, the Secretary, in consultation with affected State and Federal agencies, formulate an analysis of the impacts of project depth alternatives ranging from -42 feet to -48 feet, along with a recommended plan for navigation and an associated mitigation plan, to be approved jointly with the Department of the Interior, the Department of Commerce and the Environmental Protection Agency (EPA). This report is submitted in fulfillment of these conditions, so that the project may be carried out in accordance with the WRDA 1999 authorization, subject to the requested statutory modification to increase the authorized total project cost, as described in paragraph 10 below.

2. The report recommends implementation of a project that will contribute to the economic efficiency of commercial navigation. Savannah Harbor is a deep draft navigation harbor located on the South Atlantic U.S. coast, 75 statute miles south of Charleston Harbor, South Carolina, and 120 miles north of Jacksonville Harbor, Florida. The Harbor comprises the lower 21.3 miles of the Savannah River (which, with certain of its tributaries, forms the boundary between Georgia and South Carolina along its entire length of 313 miles) and 11.4 miles of channel across the bar to the Atlantic Ocean. Improvements were considered from deep water in the ocean upstream to the area of the Garden City Terminal operated by the Georgia Ports Authority. The recommended plan will result in transportation cost savings by allowing the larger Post-Panamax vessels to operate more efficiently and experience fewer tidal and transit delays. The Georgia Department of Transportation is the non-Federal cost sharing sponsor.

3. The reporting officers recommend construction of a -47 foot Mean Lower Low Water (MLLW) depth alternative plan to modify the existing Savannah Harbor Navigation Project. The selected plan would require dredging and subsequent placement of 24 million cubic yards of new work sediments. Approximately 54% of this sediment would be deposited in existing upland

Encl 3

dredged material containment areas (DMCAs) and about 46% would be deposited in the US Environmental Protection Agency-approved Ocean Dredged Material Disposal Site (ODMDS) or an existing DMCA. The required Site Management and Monitoring Plan for the Savannah ODMDS must be completed and signed by the EPA and the Corps before the EPA can issue a concurrence for disposal of material from the SHEP into the Savannah ODMDS. Any portion of this material that does not meet the Ocean Dumping Criteria must be placed within an upland Confined Disposal Facility (CDF) that has sufficient capacity for the volume of proposed dredged material that does not meet the Ocean Dumping Criteria. The selected plan for navigation improvements consists primarily of the following:

a. Extending the existing entrance channel 7.1 miles from Stations -60+000B to -97+680B and deepening to -49 feet MLLW from the new ocean terminus to Station -14B+000B, then deepening to -47 feet MLLW from Station –14B+000B to Station 0+000 and, deepening the inner harbor to -47 feet MLLW from Station 0+000 to 103+000;

b. Widening bends on the entrance channel at one location (Stations -23+000B to -14+000B) and in the inner harbor channel at two locations; (Stations 27+700 to 31+500, and Stations 52+250 to 55+000);

c. Constructing two meeting areas (Stations 14+000 to 22+000 and Stations 55+000 to 59+000);

d. Deepening and enlarging the Kings Island Turning Basin to a width of 1,600-feet;

e. Restoring dredged material volumetric capacity in existing DMCAs; and

f. A mitigation plan which includes the features described below.

Other prior authorized features of the existing Savannah Harbor Navigation Project located beyond the limits described above in paragraph 3 would remain unchanged by the selected plan of improvement and would remain components of the Savannah Harbor Navigation Project.

4. The mitigation plan includes the following features:

a. Construction of a fish bypass around the New Savannah Bluff Lock and Dam in Augusta, Georgia. Construction of this feature would compensate for loss of shortnose and Atlantic sturgeon habitat in the estuary, by allowing the endangered shortnose sturgeon and the endangered Atlantic sturgeon access to historic spawning grounds at the Augusta Shoals that are currently inaccessible;

b. To minimize impacts to ecologically unique tidal freshwater wetlands in the estuary, construction of a series of flow re-routing features in the estuary to include a diversion structure, cut closures, removal of a tidegate structure, and construction of a rock sill and submerged sediment berm;

c. Acquisition and preservation of 2,245 acres of wetlands;

d. Restoration of approximately 28.75 acres of tidal brackish marsh;

e. Installation of an oxygen injection system, to compensate for adverse effects on dissolved oxygen levels in the Savannah River estuary;

f. Construction of a raw water storage impoundment for the City of Savannah's industrial and domestic water treatment facility, to offset increased chloride levels at the intake on Abercorn Creek during periods of low flow and high tide;

g. Construction of a boat ramp on Hutchinson Island to restore access to areas in Back River made inaccessible due to construction of the flow re-routing features;

h. One-time payment to Georgia Department of Natural Resources (GA DNR) for a Striped bass stocking program, to compensate for loss of Striped bass habitat;

i. Recover, document, and curate the items of historic significance of a Civil War ironclad (*CSS Georgia)*, listed on the National Register of Historic Places;

j. Monitoring to ensure that (1) the impacts described in the FEIS are not exceeded, and (2) the dissolved oxygen and wetland mitigation features function as intended. Monitoring will occur pre-construction, during construction, and up to 10 years post-construction; and

k. Adaptive management be implemented as outlined in the FEIS to (1) review the results of dissolved oxygen (DO) monitoring as well as the success of wetlands mitigation, and (2) modify features if necessary. In accordance with the FEIS, an Adaptive Management Team will be established, with the active participation of the cooperating agencies, for the purpose of effectively implementing the monitoring and adaptive management plan related to DO levels in the system and wetlands mitigation, and to ensure that the wetlands mitigation requirements and DO levels are met in the system.

5. The Project Cost Breakdown based on October 2011 Prices is estimated as follows:

a. Project First Cost. The estimated project first cost is $652,000,000, which includes the cost of constructing the General Navigation Features (GNFs) and the value of lands, easements, rights of-way and relocations estimated as follows: $257,000,000 for channel modification and dredged material placement; $311,000,000 for environmental and other mitigation; $84,000,000 for pre-engineering and design and construction management; and $163,000 for the value of lands, easements, rights-of-way, and relocations (except utility relocations) provided by the non-Federal sponsor. Included within the environmental mitigation costs is $35,600,000 for monitoring and $24,600,000 for adaptive management. To the extent appropriated by Congress, monitoring and adaptive management will be implemented as outlined in the FEIS, including the Corps commitments for the dissolved oxygen mitigation system and wetlands mitigation.

b. Estimated Federal and Non-Federal Shares. The estimated Federal and non-Federal shares of the project first cost are $454,000,000 and $198,000,000, respectively, as apportioned in accordance with the cost sharing provisions of Section 101(a)(1) of WRDA 1986, as amended (33 U.S.C. 2211(a)(1)), as follows:

(1) The costs for the deepening of the GNFs from -42 to -45 feet MLLW will be shared at the rate of 75 percent by the Government and 25 percent by the non-Federal sponsor. Accordingly, the Federal and non-Federal shares of the estimated $509,000,000 cost in this zone are estimated to be $383,000,000 and $126,000,000, respectively.

(2) The costs for the deepening of the GNFs from -45 to -47 feet MLLW will be shared at the rate of 50 percent by the Government and 50 percent by the non-Federal sponsor. Accordingly, the Federal and non-Federal shares of the estimated $143,000,000 cost in this zone are estimated to be $71,500,000 and $71,500,000, respectively.

(3) As a condition of issuance of the Section 401 Water Quality Certification by the South Carolina Department of Health and Environmental Control (DHEC), the potential non-Federal sponsor, the Georgia Ports Authority (GPA), agreed to provide financial assurance, in a manner acceptable to DHEC, that it will fund operation and maintenance of the Dissolved Oxygen system in any year that sufficient federal funds for the operation and maintenance of the system are not made available. This obligation extends for the life of the project. The GPA intends to place its full share of funds for adaptive management in an escrow account during project construction.

(4) The Savannah Harbor Expansion Project complies with Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations, dated February 11, 1994. By letter dated July 10, 2012, the GPA has indicated that it intends to establish, with the assistance of the EPA, a community advisory group that meets periodically to identify and address community concerns or recommendations that may arise associated with ongoing port activities. GPA will also facilitate sustainability by pursuing electrification of port infrastructure, reduced idling at distribution centers, and fleet upgrades under the SmartWay Port Drayage Truck program. In addition, in consultation with EPA Region 4 and the Georgia Environmental Protection Division, the GPA intends to conduct an air monitoring study not to exceed one year at no more than four monitoring sites, to evaluate any potential impacts on surrounding communities. This study would occur once the project is complete and GPA is serving Post-Panamax ships in normal operations. These efforts by the GPA are not included in the project costs. In cooperation with this effort, the Corps will provide technical assistance to the community to help explain scientific data or findings related to ongoing port activities and studies. The federal technical assistance is included in the estimated project costs.

c. In addition to payment by the non-Federal sponsor of its share of costs as estimated and addressed in sub-paragraphs b.(1) and (2), the estimated non-Federal share of $198,000,000 includes $163,000 for the estimated value of lands, easements, rights-of-way, and relocations

(except utility relocations) that it must provide pursuant to Section 101(a)(3) of WRDA 1986, as amended (33 U.S.C. 2211(a)(3)).

d. Additional 10 Percent Payment. In addition to the non-Federal sponsor's estimated share of the project first cost determined in b. above, pursuant to Section 101(a)(2) of WRDA 1986, as amended (33 U.S.C. 2211(a)(2)), the non-Federal sponsor must pay an additional 10 percent of the cost of the GNFs of the project in cash over a period not to exceed 30 years, with interest. The additional 10 percent payment is estimated to be $65,000,000 before interest is applied. The value of lands, easements, rights-of-way, and relocations, estimated at $163,000, provided by the non-Federal sponsor under Section 101(a)(3) of WRDA 1986, as amended (33 U.S.C. 2211(a)(3)), and the costs of utility relocations borne by the non-Federal sponsor under Section 101(a)(4) of WRDA 1986, as amended (33 U.S.C. 2211(a)(4)), will be credited toward payment of this amount.

e. Operation and Maintenance Costs. The additional annual cost of operation and maintenance for this recommended plan is estimated to be $5,100,000. In accordance with Section 101(b)(1) of WRDA 1986, as amended (33 U.S.C. 2211(b)(1)), the non-Federal sponsor will be responsible for an amount equal to 50 percent of the excess of the cost of the operation and maintenance of the project over the cost which would be incurred for operation and maintenance of the project if the project had a depth of -45 feet MLLW. The incremental increase in annual cost attributable to operation and maintenance for the depth in excess of -45 feet MLLW is $303,000 with the non-Federal sponsor responsible for $152,000. As specified in the 1999 Report of the Chief of Engineers, the costs of operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) of the modified City of Savannah water system will remain a City of Savannah responsibility and will not be operated and maintained as a project General Navigation Feature. Similarly, the boat ramp on Hutchinson Island will be transferred to a local entity upon completion of construction. The local entity will be responsible for the OMRR&R. Lands acquired for wetland preservation would be transferred to the Savannah National Wildlife Refuge and the OMRR&R costs would be borne by the US Fish and Wildlife Service. The project will also make a one-time payment to the existing GA DNR Striped bass Stocking Program. This action has no associated OMRR&R costs. Other project mitigation features to address the adverse impacts of the project will be operated and maintained in the same manner as other GNF are operated and maintained.

f. Associated Costs. Estimated associated costs of $7,700,000 include $2,600,000 in non-Federal costs associated with development of local service facilities (including dredging of berthing areas); and $5,100,000 for navigation aids (a U.S. Coast Guard expense).

g. Authorized Project Cost and Section 902 Calculation. The project first cost, for the purposes of calculating the maximum cost of the project pursuant to Section 902 of WRDA 1986, as amended, includes the cost of constructing the GNFs and the value of lands, easements, and rights-of-way. Accordingly, as set forth in paragraph a, above, based on October 2011 prices, the estimated project first cost for these purposes is $652,000,000 with an estimated Federal share of $454,000,000 and an estimated non-Federal share of $198,000,000.

CECW-PC
SUBJECT: Savannah Harbor Expansion Project, Georgia and South Carolina

6. Based on October 2011 price levels, a 4-percent discount rate, and a 50-year period of analysis, the total equivalent average annual costs of the -47 foot depth project are estimated to be $38,900,000. The average annual equivalent benefits are estimated to be $213,100,000. The average annual net benefits are $174,200,000. The benefit-to-cost ratio for the recommended plan is 5.5:1.

7. Section 119 of the Energy and Water Development Appropriations (EWDA), 2003, Division D of Public Law 108-7, authorizes the Secretary of the Army, acting through the Chief of Engineers, to credit toward the non-Federal share of the cost of the Savannah Harbor Expansion Project, authorized by Section 101(b)(9) of WRDA 1999, an amount equal to the Federal share of the costs incurred by the non-Federal interests subsequent to project authorization to the extent that the Secretary determines such costs were necessary to ensure compliance with the conditions of the project authorization. Of the project total costs, an estimated $23,000,000 is included for the creditable work. The non-Federal sponsor will receive credit in accordance with cost sharing for Navigation projects as provided for in WRDA 1986.

8. Risk and Uncertainty. Uncertainties were evaluated for economic benefits, costs, environmental impacts, mitigation effect, and sea-level change. The economic sensitivity analysis concluded that a Jasper County terminal would not have a significant effect on the recommendation. In addition, sensitivities to commodity forecasts, vessel availability and loadings confirmed that the improvements to Savannah Harbor are economically beneficial. Consideration was given to uncertainties that exist in the ability to predict the impacts from the proposed harbor deepening alternatives. In accordance with the Corps Engineering Circular EC 1165-2-212 on sea level change, the study performed an analysis of three Sea Level Rise (SLR) rates. The baseline estimate representing the minimum expected sea level change is 0.5-feet. The intermediate estimate is 0.9-feet and the high estimate representing the maximum expected sea level change is 2.3-feet. No impact from sea-level rise uncertainty is expected regarding the dredging, because dredging depths are relative to the Mean Lower Low Water datum, which changes with sea level. Structural features also carry minimal risk from sea-level rise as they are designed to function over a wide range of stages. Sea-level rise has a minor risk of the project over-mitigating from chloride impacts. Other uncertainties, examined in regards to environmental mitigations (dissolved oxygen, biological response), showed little risk.

9. In accordance with the Corps Engineering Circular EC 1165-2-209 on review of decision documents, all technical, engineering and scientific work underwent an open, dynamic and vigorous review process to ensure technical quality. This included District Quality Control (DQC), Agency Technical Review (ATR), Policy and Legal Compliance Review, Cost Engineering Directory of Expertise (DX) Review and Certification, Model Review and Approval and Type I Independent External Peer Review (IEPR). Concerns expressed by the ATR team have been addressed and incorporated into the final report. The IEPR was completed by Battelle Memorial Institute. A total of 24 comments on the report and one comment on the responses to agency and public comments were documented. The IEPR panel considered eight of the comments of medium significance and the others as low significance. The comments were related to plan formulation, commodity forecasts, modeling, beneficial uses, impacts, risks and uncertainties, contingency, and sea-level rise. In response, sections in the main report and EIS

were expanded to include additional information. The final IEPR Report was completed in February 2011.

10. The project was authorized in Section 101(b)(9) of WRDA 1999 to be carried out at a total cost of $230,174,000. When escalated to October 2011 price levels in accordance with the procedure set out in ER 1105-2-100, Appendix G, implementing Section 902 of WRDA 1986, the authorized total project cost amounts to $469,000,000. The current estimated first cost of $652,000,000 exceeds that amount by more than 20 percent, necessitating a statutory modification to the project to increase its authorized total cost.

11. Washington level review indicates that the plan recommended by the reporting officers is technically sound, environmentally and socially acceptable, and on the basis of Congressional directives, economically justified. The plan complies with all essential elements of the U.S. Water Resources Council's Economic and Environmental Principles and Guidelines for Water and Land Related Resources Implementation Studies. The recommended plan complies with other administration and legislative policies and guidelines. The views of interested parties, including Federal, State and local agencies, have been considered. State and agency comments received during review of the final report/environmental assessment included concerns raised by the National Marine Fisheries Service, the United States Environmental Protection Agency and the Department of Interior which ranged from funding concerns, to the recent listing of the Atlantic sturgeon and the possible presence of hard bottoms in or near the project footprint to real estate transfer information. These concerns were addressed through coordination and USACE responses dated July 11, 2012. Comments were also received from state of Georgia which were generally in support of the project and recognized that earlier comments had been addressed in the final document. Two entities from the state of South Carolina provided comments expressing their preference for the -45 foot alternative and their concerns regarding the environmental effects. Reponses were provided re-iterating the considerations during the planning process and the extensive coordination that occurred regarding environmental effects and mitigation with the natural resource agencies. In compliance with Section 101(b)(9) of WRDA 1999, representatives of the Secretary of the Interior, the Secretary of Commerce, and the Administrator of the Environmental Protection Agency approve the selected plan and have determined that the associated mitigation plan adequately addresses the potential environmental impacts of the project.

12. I concur with the findings, conclusions, and recommendations of the reporting officers. Accordingly, I recommend that the plan to improve navigation in the Savannah Harbor be authorized in accordance with the reporting officers' selected plan at an estimated cost of $652,000,000 with such modifications as in the discretion of the Chief of Engineers may be advisable. My recommendation is subject to cost sharing, financing, and other applicable requirements of Federal and State laws and policies, including WRDA 1986, as amended (33 U.S.C. 2211). The non-Federal sponsor would provide the non-Federal cost share and all lands, easements, and rights-of-way, including those necessary for the borrowing of material and the disposal of dredged or excavated material, and would perform or assure the performance of all relocations, including utility relocations. This recommendation is subject to the non-Federal sponsor's agreeing in a Project Partnership Agreement, prior to project implementation, to

comply with all applicable Federal laws and policies, including but not limited to the following requirements:

a. Provide, during construction, funds necessary to make its total contribution for commercial navigation, when added to the non-Federal contribution that may be afforded credit pursuant to Section 119 of the EWDA, 2003, equal to:

(1) 25 percent of the cost of construction of the GNFs attributable to dredging to a depth in excess of -20 feet MLLW but not in excess of -45 feet MLLW, plus

(2) 50 percent of the costs attributable to dredging to a depth over -45 feet MLLW;

b. Place the estimated non-Federal sponsor's share of the monitoring and adaptive management costs (paragraph 4, j and k) in an escrow account at the time the Project Partnership Agreement is executed.

c. Provide all lands, easements, and rights-of-way (LER), including those necessary for the borrowing of material and the disposal of dredged or excavated material, and perform or assure the performance of all relocations, including utility relocations, all as determined by the Federal Government to be necessary for the construction or operation and maintenance of the GNFs;

d. Pay with interest, over a period not to exceed 30 years following completion of the period of construction of the project, an additional amount equal to 10 percent of the total cost of construction of the GNFs less the amount of credit afforded by the Government for the value of the LER and relocations, including utility relocations, provided by the non-Federal sponsor for the GNFs. If the amount of credit afforded by the Government for the value of the LER and relocations, including utility relocations, provided by the non-Federal sponsor equals or exceeds 10 percent of the total cost of construction of the GNFs, the non-Federal sponsor shall not be required to make any contribution under this paragraph, nor shall it be entitled to any refund for the value of the LER and relocations, including utility relocations, in excess of 10 percent of the total cost of construction of the GNFs;

e. Provide, operate, and maintain, at no cost to the Government, the local service facilities, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government;

f. In the case of project features greater than -45 feet MLLW in depth, provide 50 percent of the excess cost of operation and maintenance of the project over that cost which the Secretary determines would be incurred for operation and maintenance if the project had a depth of -45 feet MLLW;

g. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor owns or controls for access to the project for the purpose of completing, inspecting, operating and maintaining the GNFs;

h. Hold and save the United States free from all damages arising from the construction, operation and maintenance of the project, any betterments, and the local service facilities, except for damages due to the fault or negligence of the United States or its contractors;

i. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of three years after completion of the accounting for which such books, records, documents, and other evidence are required, to the extent and in such detail as will properly reflect total cost of the project, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 CFR Section 33.20;

j. Perform, or ensure performance of, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601-9675, that may exist in, on, or under the LER that the Federal Government determines to be necessary for the construction or operation and maintenance of the GNFs. However, for lands that the Government determines to be subject to the navigation servitude, only the Government shall perform such investigation unless the Federal Government provides the non-Federal sponsor with prior specific written direction, in which case the non-Federal sponsor shall perform such investigations in accordance with such written direction;

k. Assume complete financial responsibility, as between the Federal Government and the non-Federal sponsor, for all necessary cleanup and response costs of any hazardous substances regulated under CERCLA that are located in, on, or under the LER that the Federal Government determines to be necessary for the construction or operation and maintenance of the project;

l. To the maximum extent practicable, perform its obligations in a manner that will not cause liability to arise under CERCLA;

m. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended (42 U.S.C. 1962d-5b) and Section 101(e) of WRDA 1986, Public Law 99-662, as amended (33 U.S.C. 2211(e)) which provide that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element;

n. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended (42 U.S.C. 4601-4655) and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way necessary for construction, operation, and maintenance of the project including those necessary for relocations, the borrowing of material, or the disposal of dredged or excavated material; and inform all affected persons of applicable benefits, policies, and procedures in connection with said act;

CECW-PC
SUBJECT: Savannah Harbor Expansion Project, Georgia and South Carolina

o. Comply with all applicable Federal and State laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army"; and all applicable Federal labor standards requirements including, but not limited to, 40 U.S.C. 3141-3148 and 40 U.S.C. 3701-3708 (revising, codifying and enacting without substantive change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a et seq.), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 et seq.), and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c));

p. Provide the non-Federal share of that portion of the costs of mitigation and data recovery activities associated with historic preservation, that are in excess of 1 percent of the total amount authorized to be appropriated for the project; and

q. Not use funds from other Federal programs, including any non-Federal contribution required as a matching share, therefore, to meet any of the non-Federal sponsor's obligations for the project unless the Federal agency providing the Federal portion of such funds verifies in writing such funds are authorized to be used to carry out the project.

13. The recommendation contained herein reflects the information available at this time and current departmental policies governing formulation of individual projects. It does not reflect program and budgeting priorities inherent in the formulation of a national civil works construction program or the perspective of higher review levels within the executive branch. Consequently, the recommendation may be modified before it is transmitted to Congress as a proposal for implementation funding. However, prior to transmittal to Congress, the sponsor, the State, interested Federal agencies, and other parties will be advised of any significant modifications and will be afforded an opportunity to comment further.

THOMAS P. BOSTICK
Lieutenant General, U.S. Army
Commanding

Keith Golden, P.E., Commissioner

GEORGIA DEPARTMENT OF TRANSPORTATION
One Georgia Center, 600 West Peachtree Street, NW
Atlanta, Georgia 30308
Telephone: (404) 631-1000

February 9, 2012

Colonel Jeffrey M. Hall
U.S. Army Corps of Engineers
PO Box 889
Savannah, Georgia 31402-0889

Dear Colonel Hall:

I am writing in response to your letter dated January 20, 2012, concerning the Georgia Department of Transportation's (GDOT) ongoing support of the Savannah Harbor Expansion Project (SHEP). I understand that Mr. David Griffin of our Intermodal Division has received a DVD containing the Environmental Impact Statement (EIS) and General Re-Evaluation Report (GRR) for the project.

Please accept this letter as confirmation of GDOT's continued support of the Selected Plan as the non-federal cost share sponsor.

Thank you for the opportunity to review the project documents. GDOT looks forward to continued cooperation with the Corps in seeing the SHEP through to completion. If additional information is needed, please do not hesitate to contact me or Mr. David Griffin, Waterways Program Manager, at (404) 631-1228.

Sincerely,

Keith Golden, P.E.
Commissioner

KG:CLC:dg

cc: Curtis Foltz, Executive Director, GPA
Gerald M. Ross, P.E., Chief Engineer
Todd Long, P.E., GDOT Director of Planning
Carol L. Comer, GDOT Director of Intermodal

Encl 4

THE DEPUTY SECRETARY OF COMMERCE
Washington, D.C. 20230

July 5, 2012

The Honorable Jo-Ellen Darcy
Assistant Secretary of the Army, Civil Works
108 Army Pentagon
Washington DC 20310

Dear Assistant Secretary Darcy:

The National Oceanic Atmospheric Administration, on behalf of the Department of Commerce, has reviewed the Final Environmental Impact Statement (EIS) for the Savannah Harbor Expansion Project, the Final General Re-evaluation Report (GRR), and the draft Report of the Chief of Engineers. Under the Water Resources Development Act of 1999, the Secretary of Commerce must approve the selected project plan and determine that the associated mitigation plan adequately addresses the potential environmental impacts of the project. On March 2, 2012, the authority to approve and make this determination was delegated to the Deputy Secretary.

The Department of Commerce finds the U.S. Army Corps of Engineers (Corps) has responded to or addressed all the comments we provided on the November 2010 Draft GRR and EIS and has incorporated additional suggestions we have provided since that time. We believe the Final EIS reasonably identifies the environmental impacts expected from the various project alternatives, and the mitigation plans reasonably reduce those impacts to acceptable levels.

Based on that review, the Department of Commerce approves the selected plan as outlined in the Final GRR, the Final EIS, and the draft Chief's Report, and determines the associated mitigation plan adequately addresses the potential environmental impacts of the project. We approve the Savannah Harbor Expansion Project with the understanding that if there are changes to the GRR, the EIS, or the mitigation plan before the Record of Decision is signed, the Corps will request that the Department of Commerce review and reapprove the final plan.

Sincerely,

Rebecca M. Blank

Rebecca M. Blank

Encl 5

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Washington, D.C. 20240

In Reply Refer To:
FWS/R4/051853

JUL 0 9 2012

The Honorable Jo-Ellen Darcy
Assistant Secretary of the Army (Civil Works)
108 Army Pentagon
Washington, D.C. 20310-0108

Re: Savannah Harbor Expansion Project Department of the Interior Record of Decision

Dear Assistant Secretary Darcy:

Please accept this letter as the Department of the Interior's (Department) final review of planning documents for the U.S. Army Corps of Engineers' (Corps) Savannah Harbor Expansion Project (SHEP). Since 1999, the U.S. Fish and Wildlife Service (Service), U.S. Geological Survey (USGS), and National Park Service (NPS) have actively participated in the planning for SHEP. The Service and the Corps have completed consultation under the Endangered Species Act. The Service has provided Fish and Wildlife Coordination Act Reports, USGS has provided hydrology and wetlands monitoring technical assistance, and NPS has worked with the Corps to ensure that the project would not affect the Cockspur Island Lighthouse. The Department has coordinated bureau comments during all phases of SHEP compliance with the National Environmental Policy Act. We have reviewed the Final General Re-Evaluation Report (FGRR) and Final Environmental Impact Statement (FEIS) dated April 2012. Authorizing language for SHEP in the Water Resources Development Act of 1999 (P. L. 106-53, Sec. 101(b)(9)) stipulates that the project may proceed only after the Secretary of the Interior, Secretary of Commerce, and Administrator of the Environmental Protection Agency approve the selected plan and determine that the associated mitigation plan adequately addresses its potential environmental impacts. The Secretary of the Interior has delegated to me, the Service's Director, the Department's responsibility for this approval and determination. This letter is my record of decision.

1. The FGRR and FEIS incrementally evaluate various structural and non-structural alternatives, including alternative terminal locations, to address navigational problems and inefficiencies in Savannah Harbor. The Corps' recommended plan is the National Economic Development plan, which deepens the inner harbor to 47 feet below mean lower low water (MLLW). Navigational features of the plan include:

   (a) Extending the existing entrance channel 7.1 miles from Station -60+000B to Station -97+680B and deepening to -49 feet MLLW from the new ocean terminus to Station -14+000B, then deepening to -47 feet MLLW from Station -14+000B to Station 0+000, and deepening the inner harbor to -47 feet MLLW from Station 0+000 to Station 103+000;

Encl 6

(b) widening bends on the entrance channel at one location (Stations -23+000B to -14+000B) and in the inner harbor channel at two locations (Stations 27+700 to 31+500, and Stations 52+250 to 55+000);
(c) constructing two meeting areas – one at Stations 14+000 to 22+000 and one at Stations 55+000 to 59+000;
(d) deepening and enlarging the Kings Island Turning Basin to a width of 1,600 feet; and
(e) replacing dredged material storage capacity in existing dredged material containment areas.

2. The FGRR and FEIS include data and describe models of the Savannah River estuary that were used to examine the potential effects of alternative channel depths and mitigation measures. Predicted changes to the estuary include salinity increases, loss of tidal freshwater marsh, reduced striped bass reproduction and recruitment, adverse effects to habitat for shortnose sturgeon, reduced dissolved oxygen, and potential wildlife exposure to cadmium in dredged sediments. Mitigation features associated with the Corps' recommended plan include:

(a) Constructing a fish bypass around the New Savannah Bluff Lock and Dam in Augusta, Georgia;
(b) a series of flow re-routing features in the estuary that involve (1) constructing a diversion structure, rock berm, and submerged sill; (2) closing two existing cuts; (3) removing a tide gate structure; and (4) dredging sections of Upper Middle River and Little Back River;
(c) acquiring 2,245 wetland acres for transfer to the Service to become part of the Savannah National Wildlife Refuge (NWR);
(d) restoring 40.3 acres of tidal brackish marsh at disposal site 1S (28.8 acres for SHEP impacts plus 11.5 acres as advance mitigation for future Savannah Harbor mitigation needs);
(e) installing an oxygen injection system;
(f) constructing a raw-water storage pond for transfer to the City of Savannah that will supply its industrial and domestic water treatment facility during periods when chloride levels are elevated at the existing intake on Abercorn Creek;
(g) constructing a boat ramp for transfer to Chatham County;
(h) funding for the striped bass stocking program of the Georgia Department of Natural Resources;
(i) recovering, documenting and curating items of historic significance from a Civil War ironclad;
(j) procedures for disposal of cadmium-laden dredged material and associated monitoring for wildlife exposure;
(k) monitoring to determine whether the mitigation features limit the impacts to levels described in the FEIS; and
(l) adaptive management to modify the mitigation features as necessary to ensure that impacts described in the FEIS are not exceeded.

The Corps will assume responsibility for continuing operation and maintenance of the mitigation features except for those transferred to other agencies (e, f, and g, above; see paragraph 7 below regarding feature h, funding for striped bass stocking).

3. Previous channel deepening projects have reduced freshwater tidal wetlands within the Savannah River estuary from about 12,000 acres to about 3,300 acres, and the majority of the remaining acres occur on Savannah NWR. The flow-re-routing mitigation features (2(b) above) are predicted to limit the net loss of freshwater tidal wetlands associated Corps' recommended plan depth (47 feet) to 223 acres. Subject to possible modifications under the monitoring and adaptive management programs (2(k) and 2(l) above), I find that the land acquisition proposed for the Savannah NWR (2(c) above) will adequately compensate for the unavoidable impacts to freshwater tidal wetlands associated with the recommended plan.

4. In the Draft Environmental Impact Statement (DEIS), the Corps proposed to reassess the effects of sea level rise after 50 years and to use any over-compensation for wetland impacts (i.e., additions to the Savannah NWR under 2(c) above) as advance mitigation credits for use with future actions. The Department objected to this proposal, because sea level rise would have a negligible impact on the upper estuary if not for the cumulative effects of previous harbor deepening. The Corps has removed this proposal from the FEIS, which satisfies our objection. Further, the Corps has requested and received from your office a waiver from the policy to base mitigation on a project's average annual impacts. SHEP's average annual impacts are less severe than the impacts predicted immediately following construction due to the anticipated impacts of sea level rise over the next 50 years. The mitigation proposed under 2(c) above is based on the level of impacts predicted for the year after SHEP construction is completed, which I support.

5. The monitoring and adaptive management plan in the DEIS proposed to monitor various resources and adjust key mitigation features as necessary for five years following SHEP construction. The Savannah estuary is a dynamic and complex system. Predicting how this system may respond to substantial physical alterations (channel deepening, flow diversions, cut closures, etc.) is fraught with uncertainties, which were acknowledged in the DEIS. The Department recommended 10 years of post-construction monitoring in order to increase the likelihood that the full range of potential SHEP impacts are observed, some of which may take more than five years to manifest due to highly variable river flows and other factors. The Corps has largely adopted our recommendation for 10 years of post-construction monitoring in the FEIS. I find that the types and duration of monitoring now proposed, including at least two years of monitoring following any adaptive management modifications to the mitigation features, should provide a sufficient basis for determining whether the mitigation features are limiting impacts to the levels predicted in the FEIS.

6. Due to the relatively high level of risk and uncertainty associated with SHEP impacts, the Department's comments on the DEIS expressed concern about responding to impacts that may substantially exceed predictions, and we requested assurances for an adequately funded adaptive management program. The Corps proposes in the FGRR/FEIS to treat adaptive management as a construction cost, and to keep the project in construction status until all post-construction monitoring is completed, including any monitoring of necessary modifications to the mitigation features. The non-federal project sponsor commits to placing its full share of funds for adaptive management in an escrow account during project construction. The total budget for adaptive management of about $20 million is estimated as 5 to 10 percent of the construction costs for key mitigation features.

It is not possible to predict the timing, number, or types of modifications to the mitigation features that may become necessary; therefore, the ideal arrangement would make the entire adaptive management budget available at any time during post-construction monitoring in order to respond fully and promptly to a substantial failure of one or more mitigation features. I recognize that the Corps' limited authority to carry over funds between fiscal years renders this arrangement infeasible. Instead, the Corps proposes to include approximately $2 million for adaptive management in the SHEP construction budget request each year for the duration of the 10-year post-construction monitoring period. During these 10 years, if currently available funding is not sufficient to implement warranted modifications to the mitigation features, the Corps would seek excess funds from other projects for reprogramming to SHEP (FEIS Appendix D pg. 43). I request the Corps commit to the goal of full funding for the adaptive management program, as allowed by law, and strongly recommend the Corps also work with the non-Federal Sponsor on language in the SHEP Project Partnership Agreement (PPA) that would allow withdrawals from the non-Federal sponsor's adaptive management escrow account for needs that exceed available construction and reprogrammed funds. Considering all funding options available in order to address impacts as soon as identified will enable mitigation measures to be most effective and least costly.

7. The Corps proposes to compensate for SHEP impacts to habitat for striped bass by funding the State of Georgia's striped bass stocking program (mitigation feature 2(h) above). The FEIS includes habitat conditions for striped bass among the resources for post-construction monitoring; however, the proposed budget for the adaptive management program does not include possible funding for additional striped bass stocking or other measures should impacts exceed the predicted levels. The Corps has agreed to include striped bass habitat in the adaptive management program, i.e., to determine appropriate additional mitigation if predicted impacts are exceeded, which may or may not include actions related to the stocking program; therefore, I accept the Corps' expectation that this mitigation feature is a one-time payment.

8. The Department provided comments on the DEIS about dealing with cadmium in materials dredged from, or exposed in, the channel during project construction that could pose a hazard to wildlife. We found the treatment of this issue in the DEIS unclear. We recommended specific clarifications, and also a program of monitoring bird activity in disposal areas and cadmium levels in bird tissues in addition to, and independent of, the proposed criteria for capping cadmium-laden materials in the dredged material containment areas. The recommended plan described in the FEIS has adequately addressed our concerns by clarifying procedures and by largely adopting our recommendations for monitoring both bird activity in the containment areas and cadmium levels in bird tissues.

9. The Corps' recommended plan has several components that will directly involve the Service's Savannah NWR:

   (a) Acquiring Savannah NWR land for enlarging the Kings Island Turning Basin via an exchange for other land (navigation feature 1(d) above);
   (b) purchase and transfer of land to the Savannah NWR as mitigation for unavoidable wetland impacts (mitigation feature 2(e) above); and

(c) special use permits to construct, operate, and maintain some of the flow re-routing measures (mitigation feature 2(b) above), and to restore wetlands at disposal site 1S (mitigation feature 2(d) above).

Savannah NWR personnel have coordinated with the Corps on these project components, and most recently, the Department provided comments to correct and clarify details included in the Real Estate section of the FGRR and the Mitigation Planning section (Appendix C) of the FEIS (letter dated May 11, 2012, from W.R. Taylor, Office of Environmental Policy and Compliance, to T.A. Brown, Corps Headquarters). Our comments noted that the Service will accept land only in fee-title ownership (not as easements), and that acquiring Savannah NWR land for enlarging the turning basin will occur as a value-for-value land exchange based on appraisals meeting federal standards at the time of the transaction. The Corps will need to work directly with Savannah NWR personnel to complete these real estate and land access arrangements as the SHEP is implemented, which I am confident will occur in full compliance with applicable Service and Departmental policies and regulations.

10. Based on the foregoing review of the Corps' treatment of issues in the FGRR and FEIS that the Department has raised during the course of SHEP planning, and provided there are no changes to the project as described in the FGRR, FEIS, and the Corps' ROD after the date of this letter, I approve the Corps' selected plan for harbor improvements. With the request to achieve a fully funded adaptive management plan, I find that the associated mitigation plan adequately addresses the potential environmental impacts applicable to the jurisdiction and special expertise of the Department.

Sincerely,

DIRECTOR

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

July 11, 2012

The Honorable Jo-Ellen Darcy
Assistant Secretary of the Army, Civil Works
108 Army Pentagon
Washington, DC 20310

SUBJ: **United States Environmental Protection Agency Review of the Selected Plan and the Associated Mitigation Plan for the Savannah Harbor Expansion Project, Georgia**

Dear Assistant Secretary Darcy:

In Section 101(b)(9) of the Water Resources Development Act of 1999 (WRDA 1999), Congress conditionally authorized funds for the Savannah Harbor Expansion Project. The authorization provided that the project may be carried out only after two specific sets of actions are completed. First, the Secretary of the Army, in consultation with affected Federal, State of Georgia, State of South Carolina, regional and local entities, reviews and approves an environmental impact statement for the project that includes (I) an analysis of the impacts of project depth alternatives ranging from 42 feet through 48 feet and (II) a selected plan for navigation and an associated mitigation plan as required under 906(a) of the Water Resources Development Act of 1986 (33 U.S.C. 2283(a)). Second, the Secretary of the Interior, the Secretary of Commerce, the Administrator of the Environmental Protection Agency and the Secretary approve the selected plan and determine that the associated mitigation plan adequately addresses the potential environmental impacts of the project. Further, WRDA 1999 required that the mitigation plan be implemented before or concurrently with construction of the project. On April 18, 2012, the Administrator of the United States Environmental Protection Agency, Ms. Lisa P. Jackson, formally delegated her authority to me. In accordance with this authorization, the EPA has reviewed both the selected plan and the associated mitigation plan. As further discussed below, the EPA is approving both the selected plan and associated mitigation plan provided there are no material changes to the Final General Re-Evaluation Report (FGRR), Final Environmental Impact Statement (FEIS), the final draft Chief's Report (July 10, 2012) and the Corps' draft Record of Decision after the date of this letter, effective upon execution of the Chief's Report and Record of Decision.

This project is proposed by the Georgia Ports Authority (GPA) of the Georgia Department of Transportation, as the non-federal project sponsor (sponsor). "The Final Environmental Impact Statement (FEIS) for the Savannah Harbor Expansion Project, Chatham County, Georgia and Jasper County, South Carolina, January 2012," identified the selected plan as the 47-foot depth alternative and indicates that choice is the National Economic Development (NED) Plan, which is "the plan that maximizes net economic benefits to the Nation and fully complies with Army policy (Section 3.05, page 3-22)." Additionally, the FEIS identified the mitigation plan in Appendices C and D.

Based upon the assessment contained in the enclosure to this letter and under the authority delegated to me by the Administrator of the United States Environmental Protection Agency, I approve the selected

Encl 7

plan and the associated mitigation plan (FEIS, Appendices C and D) for the Savannah Harbor Expansion Project, Savannah, Georgia. The EPA has received a copy of the final draft Chief's Report and the final draft Record of Decision (ROD), and we understand that these documents together reflect the Corps' determination on the project and include all items to implement the project. The EPA finds that these documents appropriately include the EPA's requested commitments (see Enclosure Section VI). At this time the Chief's Report and the ROD are final draft documents that the EPA understands will be submitted to Army headquarters for execution. Given that these documents are final drafts, the date of the EPA's approval action is effective once the Chief of Engineers has signed the Chief's Report, and the Assistant Secretary of the Army signs the ROD, and provided the Chief's Report and the ROD are signed with no material changes after the date of this letter.

The EPA appreciates the Corps and GPA's effort to address environmental justice issues. We note GPA's willingness to establish, with the EPA's assistance, a community advisory group that will meet periodically to identify and address community concerns or recommendations that may arise associated with ongoing port activities and conduct air studies. Finally, the EPA appreciates the extensive opportunities for collaboration with the COE during the development of the FEIS, and we also appreciate the ability to work closely with the Cooperating Agencies, and many other stakeholders in order to develop innovative environmental solutions for a range of Savannah Harbor Expansion issues.

Should you have questions regarding our approval, please contact A. Stanley Meiburg, Deputy Regional Administrator, or Heinz Mueller, Chief of the NEPA Program Office, at 404-562-9611 or mueller.heinz@epa.gov.

Sincerely,

Gwendolyn Keyes Fleming
Regional Administrator

Enclosure:

Project Assessment Document

cc: Lieutenant General Thomas P. Bostick, P.E., U.S. Army Chief of Engineers
Major General Todd Semonite, P.E., U.S. Army Deputy Chief of Engineers
Colonel Jeffrey M. Hall, U.S. Army Savannah District Engineer

Savannah Harbor Expansion Project (SHEP)
EPA Assessment Document
(Pursuant to Water Resources Development Act of 1999-Section 102(b)(9))

I. Executive Summary: In Section 101(b)(9) of the Water Resources Development Act of 1999 (WRDA 1999), Congress conditionally authorized the Savannah Harbor Expansion Project. The authorization provided that the project may be carried out only after, among other requirements, the Administrator of the EPA approves the selected plan and determines that the associated mitigation plan adequately addresses the potential environmental impacts of the project. This authority was delegated to the Regional Administrator for EPA Region 4. This Assessment Document summarizes the basis for the Regional Administrator's determination.

The selected plan and the associated mitigation plan are set out in the FEIS document in the Executive Summary and Appendix C and D, respectively. The EPA has reviewed the selected plan and associated mitigation plan relative to its statutory and regulatory authorities, including the Federal Water Pollution Control Act (Clean Water Act) (33 U.S.C. § 1251 et seq.), the Clean Air Act (42 U.S.C. § 7401 et seq.) and the Marine, Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. §.1401 et seq.).

II. Project Background:

A. Project Description: This project is proposed by the Georgia Ports Authority (GPA) of the Georgia Department of Transportation, as the non-federal project sponsor (sponsor) and involves proposed deepening of the inner harbor and entrance navigation channel to alternative incremental depths up to 48-ft with an additional allowable over depth of dredging and 6-ft advance maintenance dredging (depending on the location). The Savannah Harbor was last deepened in 1994 to 42-ft depth. In 1999, the Water Resources Development Act (WRDA) authorized the Corps to dredge Savannah Harbor to a maximum depth of 48-ft, which is 6-ft deeper than the existing condition. As a condition of approval, WRDA 1999 required the EPA Administrator and Secretaries of the U.S. Departments of Commerce (DOC), the Department of Interior (DOI) and the Army approve the selected plan and associated mitigation plans.

On January 22, 2002, the Corps released a Notice of Intent (NOI) to conduct a Tier 2 Environmental Impact Statement for Savannah Harbor Expansion Project. The lead agency is the US Army Engineer District, Savannah, and the Cooperating Agencies are the Environmental Protection Agency (Region 4), the Department of Commerce (acting through the National Marine Fisheries Service), and the Department of the Interior (acting through the US Fish and Wildlife Service). The Draft Environmental Impact Statement (DEIS) was released to the public for comment on November 26, 2011 and EPA provided comments in a letter dated Jan 28, 2011. The Final Environmental Impact Statement (FEIS) was released to the public for comment on April 11, 2012 and EPA provided comments in a letter dated June 5, 2012.

B. Preferred Alternative: In both the DEIS and FEIS, the Corps identified the preferred alternative as the 47-ft depth alternative, the National Economic Development (NED) Plan, which is identified as "the plan that maximizes net economic benefits to the Nation and fully complies with Army policy." (FEIS, Executive Summary)

C. NEPA Review: EPA conducted reviews of the DEIS and FEIS. Listed below is a timeline of these reviews.

NEPA Review History:

- Copy of DEIS transmitted to EPA – **November 15, 2010**
- DEIS Comments Provided to Corps – **January 28, 2011**
- Copy of FEIS transmitted to EPA – **April 17, 2012**
- FEIS Comments Provided to Corps – **June 5, 2012**

III. EPA Analysis: EPA has requested that the Corps commit to include specific set of conditions in the final Chief's Report). These conditions commit the Corps to implement certain activities to address uncertainties inherent with this type of project. These conditions relate to Adaptive Management, wetlands and Dissolved Oxygen (DO) mitigation, financial assurances, environmental justice, and the Marine Protection, Research, and Sanctuaries Act (MPRSA) Section 103 process. These conditions are specified at the end of this attachment (See Section VI - EPA Conditions). EPA has reviewed the final draft Chief's Report and the Corps has included specific commitments at EPA's request that address these issues. EPA's action today approving the selected plan and mitigation plan reflects inclusion of these conditions.

A. Wetlands:

1. Description of Issue: For the 47-ft deepening alternative supported by the sponsor, direct impacts to wetlands include 15.68 acres of brackish marsh wetlands by excavation and 223 acres of indirect impacts to freshwater wetlands due to salinity changes (as noted in the FEIS Appendix C). The Corps intends to restore approximately 40.3 acres of brackish marsh at Disposal Area 1S, which is located within the boundaries of the Savannah National Wildlife Refuge (SNWR). The Corps proposes to mitigate the indirect impacts through the preservation of 2,245 acres of wetlands (consisting of bottom land hardwoods and upland buffer to be added the SNWR).

The proposed mitigation for this project has resulted from a culmination of guidance and direction of the Wetland Interagency Coordination Team (ICT). The Corps created the ICT in 2003 to gather multi-agency comments and recommendations on wetland impact evaluations and proposed mitigation. The ICT held five meetings from 2003 – 2009. EPA expressed concerns relating to wetlands mitigation during these ICT meetings (see Appendix N of FEIS) and in NEPA comments on the DEIS.

During the ICT meetings and in our preceding comments on the DEIS, EPA expressed concerns about the Corps' emphasis on preservation of freshwater wetlands. In addition, EPA expressed concerns that the proposed mitigation was not consistent with Section 404(b)(1) Guidelines and the 2008 Mitigation Rule with respect to replacement of in-type and function of both the freshwater and saltwater wetlands being impacted by the project. EPA also expressed concerns with regards to the application of the Corps' SOP for Wetland Mitigation and the proposed mitigation monitoring plan. Specifically, we provided recommendations in our January 28, 2011 DEIS Comment Letter that the wetland mitigation monitoring plan should evaluate wetland functional changes throughout the harbor and that the monitoring plan extend at least seven years after construction of SHEP.

Between the issuance of the DEIS and the release of the FEIS, the Corps and EPA held a meeting (June 1, 2011) to discuss EPA concerns listed in EPA's DEIS comment letter. During the June 1, 2011 meeting the Corps provided results of its analysis in which the Corps' Agency Technical Review (ATR) Team validated the use of the Corps' SOP for Wetland Mitigation (Appendix U of FEIS). Also during the June 1, 2011 meeting, the Corps provided a justification for the how the SHEP proposed mitigation complied with the 2008 Mitigation Rule and was consistent with the 2001 EPA Region 4 Mitigation Policy (Policy). The Corps also contended in the meeting that the 2008 Mitigation Rule did not apply to SHEP because it was a civil works project that predated the 2008 Mitigation Rule (See Appendix C of FEIS). In response to our concerns regarding the mitigation and monitoring plan, the Corps provided a revised monitoring and adaptive management program outline in Appendix D in the FEIS. The Savannah estuary is a very dynamic and complex system. Predicting how this system may respond to substantial physical alterations (channel deepening, flow diversions, cut closures, etc.) remains somewhat scientifically uncertain, which is acknowledged in the DEIS. Due to these uncertainties and the related uncertainty associated with the mitigation, the Corps has developed an extensive monitoring program to quantify the magnitude of the marsh conversion that does occur. If impacts to tidal freshwater marsh exceed those expected, funds will be made available to purchase additional lands for preservation as noted in the Monitoring and Adaptive Management Plan (Appendix D in the FEIS). Adaptive management of the mitigation features is anticipated to require approximately $2 million per year during the 10 year post construction monitoring period. The Corps estimates that the total cost for adaptive management is about 5 to 10 percent of the construction costs for key mitigation features. The non-Federal project sponsor has indicated its intent to place its full share of funds for adaptive management in an escrow account during project construction.

2. Resolution Summary: The development of a monitoring and adaptive management plan is an important step in satisfying our concerns with the proposed wetland mitigation outlined over the course of the development of the SHEP. After carefully weighing of all the interests of the Cooperating Agencies, a decision was made by EPA to accept the mitigation package as proposed by the Corps with certain conditions. This decision best balances the interests of all parties and allows for adequate monitoring and follow-on adaptive management as identified in Appendices C and D of the FEIS. EPA requested that the Corps commit to implementing the monitoring and adaptive management referenced in the FEIS (see Section VI - EPA Conditions). EPA has reviewed the final draft Chief's Report and the Corps has included specific commitments that address this issue.

B. Water Quality/Dissolved Oxygen:

1. Description of Issue: EPA has expressed concern regarding DO early in the NEPA process (FEIS, Appendix N). Savannah Harbor is impaired for DO due to historical deepening projects and a large number of dischargers of biological oxygen demanding substances into the Harbor, which cause the dissolved oxygen levels in the Harbor to drop to very low levels in the summer months. Based on the existing dissolved oxygen impairment, EPA developed and finalized a Total Maximum Daily Load (TMDL) based on Georgia's then-applicable water quality standard (WQS) for dissolved oxygen in 2006. The TMDL requires a "zero discharge" of biological oxygen demanding substances into and upstream of the Harbor. In April 2010, Georgia revised its WQS for dissolved oxygen to be consistent with South Carolina's approved

WQS. Since that time, EPA has been working closely with Georgia and South Carolina to develop a new TMDL consistent with the revised WQS. As reflected in a revised draft TMDL issued by EPA for public comment in May 2010, Georgia's new WQS will allow for some loadings of oxygen demanding substances into the harbor, but the existing harbor dischargers will still be required to considerably reduce their existing permitted loads. EPA is continuing to work with South Carolina and Georgia to determine the best approach to revise the 2006 TMDL and address the continued impairment of the new WQS. Our major concern expressed during the Tier II NEPA process related to the mitigation of the project's DO impacts. In our DEIS comment letter, EPA found that the Speece Cones would adequately restore and distribute DO throughout the Savannah Harbor River system to mitigate the predicted deficiencies of DO in the affected reaches to pre-project levels under normal flow conditions. However, EPA remained concerned that the DO mitigation might not be sufficient under drought conditions. In the letter, EPA requested the Corps assess and document in the FEIS the August 1999 low-flow conditions similar to the August 1997 normal-flow data analysis provided in the DEIS. Additionally, EPA notes that, "To achieve success in project DO mitigation, EPA expects three assurances from the Corps and/or GPA sponsor. These are: 1) post-construction field monitoring of DO levels to ensure the above-described level of DO restoration, 2) guaranteed mitigation throughout the life of the project, and 3) installation and operation of the Speece Cones before dredging begins to ensure that the project's predicted impacts to DO are minimized and mitigated from the outset in order to avoid any potential temporary impacts on the aquatic community while dredging occurs."

2. Resolution Summary: EPA's FEIS Comment letter includes the following, "In response to EPA's comments on the issue of funding of operation and maintenance of speece cones for the life of the project, COE stated that it agreed to operate and maintain the mitigation features as described in the FEIS throughout the project's life. Additionally, SCDHEC made the operation and maintenance of the oxygenation system (Speece Cone) a term and condition of the Corps and GPA Section 401 Certification, dated November 15, 2011. GPA has agreed to provide financial assurance in the event that federal funding for the oxygenation system is insufficient in any year. Specifically, South Carolina's 401 Certification provides that "[t]he GPA will provide financial assurance, in a manner acceptable to DHEC, that it will fund operation and maintenance of the Dissolved Oxygen system in any year that sufficient federal funds for the operation and maintenance of the system are not made available. This obligation extends for the life of the project. Such financial assurance may be achieved through a Standby Trust Fund, Surety Bond, Letter of Credit, Insurance, or other means deemed acceptable to DHEC. The GPA will provide the financial assurance before any dredging begins." This commitment of financial assurance provides greater certainty that operations and maintenance costs will be covered through the life of the project." The FEIS includes a copy of the certification (Appendix Z). EPA requested that the Corps commit, in conjunction with GPA, to implement the DO system and associated monitoring and adaptive management (See Section VI - EPA Conditions). EPA has reviewed the final draft Chief's Report and the Corps has included specific commitments that address this issue.

C. Dredge Material Disposal Issues:

1. Description of Issue: The MPRSA, also known as the Ocean Dumping Act or ODA governs disposal of dredged material in ocean waters along with EPA's regulations and criteria

established at 40 CFR Parts 220-229. In EPA's DEIS comment letter, EPA identified issues with disposing portions of the dredged material in disposal sites 11 and 12, which would be utilized as experimental fish habitat mounds. EPA stated that generally the Agency is supportive of fish habitat enhancements, but expressed concerns that the proposed fish enhancements may not be consistent with MPRSA. EPA recommended the Corps evaluate other alternative sites for disposal. As a result of EPA's DEIS comments, the Corps revised the near shore placement plan, i.e., deleting Sites 11 and 12. These sediments are proposed for placement in the Ocean Dredged Material Disposal Site (ODMDS), and testing protocols for offshore disposal will be used to evaluate these sediments. Also identified in EPA's DEIS Comment Letter were concerns regarding the extension of the existing channel offshore for over seven miles. The Corps determined the channel extension was needed since the ocean depths in these areas could not support post-Panamax vessels under all tide and cargo conditions. The amount of dredged material was estimated to increase by 4.6 mcy due to the extension. EPA also identified concerns relating to the characterization of the dredged material and emphasized this in the DEIS Comment Letter by stating, "Specifically, the FEIS should address the multiple factors outlined in the Enclosure, including full characterization of the dredged material, identification and analysis of disposal options, potential evaluation of the Savannah ODMDS capacity in relation to any material that would be disposed in the ODMDS, precise identification of the proposed channel route and alternative routes, and discuss findings. EPA's full understanding of the ocean channel extension component is essential to the overall NEPA analysis and Agency approval of the SHEP." EPA further reiterated the characterization of dredge material in the FEIS Comment Letter, stating:

> *"It is EPA's position that the proposed dredged material does not meet any of the exclusionary criteria and therefore must undergo testing and evaluation in accordance with the 40 CFR Parts 220-229. Samples of bottom sediments from the excavation area in the existing entrance channel have recently been tested to evaluate contaminants which may be present in new work sediment materials. Additional sampling and testing (bioaccumulation studies) for the existing channel and extension of the harbor entrance channel have been completed to evaluate whether the new work material complies with the Ocean Dumping Criteria and is suitable for placement in the Savannah ODMDS. The results of these analyses were used to prepare a Section 103 Evaluation for SHEP, which the CORPS provided to EPA Region 4 on May 25, 2012, accompanied by a request that EPA concurs with the Corps's determination regarding the suitable disposal of the dredging sediments from Stations +4+000 to -97+680B."*

2. Resolution Status: The review of the Site Management and Monitoring Plan (SMMP) and MPRSA 103 evaluation is currently underway and will be completed on a separate schedule from the WRDA approval. The process will need to be completed and concurrence obtained before ocean disposal of dredged material can take place. It is expected that the full evaluation, including capacity and disposal modeling, will be completed within one year and EPA will be in a position to certify the project, which will allow the project to begin. Also, as required under MPRSA, the certification will also have to be reissued every three years for implementation of the project to continue. The Corps in coordination with EPA has committed to completing the SMMP for the Savannah ODMDS before the Corps will dispose of material from SHEP into the Savannah ODMDS and they have agreed to place material not meeting the Ocean Dumping Criteria into a Confined Disposal Facility (CDF) (See Section VI - EPA

Conditions). EPA has reviewed the final draft Chief's Report and the Corps has included specific commitments that address this issue. EPA will continue to work with the Corps to complete the 103 process.

D. Air:

1. Description of Issues:

General Air Quality: In EPA's DEIS Comment Letter, EPA listed concerns relating to general air quality and air toxics. Specifically, EPA expressed that the DEIS did not appear to demonstrate that the project would not interfere with the area's attainment and maintenance of the national ambient air quality standards (NAAQS) for either the No Action Alternative or the Tentatively Recommended Plan. EPA also commented that the current emissions inventory of the DEIS (Appendix K) did not appear to provide a future emissions analysis for comparison against the current conditions data provided for the selected criteria pollutants and other parameters measured, or a dispersion analysis. In the DEIS, EPA questioned the Corps's assumption that emissions will decrease in the future with the expansion because future larger vessels (Panamax and post-Panamax) are anticipated to have lower emissions than the existing smaller fleet. EPA stated that the FEIS should compare the fuel efficiency/emissions of larger versus smaller vessels using an "emissions per Twenty-foot equivalent unit (TEU) metric" as the basis of comparison. Finally, EPA recommended specific air improvement strategies and requested that the Corps include these strategies in the decision document to ensure the sustainability of the project.

Air Toxics: In EPA's DEIS Comment Letter, EPA raised comments regarding the importance of identifying specific air toxic emission increases associated with the different options and selected plan, and considering whether actions could be taken to reduce any anticipated increases in air toxics. EPA also noted that the Corps compared air toxics emissions from the proposed projects with those from the entirety of Chatham County, as opposed to comparing between different project options. Based on its comparison of port-related air toxics emissions versus county-wide emissions (which predictably would find that emissions from the small port area would be a small portion of the entire county's air toxics emissions), the Corps concluded that the Port is not a major contributor to the overall county emissions and that additional analyses were not warranted. To resolve these issues, EPA requested that the Corps conduct specific analysis to be included within the FEIS to include: 1) preparation of a screening level risk assessment to evaluate the potential impacts associated with emissions of air toxics related to the harbor deepening and its operation; 2) extension of the inventory for air toxics be provided for both current and future emissions data (specifically EPA requested that the future condition analysis for air toxics (and NAAQS) be extended beyond 2032 to encompass the entire 50-year life of the project (2065); 3) requested dispersion modeling for criteria pollutants be expanded to include air toxics emissions; and 4) the Corps should include an emissions density map, population density map, and a map identifying locations of sensitive populations which would be informative for the reader. (EPA requested that the modeling results should be used in the requested screening level risk assessment to help determine effects on landside sensitive receptors such as potential EJ areas located along road/rail corridors and determine any areas of localized higher concentrations.)

2. Resolution Summary:

General Air Quality: Through stakeholder and other meetings with the Corps, as well as written comments EPA raised its air-related comments. In addition, EPA met with representatives from the Georgia Ports Authority regarding previous and ongoing efforts to perform emissions inventories at Georgia Ports. The Corps addressed most of EPA's significant comments listed in the DEIS. The Corps conducted a more detailed air quality assessment in 2010 and expanded the Corps 2006 air quality analysis to the entire harbor to more completely assess air quality impacts from the proposed harbor deepening. This more detailed assessment evaluated the air emissions from all cargo-carrying vessels and landside cargo handling equipment at both the GPA and privately-operated terminals at the Port. The Corps provided EPA with summary emissions data.

Air Toxics: As a part the GPA's and Corps 2010 Air Quality Assessment, estimates of "air toxics" emitted at the Port were calculated. To address EPA's comments and suggestions regarding an effective emissions inventory for SHEP and to supplement the 2006 and 2010 studies, GPA commissioned (2011) and is currently funding the Georgia Institute of Technology (Georgia Tech) to conduct a $250,000 follow-up study to the FEIS known as "Detailed Criteria and Hazardous Air Pollutant Emission Inventories for the Ports of Savannah and the Savannah Metropolitan Area." In written comments provided to the GPA in April 2011 concerning the workplan that Georgia Tech would pursue in this study, EPA suggested using a detailed emissions inventory and dispersion modeling at a fine scale (100 meter grid at most) to estimate local concentrations and hot spots. EPA also suggested additional analyses regarding emissions inventory and risk assessment.

Resolution Summary of General Air Quality and Air Toxics Issues: EPA encourages GPA to continue to support the Georgia Tech air study. EPA requested that GPA, in consultation with EPA Region 4 and Georgia EPD commit to conduct an air monitoring study and pursuing electrification of port infrastructure, reducing idling at distribution centers, and fleet upgrades under the SmartWay Port Drayage Truck program, (See Section VI - EPA Conditions). EPA has reviewed the final draft Chief's Report and a GPA Commitment Letter dated July 10, 2012 that address this issue.

E. Environmental Justice (EJ) and Children's Health Considerations

1. Description of Impacts: Most of the communities surrounding the project have elevated levels of minority and low-income populations (i.e., 45 percent of the population of Chatham County, Georgia, is comprised of minorities). Therefore, it was appropriate that project effects on potential EJ communities and children's health were considered in the DEIS (consistent with NEPA and relevant Executive Orders - EO 12898 and EO 13045). EPA indicated in our FEIS comment letter that the EJ analyses be expanded to include potential landside emission effects on nearby populations, public concerns offered by the Stakeholder Engagement Group (SEG) and other meetings and their follow-up outcomes, specific EJ outreach activities and the degree to which representatives from potential EJ communities were involved or EJ concerns were discussed and addressed, and disclosure of the demographics of children under age 18 within the project area. EPA recommended the FEIS indicate whether the

Port has a mechanism or long-term program designed to update surrounding communities on port expansion/changes and for receiving regular feedback or concerns from area residents.

2. Resolution Summary: The Corps conducted an examination of the potential impact on minority populations, low-income populations, and children from the proposed Savannah Harbor Expansion Project, including demographics, proposed road improvements, and potential impacts on air quality, traffic, noise, and lighting. The DEIS and FEIS described efforts that are currently underway or projected to minimize some of the projects impacts on surrounding communities. During the DEIS public comment period, stakeholder groups including the *Citizens for Environmental Justice* and the Keck School of Medicine expressed concerns related to EJ that the Corps has responded to in the Appendix A. The FEIS indicated that the Corps disagreed with the stakeholders' assessment that the neighboring communities will experience disproportionate impacts from activities related to the Port and port expansion efforts.

Nevertheless, given the relatively high percentage of residents with environmental justice concerns in the community, the level of growth anticipated by the Port, the environmental and public health concerns raised by local EJ organizations, and other uncertainties that remain, EPA recommended that the ROD or Chief's Report include a requirement for the formation of a formal community advisory group (CAG) with neighboring communities that meets periodically to identify and address community concerns or recommendations that may arise as a result of ongoing port activities. The CAG should be provided with independent technical assistance or support help explain scientific or technological data, findings or studies related to the proposed project and ongoing port-related activities. To assure community residents living in close proximity to the Port and transportation corridor that the Port's future growth and expansion efforts will not result in substantive localized impacts (i.e., air, traffic), a monitoring program should also be established (see air section). Any air quality studies commissioned by the GPA should evaluate impacts to vulnerable populations including children living in the vicinity of the project.

EPA requested that the Corps commit to establishing a CAG, providing independent technical assistance on study results to the community, pursuing electrification of port infrastructure, reduced idling at distribution centers, fleet upgrades under the SmartWay Port Drayage Truck program, and conducting air monitoring study not exceeding 1 year post construction (See Section VI - EPA Conditions). EPA has reviewed the final draft Chief's Report and a GPA Commitment Letter dated July 10, 2012 in which the Corps and GPA include specific commitments that address this issue.

IV. EPA's Assessment of the Selected Plan:

A. The Selected Plan: Per the FEIS, the 47-ft depth alternative is the Selected Plan, which is also the NED Plan. The central feature of the selected plan includes deepening of the existing channel from the ocean bar to the Port of Savannah. The total length of improvements is approximately 38 miles (from an upstream river limit Station 103+000 to end of the ocean bar channel -97+680B). The proposed five foot deepening (-47 feet MLW) of the Federal navigation channel would require the removal of approximately 23.6 million cubic yards of new work sediment. The Selected Plan provides for an ocean bar navigation channel of -49-feet MLW deep and 564-feet wide (Station -97+680B) from the Atlantic Ocean to the channel between the

jetties (Station -14+000B). The ocean bar channel would continue at -47-feet MLW and 464-feet wide from the jetties to the harbor entrance just north of Tybee Island (Stations -14+000B to 0+000). From the harbor entrance (Station 0+000) to the upstream limit of the improvements (Station 103+000) the navigation channel would continue at -47-feet MLW and 464-feet wide. The existing Kings Island Turning Basin, the eight berths at Garden City Terminal (Berths 2, 3, 4, 5, 6, 7, 8, and 9), three channel bend wideners and two meeting areas would also be deepened to -47 feet MLW. The recommended improvements end at the Garden City Terminal (Station 103+000), but the Savannah Harbor Federal Navigation Project extends to Station 112+500. Channel side slopes from the ocean ward end of the bar channel would be 5H:1V. Side slopes for the remaining project (including Kings Island Turning Basin, the eight berths at Garden City Terminal (Berths 2, 3, 4, 5, 6, 7, 8, and 9), three channel bend wideners and two meeting areas would be 3H:1V. Because the side slopes of the navigation channel do not change, the estimated average annual maintenance dredging is about 7.1 million cubic yards. Two feet of allowable overdepth and up to 6 feet of advance maintenance in selected areas (see Table 3-2, above) would also be included for the proposed action.

B. Rationale for Selected Plan Presented in FEIS: The Corps developed and evaluated five channel deepening alternatives, in addition to the No Action Alternative. Each channel deepening alternative contains mitigation features to address adverse environmental impacts that they would otherwise produce. The 47-ft depth alternative, the NED, is the plan that maximizes net economic benefits to the Nation (See GRR). Under current Federal planning policy, the NED plan would be recommended for implementation unless there are overriding considerations that favor recommendation of another plan. Benefits that would accrue from the deepening of Savannah Harbor include reductions in light loading of vessels and vessel delays waiting for appropriate tidal cycles. Shippers will also be able to use larger, more efficient vessels. The economic benefits increase with each additional increment of channel deepening. Environmental impacts associated with a shallower depth would be less than those associated with the NED plan, but the lesser impacts of the 44-foot depth, 45-foot depth, and 46-foot depth alternatives are not considered sufficient to justify recommendation of these alternatives instead of the NED Plan. Prior to release of the Draft GRR and EIS for agency and public comment, the State of Georgia asked the Corps to consider the 48-foot depth alternative as the Locally Preferred Plan. As a result of comments received and subsequent discussions with the sponsor, the Corps declined to select the 48-foot alternative as the NED, subsequently GPA selected the 47-ft depth alternative as the locally preferred alternative.

C. Process of Assessment: As noted above, EPA reviewed the selected plan and associated mitigation plan pursuant to WRDA and relative to EPA's statutory and regulatory authorities, including the Federal Water Pollution Control Act (Clean Water Act) (33 U.S.C. § 1251 et seq), the Clean Air Act (42 U.S.C. §7401 et seq) and the MPRSA of 1972 (33 U.S.C. §1401 et seq).

As background, EPA has extensively participated in the NEPA process to ensure the Agency was represented and our concerns were expressed throughout the development of the NEPA document. Over the course of nearly ten years, EPA has participated in numerous interagency coordination teams (Wetlands Interagency Coordination Team, Water Quality Interagency Team, etc.), reviewed over 40 different technical documents and models, participated in numerous executive management meetings. EPA reviewed the DEIS and FEIS and provided comments to the Corps as required by Section 309 of the CAA and Section 102(2)(C) of NEPA. To the extent

possible, EPA also reviewed the public comments on the DEIS and FEIS, and the Corps' responses to those comments, to ensure EPA's relevant issues related to the Agency's statutory and regulatory authorities were considered. The NEPA review in combination with the sufficiency review provides the foundation for EPA's assessment under WRDA.

V. EPA's Assessment of the Mitigation Plan: As noted above, EPA requested and the Corps agreed to include in the final draft of the Chief's Report a number of conditions to address EPA's remaining concerns (See Section VI - EPA Conditions). Several of our comments relate to the proposed mitigation plans described in the FEIS. These include an adaptive management and monitoring program to ensure the wetlands mitigation as well as the DO mitigation function as expected. This is linked with a financial commitment based on federal appropriations backed up by the Georgia Ports Authority commitment for the DO system operation and maintenance; and for monitoring and adaptive management. Below is a summary of our assessment of the mitigation plans described in the FEIS and our FEIS issues related to the proposed plans.

A. Mitigation Plan (FEIS, Appendix C, May 2012):

1. Dissolved Oxygen: As noted above, in 2006 and in cooperation with the states of Georgia and South Carolina, EPA implemented a "no discharge" TMDL for DO due to long standing drought conditions and in April 2010, EPA published a revised Draft TMDL for DO. Early on the resource agencies raised concerns that the project would adversely impact the DO water quality standard. The Corps contracted with MACTEC to conduct a study to determine different methods to improve the DO levels within Savannah Harbor. In 2005, MACTEC completed the report, which included the examination of 25 methods of DO improvement (FEIS, Appendix C, page 39). MACTEC concluded that oxygen injection was the most cost effective method to increase DO levels within the harbor. In 2006, the Corps developed preliminary designs and discussed with both the resource agencies and the public. From this input, the Corps considered various locations (with depths of 44-ft, 45-ft, 46-ft and 48-ft) to place oxygen injection systems. After flow alteration locations were identified and modeled with the hydrodynamic and water quality models, the Corps used this information to identify locations for the oxygen injection systems (described in the report titled "Final Report, Design of Dissolved Oxygen Improvement Systems in Savannah Harbor, April 24, 2008"). To determine the effectiveness of the oxygen improvement system, in 2007, the Corps conducted a full-scale demonstration project. Overall, MACTAC found that the oxygen injection system was successful and would improve the DO levels within the Savannah harbor ("Savannah Harbor ReOxygenation Demonstration Project Report").

EPA concurred with the Corps findings that the oxygen injection system would increase DO levels to offset the projects impacts to DO (See EPA DEIS Comment Letter). However, EPA expressed concern about the Corps' lack of financial commitment over the project lifespan to ensure adequate DO monitoring as well as maintenance of the oxygen injection system (See EPA DEIS Comment Letter). The SCDHEC Final Agency Decision relative to the 401 certification included wording indicating that GPA agreed to provide financial assurance for 50 years should federal funding be insufficient in any year. Based on these requirements, EPA concluded in our FEIS Comment Letter that, "This level of financial assurance provides greater certainty that operations and maintenance costs will be covered through the life of the project."

2. Wetlands: Adverse impacts to wetlands would be mitigated through three types of actions: (1) flow altering features, (2) acquisition and preservation of 2,245 acres of existing bottomland hardwoods, and (3) restoration of former Disposal Area 1S. The flow-altering features include the following for the preferred alternative (47-ft deepening): a) Diversion Structure at McCoys Cut b) Close western arm at McCoys Cut c) Close Rifle Cut d) Remove Tidegate e) Sill and Broad Berm in Sediment Basin and f) Deepening at McCoys Cut.

In our DEIS comment letter, EPA expressed concerns regarding the following primary areas associated with the proposed wetland mitigation for SHEP: 1) assigning higher "value" to wetland functions to one wetland type (brackish) over another (saltmarsh), 2) the uncertainties around revegetation at the Disposal Area 1S and that the proposed mitigation will generate "excess" credits, 3) the complexities and uncertainties associated with the salinity models, 4) application of the Savannah District's SOP in calculating compensatory mitigation, and 5) the general disagreement with the Corps over the level of adverse impacts to wetlands. After carefully weighing of all the interests of the Cooperating Agencies, a decision was made by EPA to accept the mitigation package as proposed by the Corps with certain conditions. This decision best balance the interests of all parties and allows for adequate monitoring and follow-on adaptive management as identified in Appendices C and D of the FEIS.

B. Monitoring and Adaptive Management Plan (FEIS Appendix D, May 2012): The Corps followed the 2003 CEQ NEPA Task Force Report on Modernizing NEPA Implementation as a framework to establish its monitoring and adaptive management plan. Using the framework outlined by the Task Force, the Corps adopted the "Predict", "Mitigate", Implement", "Monitor" and "Adapt". According to the FEIS Appendix D (page 1), the Corps defines adaptive management as, "evaluating the accuracy of the predicted environmental impacts, assessing the effectiveness of the mitigation features, and modifying the project as needed to ensure the levels of environmental effects predicted in the Environmental Impact Statement (EIS) are not exceeded."

1. Monitoring: The Corps proposes to conduct monitoring at various stages throughout the life of SHEP. The purpose of the monitoring is to establish a baseline and acceptable environmental performance parameters. Performance parameters will be established for conductance, salinity, flow, and concentrations of DO. According to the FEIS, the Corps intends to do so by conducting pre-construction monitoring, monitoring during construction, and post-construction monitoring. The Corps proposes establishing a publically available website to post monitoring reports and studies throughout all phases of the project (pre-construction through post-construction monitoring). The Corps also proposes publishing annual reports discussing the construction progress, monitoring/study results and proposed adaptive management modifications. The Corps also proposes sharing this report with cooperating agencies and soliciting feedback and recommendations as to the best options regarding the report.

2. Adaptive Management: The Corps has outlined a comprehensive adaptive management plan (FEIS, Appendix D). In the FEIS, Appendix D (page 38), the Corps discusses its process in making adaptive management decisions. The Corps proposes to maintain close coordination with the Cooperating Agencies during the pre-construction and active construction stages. Should monitoring identify impacts outside the range expected, then the Corps states that they would coordinate with the Cooperating Agencies. The Corps also states that monitoring

assessments could also modify proposed construction activities so as to ensure fewer impacts. After construction, the Corps envisions the adaptive management decision process would become more focused on long term mitigation features. During the pre-construction and active construction stages, the Corps envisions coordinating with the Cooperating Agencies when the monitoring indicates a parameter exceeding expected conditions or should monitoring from a mitigation feature not be within expected values. The Corps has outlined a process in which the Cooperating Agencies can provide feedback to the Corps regarding the performance of mitigation features and monitoring results of SHEP. The Corps also has outlined a process that mitigation features can be modified, which requires the concurrence of the Cooperating Agencies. Should two of the Cooperating Agencies non-concur with the proposed modification, then the Corps proposes elevating the decision to the Washington DC level.

C. Funding of Adaptive Management: Once the proposed adaptive management measure has been approved by the various Agencies, then the Corps would request those funds through the Corps budgetary process. The Corps also states that adaptive management funds would come from the construction funds until the post construction monitoring is complete (which will continue for 10 years after construction (FEIS, Appendix D, page 42)). The Corps will develop an adaptive management funding plan along with annual construction funding. If the funding plan exceeds the funding plan estimates, the Corps will request additional funds through the normal budgetary process. The Corps states, "Adaptive management funds currently estimated at $2 million per year will be sought for the entire duration of the monitoring period and for an action needed based on the monitoring (FEIS, Appendix D)." Upon approval of the project, the GPA has agreed to set aside, in advance, their portion of the monitoring and adaptive management funds in an escrow account. The Corps also states that these funds would be expended if the modifications are deemed necessary by the Federal Lead and Cooperating Agencies. Because of the importance of strong financial assurances, EPA is recommending that the Corps commit to the monitoring and adaptive management (Appendix C and D) funding with language in the final draft Chief's Report that specifically commits the funding levels outlined in the FEIS.

VI. EPA Conditions: Below are EPA's conditions related to the WRDA approval of the selected plan and associated mitigation. As stated above, EPA has reviewed the final draft Chief's Report and the Corps has included the following specific commitments that address issues outlined above. .

A. Dissolved Oxygen and Wetlands: EPA requests the following language be added to the Chief's Report, "In accordance with the FEIS, establish an Adaptive Management Team, with the active participation of the cooperating agencies, for the purpose of effectively implementing the monitoring and adaptive management plan related to dissolved oxygen levels in the system and wetlands mitigation, and to ensure that the wetlands mitigation requirements and DO levels are met in the system."

B. Adaptive Management/Monitoring:

1. EPA requests the following language be amended in the Chief's Report to state, 'Monitoring to ensure that (1) the impacts described in the FEIS are not exceeded, and (2) the

dissolved oxygen and wetland mitigation features function as intended. Monitoring will occur pre-construction, during construction, and up to 10 years post-construction; and

2. EPA requests following language be added to the Chief's Report, "Adaptive management be implemented as outlined in the FEIS to 1) review the results of DO monitoring as well as the success of wetlands mitigation, 2) modify features if necessary

C. Financial Assurance:

1. In order the ensure there will be adequate funding for the duration of this project, EPA requests the following language be added to the Chief's Report, "To the extent appropriated by Congress, implement monitoring and adaptive management that includes the Corps commitments for the dissolved oxygen mitigation system and wetlands mitigation as outlined in the FEIS."

2. EPA requests the conditions listed in the SCDHEC 401 certification be referenced in the Chief's Report (i.e., "As to operation and maintenance of dissolved oxygen mitigation system, include language referencing the commitment by GPA to establish financial assurance sufficient to fund operation and maintenance of the system, in any year that sufficient federal funds for that purpose are not available, throughout the life of the project"). The Chief's Report should indicate that GPA intends to place its full share of funds for adaptive management in an escrow account during project construction, as reflected in the 401 certification package.

D. MPRSA- Section 103: Given that the MPRSA Section 103 process is not complete, EPA requests the following language be added to the Chief's Report, "The required Site Management and Monitoring Plan for the Savannah ODMDS must be completed and signed by the EPA and the Corps before the EPA can issue a concurrence for disposal of material from the SHEP into the Savannah ODMDS. Any portion of this material that does not meet the Ocean Dumping Criteria must be placed within an upland Confined Disposal Facility (CDF) that has sufficient capacity for the volume of proposed dredged material that does not meet the Ocean Dumping Criteria."

E. Environmental Justice: EPA supports the Corps' compliance in the Savannah Harbor Expansion Project with Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations, dated February 11, 1994.

EPA requests following language be added to the Chief's Report

"By letter dated July 10, 2012, the Georgia Ports Authority has indicated that it intends to establish, with the assistance of the Environmental Protection Agency, a community advisory group that meets periodically to identify and address community concerns or recommendations that may arise associated with ongoing port activities. GPA will also facilitate sustainability by pursuing electrification of port infrastructure, reduced idling at distribution centers, and fleet upgrades under the SmartWay Port Drayage Truck program. In addition, in consultation with EPA Region 4 and Georgia EPD, the GPA intends to conduct an air monitoring study not to exceed one year at no more than four monitoring sites, to evaluate any potential impacts on surrounding communities. This study would occur once the project is complete and GPA is serving Post-Panamax ships in normal operations."

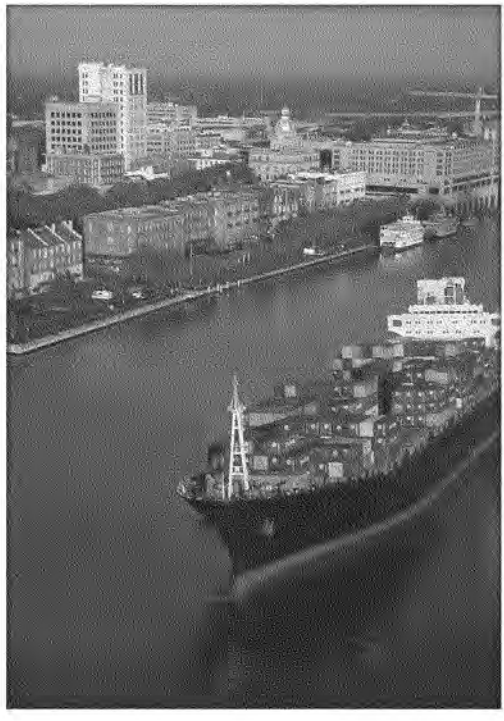
The Corps will also provide technical assistance to the community to help explain scientific data or findings related to ongoing port activities and studies.

FINAL
GENERAL RE-EVALUATION REPORT
SAVANNAH HARBOR EXPANSION PROJECT
Chatham County, Georgia and Jasper County, South Carolina

January 2012
(Revised July 2012)

Main Report
to
Appendix B

Volume 1



US Army Corps of Engineers
Savannah District
South Atlantic Division

Savannah Harbor Expansion Project
List of Final Report Revisions (July 2012)

Document	Location	Page No.	Description
GRR	Main Report	281	Revised amounts in Table 15-5 (cost sharing for CSS Georgia)
GRR	Main Report	287-288	Revised amounts in Table 15-6 (cost sharing for CSS Georgia)
GRR	Main Report	289	Revised amounts in Table 15-7 (cost sharing for CSS Georgia)
GRR	App A	4	Corrected Figure Mis-Print
GRR	App A	16	Corrected Figure Mis-Print
GRR	App A	19	Corrected Figure Mis-Print
GRR	App A	20	Corrected Figure Mis-Print
GRR	App B	3	Inserted text to include land exchange with DOI in list of estates to be acquired
GRR	App B	5	Inserted text to clarify the estimated land value for land exchange will be based on appraisal done at time of transfer
GRR	App B	6	Revised "sixty-six" to "forty-eight"
GRR	App B	7	Inserted text to clarify details of land exchange
GRR	App B	21	Inserted "and wetlands" to regarding excavation lands
EIS	Main Report	3-8	Inserted "below" before MLW
EIS	Main Report	4-68	Revised "threatened" to "endangered" for Atlantic sturgeon (Table 4-13)
EIS	Main Report	4-70	Added text to credit USFWS comments
EIS	Main Report	4-70	Changed "near project area" to "on site"; added Tybee National Wildlife Refuge to list of conservation areas
EIS	Main Report	5-137	Updated Table 5-47 (Air Quality Standards)
EIS	Main Report	5-139	Updated text for air quality
EIS	Main Report	5-152	Inserted timetable regarding completion of Jones/Oysterbed Island Revetment
EIS	Main Report	5-176	Inserted "including fish access to habitat"
EIS	Main Report	6-2	Updated Section 6.03 (Ocean Dumping Act) text to reflect current status
EIS	Main Report	9-1	Updated references
EIS	App B	25	Revised "threatened" to "endangered" for Atlantic Sturgeon (Table 4-1)
EIS	App B	27	Revised "near project area" to "on site" for Savannah and Tybee NWRs
EIS	App C	172	Revised "Draft" to "Final" (ref: USFWS Comprehensive Conservation Plan)
EIS	App C	175	Revised "parcels" to "areas"
EIS	App C	190	Revised text describing SNWR and it's geographical location in the project area
EIS	App F	2	Inserted paragraph describing late 19th century disposition of CSS Georgia
EIS	App F	5-6	Inserted/reorganized text describing historic effort to mitigate effects to CSS Georgia
EIS	App F	6-7	Inserted text to describe recent investigations
EIS	App F	8-9	Inserted text to clearly state conclusions of the existing condition and expected impacts of SHEP
EIS	App F	9-10	Revised text to clarify proposed mitigation process
EIS	App F	15-20	Moved text with detail on proposed work plan/acquisition strategy
EIS	App H	6	Inserted "could" to refer to wetlands that may be impacted during construction of the storage impoundment
EIS	App H	13	Inserted "(if required)" to refer to a discharge site for the storage impoundment
EIS	App K	101	Updated Table 5-47 (Air Quality Standards)
EIS	App K	103-104	Updated text for air quality
EIS	App M	91	Revised text to address USFWS comments on plant tissue threshold
EIS	App M	95	Updated date of revision (signature block)

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US Army Corps
of Engineers
Savannah District
South Atlantic Division

EXECUTIVE SUMMARY

Authority and Purpose

The Georgia Ports Authority (GPA) conducted a feasibility study of potential navigation improvements at Savannah Harbor, Georgia under the authority granted by Section 203 of Water Resources Development Act (WRDA) of 1986 (P.L. 99-662). The US Army Corps of Engineers (the Corps) adopted these documents prepared by the GPA and published a Draft Tier I EIS in May 1998 and the Final Tier I EIS in September 1998. In the Water Resources Development Act of 1999 (Section 101(b)(9)), the US Congress conditionally authorized deepening the Savannah Harbor navigation channel to a maximum depth of -48 feet Mean Low Water (MLW). The conditional authorization stipulated that approval of additional studies and the project is required from the Administrator of the Environmental Protection Agency, the Secretary of Commerce, the Secretary of Interior, and the Secretary of the Army.

The Corps completed the Tier I EIS process when it signed a Record of Decision (ROD) in December 1999. The ROD included additional requirements, including additional review by the Corps of Engineers and approval of the Chief of Engineers to ensure that construction of the project would comply with all applicable laws and policies.

The Savannah District of the Corps in conjunction with the USACE Deep-Draft Navigation Center of Expertise has developed this General Re-evaluation Report (GRR) to fulfill the conditions of the conditional authorization granted in 1999 and to conduct investigations required by the National Environmental Policy Act of 1969 (NEPA). This GRR and EIS provide documentation of the technical and plan formulation analyses conducted in the development of a recommended plan for navigation improvement at Savannah Harbor and associated environmental mitigation. The GRR and EIS assess mitigation plans for alternative channel depths. The EIS includes a final mitigation plan and an incremental analysis of alternative channel depths from -42 to -48 feet, as required by the conditional authorization.

This study identifies and selects the National Economic Development (NED) plan, the plan that has the greatest net economic benefits consistent with protection of the Nation's environment.

Problems and Needs

Garden City Terminal at Savannah Harbor is currently the second largest container port on the US east coast (by Twenty-foot Equivalent Unit [TEU] volume) and the fourth largest in the Nation. Garden City Terminal is a port of call for more than 40 container ship services, which call weekly on a fixed day schedule (liner services). However, Savannah Harbor also currently has the shallowest controlling depth for a major container port. The last major navigation improvements to the Federal navigation project at Savannah Harbor were completed by the Corps of Engineers in 1994, deepening the main navigation channel from -38 feet to -42 feet.

The 1994 navigation improvements were designed to accommodate a class of newly built container ships with a dead weight tonnage of approximately 60,000 tons and a maximum TEU capacity of 4,024 TEUs. The design vessel for the 1994 improvements had a length of 951 feet, a maximum operating draft of 42.6 feet, and a beam of 106 feet, which was then the maximum beam for vessels transiting the Panama Canal. The largest vessels currently calling at the Port are rated at more than 8,100 TEUs, with a dead weight tonnage of 85,900 tons, an overall length of 984 feet, a beam of 131 feet, and a maximum operating draft of 48 feet. Over the intervening years, the GPA has made major investments in landside infrastructure to accommodate increasingly larger vessels and burgeoning trade growth at the Port and the region it serves. The GPA has planned and funded improvements at Garden City Terminal to coincide with the Panama Canal Expansion Project. With these improvements in place, this terminal will be the largest single container handling facility in the Nation.

The increase in the size of containerships calling at the world's major ports, including Savannah Harbor, has been driven by economic efficiency. The world's major ports, including Savannah Harbor's trading partners, maintain channel depths that accommodate the efficient operation of the world's fleet. The primary problems identified in this analysis relate to the inefficient operation of container ships in the Federal channel at Savannah Harbor, which affects the Nation's international trade transportation costs.

Operating costs for container ships calling at Savannah Harbor are increased because vessels need to light load in order to navigate the Federal channel, which reduces vessel efficiency. Vessels using tidal advantage to accommodate arrival or departure drafts, which require additional channel depth, incur the cost of tidal delays. Light loading and tidal delays will increase in the future as present harbor users increase their annual tonnage and as larger, more efficient ships replace older, smaller ones. In addition, existing ships are experiencing problems associated with turning capabilities and overall maneuverability in some reaches of the inner harbor. The severity of problems associated with turning capabilities and overall maneuverability in some reaches of the inner harbor will increase as vessel size increases. The opportunity exists to reduce transportation cost of import and export trade through Savannah Harbor and contribute to increases in national net income.

Alternatives Considered

Several management measures were identified to address the navigation-related problems at Savannah Harbor including operational (i.e., non-structural) measures, locally implemented structural measures, structural measures implemented at other ports, and structural modification of the Federally-authorized channel. The management measures identified and evaluated in this feasibility study were developed through discussions and interviews with GPA, Garden City Terminal operations and management personnel, Savannah Harbor Pilots Association members, and public input.

Evaluated non-structural measures include reducing underkeel clearance requirements and modifications to Garden City infrastructure and operations. Evaluated structural

measures include alternative terminal locations within the South Atlantic region, development of a Regional Southeastern US Container Port, and modifications to the Federal channel at Savannah Harbor. Modifications to the Federal channel include construction of meeting areas, bend wideners, straightening of river bends, turning basin expansion, and channel deepening.

Management measures advanced for more detailed investigation and formulation into alternative plans include channel deepening, turning basin expansion, bend widener, and meeting area construction. The alternative plans evaluated in a feasibility level investigation include the Plan A - No Action, in which no improvements would be made to the existing Savannah Harbor Federal Navigation Project. The navigation channel would remain at its presently authorized 42-foot depth in the inner harbor and 44- foot depth in the entrance channel. Plan B – Channel Deepening Alternatives includes incremental channel deepening, widening, meeting area construction, and turning basin expansion.

Plan B includes several scales, ranging from a 44-foot to a 48-foot channel depth. The channel deepening plans have the following components:

- **Channel Length:** From the ocean to Station 103+000, plus an upstream transition;
- **Channel Width:** Maintain existing side slopes. The bottom width for a 48-foot channel would be 464-feet;
- **Channel Depth:** Channel depth in one-foot increments to 48-feet;
    - Plan B-44: a 2-foot channel deepening,
    - Plan B-45: a 3-foot channel deepening,
    - Plan B-46: a 4-foot channel deepening,
    - Plan B-47: a 5-foot channel deepening,
    - Plan B-48: a 6-foot channel deepening,
- **Entrance Channel Extension:** From Station -60+000 to Station -98+600;
- **Turning Basins:** Deepen and enlarge Kings Island Turning Basin to 1,600-feet x 1,600-feet (radius determined by ship simulation analysis);
- **Bend Wideners**: Use the three bend wideners identified as necessary by ship simulation analysis; and
- **Meeting Areas:** Use the three alternative meeting area alternatives in an incremental analysis (dimensions determined by the ship simulation analysis):
    - Long Island Meeting Area – 8,000 foot meeting area located from approximately Station 14+000 to Station 22+000;
    - Oglethorpe Meeting Area – 4,000 foot meeting area located from approximately Station 55+000 to Station 59+000;
    - Combination of both Long Island and Oglethorpe Meeting Areas.

The formulation of alternative plans carefully considered the optimization of channel widths and depths to maximize net average annual benefits and contributions to the NED account. This included identification of design vessels and associated dredging requirements, identification of structural and non-structural improvements, and estimation of incremental costs and benefits. The plan formulation process also considered the characteristics and quality of dredged material and requirements for disposal. All non-Federal ancillary facilities that are required to deliver project benefits were identified, costs estimated, and are included as associated costs in the alternative evaluation and economic analysis. All plans were evaluated using the System of Accounts framework established in the Principles and Guidelines (P&G 1983) promulgated by the Water Resources Council. The final alternatives were evaluated based on comparison to the No Action Plan, in order to identify the plan that maximized net economic benefits to the nation.

Extensive investigations were conducted to project potential impacts of the alternative plans. Savannah District used hydrodynamic and water quality models to identify many of the impacts to natural resources from the proposed project alternatives. These included impacts to salinity, water quality, wetlands, and fisheries. Impacts to other resources were evaluated using separate analyses. Those evaluations included potential impacts to the drinking water aquifer, the City of Savannah's raw water intake at Abercorn Creek, adjacent ocean beaches, riverine shorelines, and air quality. The Stakeholders Evaluation Group, which includes concerned members of the general public and agency officials, was instrumental in identifying potential environmental impacts, identifying appropriate impact assessment tools and techniques, and identifying mitigation measures.

The Selected Plan

The Selected Plan is the NED Plan, which includes navigation improvements to the existing channel and mitigation that extends into the upper harbor beyond the extent of the navigation improvements. The 47-foot depth alternative maximizes net benefits at an average annual equivalent of $174 million (FY 2012 price levels and discount rate; 4.00%). At the next increment (48-foot plan), there would be a decrease in net benefits, which indicates that a plan deeper than the 47-foot alternative is not the most economically efficient. Therefore, the NED plan is identified as the 47-foot plan.

The navigation components of the NED Plan consist of the:

- 47-foot deepening alternative, which includes channel bend wideners, and expansion of the Kings Island Turning Basin;
- Deepening of the entrance channel to -47 feet from Stations 0+000 to Station -14+000B and to -49 feet from Station -14+000B to Station -60+000B and extending the entrance channel from Station -60+000B to -97+680B;
- Long Island Meeting Area at -47 feet; and
- Oglethorpe Meeting Area at -47 feet.

The FY 2012 Project First Cost is $652 million for the Selected Plan. The Selected Plan FY 2012 annual average equivalent cost (including annual maintenance) is $39 million. The average annual equivalent benefits for the Selected Plan are $213 million, which result in average annual equivalent net benefits of $174 million and a benefit-to-cost ratio of 5.5. The project was authorized in Section 101(b)(9) of WRDA 1999 to be carried out at a total cost of $230,174,000. When escalated to October 2011 price levels in accordance with the procedure set out in ER 1105-2-100, Appendix G, implementing Section 902 of WRDA 1986, the authorized total project cost amounts to $469 million. The current estimated Project First Cost of $652 million exceeds that amount by more than 20 percent, necessitating a statutory modification to the project to increase its authorized total cost.

The Selected Plan would result in marsh conversion and brackish marsh loss. Impacts to fisheries would include some loss of habitat for Striped bass and Shortnose sturgeon. The Project would increase chloride concentrations in Abercorn Creek at the water intake for the City of Savannah's water treatment plant during droughts and at industrial intakes on the Savannah River.

The natural resource mitigation plan consists of the following components:

- Constructing and operating flow re-routing features in and near the Savannah National Wildlife Refuge to reduce salinity impacts to tidal freshwater and brackish wetlands and fishery habitat;
- Acquiring bottomland hardwoods/freshwater wetlands to compensate for salinity increases to tidal freshwater wetlands. The acquired lands would become part of the Savannah National Wildlife Refuge and be managed by the USFWS;
- Marsh restoration in Disposal Area 1S to compensate for loss of 15.68 acres of brackish marsh that would be lost due to excavation requirements of the project;
- Constructing and operating an oxygen injection system to remove the incremental effects of the harbor deepening project;
- Constructing and operating a fish bypass channel at the New Savannah Bluff Lock and Dam to compensate for impacts to Shortnose sturgeon habitat;
- Funding a Striped bass stocking program to compensate for adverse impacts to Striped bass spawning and nursery habitats within the estuary;
- Constructing a raw water impoundment to supply the City of Savannah water treatment plant with water during periods of high chloride concentrations;
- Implementing adaptive management features if post-construction monitoring shows them to be needed. Those features include removing the Tidegate sill, enlarging the diversion structure at the mouth of McCoys Cut, a diversion structure at the junction of Middle and Back Rivers, and acquisition of additional freshwater wetlands if required. Implementation of any or all of these features may not be needed, but the project would include funding sufficient to implement all of them. Which of these features would be implemented would depend on the findings of the monitoring.

Other features of the mitigation plan include:

- Recovery and preservation of the remains of the CSS *Georgia*; and
- Construction of a public boat ramp on Hutchinson Island.

Plan Implementation

In accordance with the provisions of Federal laws and policies, the Federal share of the first cost of implementing the Selected (NED) Plan is estimated to be $454,000,000 (FY 2012). The estimated non-Federal share of the recommended plan is $198,000,000 (FY 2012), including lands, easements, rights-of-way, relocations, disposal areas, and associated non-Federal costs. Additional annual maintenance costs to the United States are estimated to be $5,100,000 (FY 2012). Maintenance of any non-Federal ancillary facilities is a 100% non-Federal responsibility.

The GRR and EIS serve as decision documents regarding whether to implement the conditionally authorized deepening. Upon approvals, the study will proceed through preconstruction, engineering and design (PED), and construction by the Corps of Engineers. The schedule to proceed with construction is estimated to be as early as Fiscal Year 2013, subject to approvals by the Secretary of the Army, Secretary of the Department of Commerce, and Secretary of the Interior, and the Administrator of the Environmental Protection Agency, and subject to Congressional appropriations. The project base year is estimated to be Fiscal Year 2017.

Environmental Considerations

The GRR and the EIS were prepared in accordance with the requirements of the National Environmental Policy Act. The EIS was prepared with the assistance of the following Cooperating Agencies: USEPA Region IV, USFWS Southeast Region, NOAA Fisheries Service Southeast Region, and Georgia Ports Authority. Some potential environmental impacts have been avoided through modified channel design, dredged material placement location selection, dredged material placement technique, and mitigation plan design. Remaining unavoidable significant adverse impacts are mitigated through implementation of the mitigation plan. The Selected Plan has been found to be in conformance with Federal, State, and local statutes and policies.

Agency and Public Coordination

After the conditional authorization, the GPA formed the Stakeholders Evaluation Group (SEG) in 1999 to provide a recurring public forum about the project and to assist them and the Corps in identifying scientific studies and technical analyses that should be performed to identify environmental impacts that may result from proposed deepening of the harbor. The SEG has as its principal charge the development of consensus amongst the participants regarding:

- the scope and content of the scientific investigations and analyses to be performed pursuant to the development of the Final EIS; and

- the appropriate increment of channel depth and the appropriate mitigation measures.

As those studies were identified, GPA and the Corps began conducting those tasks. Since its inception, the SEG has provided input to GPA and Federal and State agencies on all aspects of the scientific investigations, analyses, and mitigation options for the proposed action. The Corps performed additional studies and investigations which it believed were necessary to properly evaluate the alternatives.

Substantial efforts have been made to inform and listen to the public, the SEG, local communities, and State and Federal resource agencies regarding the proposed harbor deepening. Since its inception in January 1999 to the present day, the Corps has met with the SEG approximately 70 times to discuss the proposed action. In addition to the Public Scoping Meeting on February 21, 2002 and the NEPA scoping meeting on April 12, 2002, a number of meetings with the public and agencies have discussed the project issues including salinity, lowered dissolved oxygen, conversion of freshwater wetlands to brackish wetlands, nekton, benthos, contaminated sediments, economics, and other impacts related to the proposed harbor deepening. A public information meeting was also held 30 days after release of the Draft EIS, on December 15, 2010, to provide opportunity for public and agency input. The models used to quantify impacts to water quality, DO, chlorides, salinity, fisheries, and conversion of freshwater wetlands to brackish wetlands have been reviewed and agreed to by the State and Federal agencies. The conclusions from these meetings and subsequent comments are incorporated into the GRR and EIS.

Table of Contents

1 Introduction 1
1.1 Location and Setting 5
1.2 Authorizations 5
1.3 Study Purpose and Scope 6
1.4 Existing Navigation Project 8
1.4.1 Navigation Channel 8
1.4.2 Advance maintenance 9
1.4.3 Turning Basins 12
1.4.4 Sediment Control Works 14
1.4.5 Freshwater Control Works 16
1.4.6 Long Term Management Strategy 18
1.4.7 Dredged Material Management Plan 18
1.5 Public Involvement 22
1.6 Planning Process and Report Organization 23
2 Prior Studies, Reports, and Existing Water Projects 25
2.1 Savannah Harbor Deepening Feasibility Report, 1991 25
2.2 Savannah Harbor Expansion Reconnaissance Report, 1996 25
2.3 Savannah Harbor Deepening Feasibility Report (Section 203) and Tier I EIS 1998 25
2.3.1 Chief's Report on Savannah Harbor Deepening Feasibility Study (Section 203) 26
2.3.2 Record of Decision on Savannah Harbor Deepening Feasibility Study (Section 203) 26
2.4 Savannah Harbor Dredged Material Management Plan-2011 Annual Work Plan 27
2.5 Environmental Improvement (Section 1135) Study 29
2.6 Savannah Harbor Long Term Management Strategy 29
2.7 Lower Savannah River Basin Environmental Restoration Project 31
3 Problems and Opportunities 31
3.1 Problems 31
3.2 Opportunities 32
4 Inventory of Existing Conditions 32
4.1 Overview of Existing Navigation Resources 33
4.2 Existing Container Ship Industry Operations 34
4.3 Existing World Container Ship Fleet 37
4.4 Existing Savannah Harbor Operations 40
4.4.1 Garden City Terminal Infrastructure and Operations 42
4.4.2 Regional Landside Transportation Infrastructure 43
4.5 Existing Garden City Terminal Cargo 44

4.5.1 Hinterland and Regional Distribution Centers 46
4.6 Existing Garden City Terminal Vessel Operations 46
4.7 Existing Socio-Economic Profile 49
4.8 Existing Environmental Resources 50
4.8.1 Geology and Sediments 50
4.8.2 Water Resources 51
4.8.3 Air Quality 53
4.8.4 Marine and Estuarine Resources 53
4.8.5 Terrestrial Resources 54
4.8.6 Wetlands 56
4.8.7 Special Status Species and Resource Areas 56
4.8.8 Recreational Resources 56
4.9 Existing Conditions: Cultural Resources 57
4.9.1 The Wreck of the CSS Georgia 58
4.9.2 Fort Pulaski National Monument (GA) 59
4.9.3 Fort James Jackson National Historic Landmark (GA) 59
4.9.4 Savannah National Historic Landmark District (GA) 59
4.9.5 Savannah River Civil War Cribs 60
5 Forecast of Without-Project Conditions 60
5.1 Panama Canal: Deepening Existing Locks (2010) and Expansion (2014) 60
5.2 US East Coast and Gulf Coast Port Configurations and Capacities 61
5.3 Garden City Terminal Infrastructure and Capacity 64
5.4 Containerized International Trade Projections 65
5.4.1 Commodity Forecast Baseline: Garden City Terminal 68
5.4.2 2008 Savannah Harbor Tonnage Forecast 71
5.4.3 2010 Updated Savannah Harbor Tonnage Forecast 72
5.4.4 Final Savannah Harbor Commodity Tonnage Forecast 74
5.4.5 Commodity Forecast: Garden City Terminal TEUs 76
5.5 International Container Ship Fleet 77
5.5.1 World Fleet 77
5.5.2 Savannah Harbor Fleet 78
5.5.3 Load Factor Analysis 82
5.5.4 Savannah Harbor Fleet Projections 85
5.6 Without-project Conditions: Socio-Economic Profile 89
5.7 Without-project Conditions: Environmental Resources 90
5.7.1 Population Growth and Associated Development 90
5.7.2 Sea-level rise 91
5.7.3 Environmental Regulations 92
5.7.4 Environmental Management 93
5.8 Without-Project Conditions: Study Area Cultural Resources 93
6 Formulation of Alternative Plans 94

6.1 Planning Goals 94
6.2 Project Objectives 95
6.3 Planning Constraints 96
6.4 Plan Formulation Criteria 96
6.5 Management Measures 99
6.5.1 Preliminary Screening of Management Measures 102
6.6 Evaluation of Alternative Non-structural Measures 104
6.6.1 Reduce Underkeel Clearance Requirement 104
6.6.2 Modification of Garden City Terminal 106
6.7 Evaluation of Alternative Structural Measures 107
6.8 Alternative Terminal Locations 111
6.8.1 Alternative Terminal Locations: Transportation Cost Differences 111
6.8.2 Alternative Terminal Locations: Criteria Evaluation 112
6.8.3 Alternative Terminal Locations: Cost Evaluation 116
6.8.4 Alternative Terminal Locations: Summary Assessment 117
6.9 Development of a Regional Southeastern US Container Port 119
6.10 Other Channel Modifications (Structural Alternatives) 121
6.10.1 Meeting Areas 121
6.10.2 Bend Wideners 123
6.10.3 Straightening of the River 123
6.10.4 Turning Basin Expansion 123
6.11 Development of Alternative Plans 124
6.12 Description of Alternative Plans 126
6.12.1 Plan A – No Action 126
6.12.2 Plan B – Channel Deepening Alternatives 126
7 Alternative Plan Evaluation: Benefits 128
7.1 Transportation Cost Savings Model Benefits 129
7.2 Meeting Area and Tide Delay Benefits 132
7.2.1 Meeting Area Benefits 132
7.2.2 Tide Delay Reduction Benefits 135
7.2.3 Cumulative Benefits – Meeting Area and Tide Delay Reduction 137
7.3 Total Average Annual Equivalent Project Benefits 137
8 Alternative Plan Evaluation: Environmental Impacts 138
8.1 Impact Avoidance 139
8.1.1 Modified Channel Design 139
8.1.2 Dredged Material Placement Location Selection 141
8.1.3 Alternative Disposal Methods or Beneficial Use of Dredged Sediments 141
8.1.4 Dredged Material Placement Technique Selection 144
8.2 Impact Assessment 146
8.2.1 Groundwater Impacts 154

8.2.2 Erosion Impacts 155
8.2.3 Air Quality Impacts 156
9 Alternative Plan Evaluation: Mitigation Planning 157
9.1 Mitigation Measure Identification 157
9.2 Marsh Mitigation Plan Development 158
9.2.1 Identification of Lands to be Acquired 168
9.2.2 Salt Water and Brackish Wetland Compensation 169
9.3 Dissolved Oxygen Mitigation Plan Development 171
9.4 Shortnose Sturgeon Mitigation Plan Development 174
9.5 Striped Bass Mitigation Plan Development 176
9.6 Chloride Mitigation Plan Development 178
9.6.1 Chloride Impacts to Savannah's Municipal and Industrial Water Treatment Plant 178
9.6.2 Mitigation for Impacts at City of Savannah's Water Treatment Plant 181
9.7 Secondary Impacts 185
9.8 Cumulative Impacts 185
10 Alternative Plan Evaluation: Costs 186
10.1 Identification of Alternative Plan Elements 186
10.2 Detailed Descriptions of Alternative Plans 187
10.2.1 Shared Plan Elements 187
10.2.2 Incremental Project Elements 189
10.3 Alternative Plan Costs 191
10.3.1 Construction Cost Narrative 191
10.3.2 Incremental Dredging-Related Costs 195
10.3.3 Incremental Mitigation Costs 196
10.3.4 Total Incremental Construction Costs 197
10.3.5 Interest During Construction 197
10.3.6 Operation and Maintenance Costs 198
10.3.7 Total Average Annual Equivalent Costs 199
10.4 Value Engineering Analysis 200
11 Plan Comparison 202
11.1 Net Benefits of Alternative Plans 202
11.2 NED Plan Identification 204
11.3 Summary of Accounts and Plan Comparison 204
12 Uncertainty Considerations 229
12.1 Economic Analysis Uncertainty 229
12.1.1 Jasper County Terminal Sensitivity Analysis 229
12.1.2 Alternative Sensitivity Analyses 234
12.2 Cost Risk Analysis 240
12.3 Environmental Impact and Mitigation Uncertainty 241
12.3.1 Uncertainty in Salinity Predictions 242

12.3.2 Risk with Salinity Predictions 242
12.3.3 Uncertainty in Dissolved Oxygen Predictions 242
12.3.4 Risk with Dissolved Oxygen Predictions 243
12.3.5 Uncertainty in Biological Responses 243
12.3.6 Risk in Biological Responses 244
12.4 Risk in Sea-Level Change Assumptions 244
13 Public Involvement, Review, and Consultation 245
13.1 Public Involvement Program 245
13.2 USACE Environmental Operating Principles 247
13.3 Application of USACE Campaign Plan 249
13.4 Scoping and Draft EIS 253
13.5 Agency and Public Coordination 254
13.6 Summary of Comments on November 2010 Draft GRR and Draft EIS 256
14 Selected Plan 259
14.1 Environmental Effects 263
14.2 Mitigation Details 264
14.2.1 Mitigation Costs 267
14.3 Plan Construction 267
14.4 Operation and Maintenance 272
14.4.1 Advance Maintenance 273
15 Plan Implementation Requirements 273
15.1 Section 902 Cost Limitation 273
15.2 Cost Sharing 285
15.3 Financial Analysis of Non-Federal Sponsor's Capabilities 290
15.4 Land Requirements 290
15.5 Non-Federal Sponsor's Responsibilities 291
16 Conclusions 294
17 District Engineer's Recommendation 297

List of Tables

Table 1-1: Savannah Navigation Channel Dimensions 9
Table 1-2: Advance Maintenance Areas (feet below MLLW) 12
Table 1-3: Turning Basin Locations and Dimensions 14
Table 1-4: Savannah Harbor Navigation Project Dredged Material Containment Areas 20
Table 4-1: Controlling Depths at Major US East Coast Ports, the Panama Canal, and Major Foreign Trading Partner Ports 36
Table 4-2: Current World Containership Fleet (July 13, 2010) 38
Table 4-3: World Container Ship Orderbook by Scheduled Delivery Date 38
Table 4-4: 2013 World Container Ship Fleet (July 13, 2010) 39
Table 4-5: World Fleet Existing and Ordered Post-Panamax Vessels (number of vessels) 40
Table 4-6: Savannah Harbor Waterborne Freight Traffic: 1995 – 2009 (thousands of short tons) 41
Table 4-7: Garden City Terminal TEU Volumes (1995 – 2010) 45
Table 4-8: 2007 Savannah Harbor Container Ship Arrival and Departure Drafts (number of calls) 47
Table 4-9: Savannah Harbor Economic Impact – 2009 (millions of 2009 dollars) 50
Table 5-1: Panama Canal Maximum Vessel Dimensions 61
Table 5-2: New, Planned, or Proposed Container Terminals U S East and Gulf Coasts 61
Table 5-3: Savannah Harbor Container Ship Services 66
Table 5-4: Savannah Harbor Historical Containerized Import Tonnage 69
Table 5-5: Historical Savannah Harbor Containerized Export Tonnage 70
Table 5-6: Commodity Forecast Baseline (Year-2010) Tonnage 70
Table 5-7: Global Insight's 2008 Savannah Harbor Containerized Trade Forecast – Imports (Metric Tons) 71
Table 5-8: Global Insight's 2008 Savannah Harbor Containerized Trade Forecast – Exports (Metric Tons) 72
Table 5-9: 2010 Savannah Harbor Import and Export Tonnage Forecast 73
Table 5-10: Savannah Harbor Updated Tonnage Forecast Year-to-Year Rates of Change 74
Table 5-11: SHEP Containerized Trade Forecast - Import Metric Tons 75
Table 5-12: Savannah Harbor Containerized Trade Forecast - Export Metric Tons 75
Table 5-13: Container Box Weight by Service 76
Table 5-14: TEU Forecast for Selected Years 77
Table 5-15: Route Percent Share of Panamax and Post-Panamax Vessel Tonnage 81
Table 5-16: Example Load Factor Analysis Capacity Allocation – 107,000 DWT Vessel 83
Table 5-17: Projected Maximum Vessel Drafts: Savannah Harbor 84
Table 5-18: Estimated Vessel Unit Costs 85

Table 5-19: Projected FE (Panama) ECUS Vessel Calls: Garden City Terminal 86
Table 5-20: Projected ECUS MED Vessel Calls: Garden City Terminal 86
Table 5-21: Projected FE (Suez) ECUS Vessel Calls: Garden City Terminal 87
Table 5-22: Total Projected Vessel Calls: Garden City Terminal 88
Table 5-23: Local Area Population Projections 89
Table 5-24: Local Area Employment Projections 89
Table 5-25: Savannah Harbor Market Area Population Projections (2005 – 2030) 90
Table 6-1: Annual Waterborne Transportation Cost Savings and Landside Transportation Cost Increases (2003) 112
Table 6-2: Evaluation of Alternative Terminal Sites 116
Table 6-3: Facility Costs, Dredging & Mitigation Costs, and Total Costs for Alternative Terminals (2003) 116
Table 6-4: Summary Assessment of Alternative Terminals 118
Table 6-5: Evaluation of Higher Ranked Alternative Terminal Sites (2003). 119
Table 6-6: Ship Simulation Results: Bend Widening 123
Table 7-1: Savannah Share of Voyage Cost 130
Table 7-2: Average Annual Equivalent Transportation Cost Savings by Project Depth 131
Table 7-3: Incremental Transportation Cost Savings by Project Depth 132
Table 7-4: LNG Vessel Fleet (bcm) (2015-2030) 134
Table 7-5: General Cargo Fleet – Annual Vessel Calls (2017-2030) 134
Table 7-6: Meeting Area Average Annual Benefits 135
Table 7-7: Tide Delay Benefits 136
Table 7-8: Average Annual Benefits - Tide Delay Reduction 136
Table 7-9: Cumulative Benefits – Meeting Areas and Tide Delay Reduction 137
Table 7-10: Total Average Annual Equivalent Incremental Deepening Benefits 137
Table 8-1: Savannah Harbor Expansion Project-Modeling Reports 149
Table 8-2: Summary of Project-Related Impacts without Mitigation 151
Table 8-3: Summary of Project-Related Impacts with Mitigation 153
Table 9-1: Preliminary Mitigation Measure Ranking 161
Table 9-2: Mitigation Planning Dual Approach: Measures and Combinations 162
Table 9-3: Preliminary Marsh Mitigation Evaluation: -48 Foot Deepening Alternative 162
Table 9-4: Marsh Mitigation Plan Evaluation: -48 Foot Deepening Alternative 164
Table 9-5: Marsh Mitigation Plan Cost Effectiveness: -48 Foot Deepening Alternative 165
Table 9-6: Summary of SOP Calculations: 48 Foot Alternative 167
Table 9-7: Wetland Preservation Calculations 167
Table 9-8: Impacted Wetland Characteristics 169

Table 9-9: Re-Vegetation Rate for Created Marsh 170
Table 9-10: Dissolved Oxygen System Requirements 172
Table 9-11: Striped Bass Weighted Average Impact 177
Table 9-12: Striped Bass Annual Mitigation Costs 177
Table 9-13: Striped Bass Lump Sum Compensation Value 178
Table 10-1: Dredged Material Volume Estimates[1]: Meeting Areas (cubic yards) 188
Table 10-2: Dredged Material Volume Estimates:[1] Incremental Deepening Alternatives (cubic yards) 190
Table 10-3: Dredging Related Costs: Incremental Deepening Alternatives (October 2010 Dollars) 195
Table 10-4: Mitigation-Related Costs: Incremental Deepening Alternatives (October 2010 Dollars) 196
Table 10-5: Total Construction First Costs: Incremental Deepening Alternatives (October 2010 Dollars) 197
Table 10-6: Total Investment Costs including Interest During Construction 198
Table 10-7: Total Annual O&M Costs: Incremental Deepening Alternatives (October 2010 Dollars) 199
Table 10-8: Average Annual Equivalent (AAEQ) Project Costs: Incremental Channel Deepening Alternatives 199
Table 11-1: Economic Analysis of Alternative Deepening Plans (FY 2011) 203
Table 11-2: Meeting Area Average Annual Equivalent Net Benefits 203
Table 11-3: Savannah Harbor Expansion – System of Accounts 206
Table 12-1: Jasper County Terminal Sensitivity Analysis - 1 233
Table 12-2: Jasper County Terminal Sensitivity Analysis - 2 234
Table 12-3: Transportation Cost Model Sensitivity Analyses AAEQ Cost Savings 236
Table 14-1: Selected Plan (47-Foot Deepening) Economic Highlights 261
Table 14-2: Existing and Selected Plan Widths (feet) 262
Table 14-3: Existing and Selected Plan Depths (feet below MLLW) 263
Table 14-4: Environmental Effects of the Selected Plan 264
Table 14-5: Selected NED Plan Mitigation Costs 267
Table 15-1: SHEP Federal Funding Allocation 274
Table 15-2: SHEP Project Costs History 276
Table 15-3: SHEP Project Average Annual Costs and Benefits History 279
Table 15-4: SHEP Project Cost Comparison (1999 Authorized Plan and Selected Plan) ..... **Error! Bookmark not defined.**
Table 15-5: SHEP Project Cost Sharing Comparison (1999 Authorized Plan and Selected NED Plan) ..... **Error! Bookmark not defined.**
Table 15-6: Savannah Harbor Expansion Cost Allocation for the Selected NED 47-Foot Plan (FY12 Price Levels) 286
Table 15-7: Cost Sharing Explanations 289

List of Figures

Figure 1-1: Savannah Harbor Expansion Project 2
Figure 1-2: Inner Harbor 3
Figure 1-3: Typical Dredging Section – Inner Harbor 10
Figure 1-4: Typical Dredging Section – Entrance Channel 11
Figure 1-5: Savannah Harbor Turning Basins 13
Figure 1-6: Tidegate 15
Figure 1-7: Freshwater Control Works 17
Figure 1-8: Savannah Harbor Disposal Areas 20
Figure 1-9: Approved Unconfined Placement Areas for Maintenance Material 21
Figure 4-1: Selected World Harbor Depths Comparison 37
Figure 4-2: Savannah Harbor Historical Commodity Growth with Trendline 41
Figure 4-3: Garden City Terminal Historical Loaded TEUs 45
Figure 4-4: Garden City Terminal 2007 Arrival and Departure Drafts 47
Figure 5-1: FE (Panama) ECUS Trade Map 67
Figure 5-2: FE (SUEZ) ECUS Trade Map 67
Figure 5-3: Projected World Container Fleet by TEU Capacity 78
Figure 5-4: Projected Post Panamax Vessel Calls at Savannah 80
Figure 5-5: Savannah Harbor First Generation Post-Panamax Vessel Calls by Service Route 81
Figure 5-6: Savannah Harbor Second Generation Post-Panamax Vessel Calls by Service Route 82
Figure 6-1: Alternative Terminal Locations 109
Figure 8-1: Typical Channel Cross Section 140
Figure 9-1: Mitigation Options 160
Figure 9-2: Proposed Locations for Dissolved Oxygen Improvement Systems 173
Figure 9-3: Proposed Impoundment Location 183
Figure 13-1: Summary of Comment Subject Areas 256
Figure 14-1: Selected Plan Construction Schedule 271

Appendices

Appendix A: Economics
Appendix B: Real Estate
Appendix C: Engineering
Appendix D: Plan Formulation
Appendix E: Quality Control

1 Introduction

The purpose of this investigation is to determine appropriate future actions, if any, concerning navigation improvements to the Federal navigation channel at Savannah Harbor. This General Re-Evaluation Report (GRR) documents the planning process undertaken for the Savannah Harbor Expansion Project (SHEP), which assesses potential navigation improvements at Savannah Harbor (Figures 1-1 and 1-2).

Garden City Terminal, which is the Georgia Ports Authority-operated container terminal at Savannah Harbor, is currently the second largest container port on the US east coast and the fourth largest in the Nation. However, Savannah Harbor also currently has the shallowest controlling depth for a major port. Although the 42-foot controlling depth and 38-foot unrestricted access depth at Savannah Harbor is similar to current constraints at the Panama Canal (39 feet), the Panama Canal Expansion Project will be fully operational by 2014, which will allow passage for vessels with up to 50 feet of draft. The Georgia Ports Authority has planned and funded improvements at Garden City Terminal to coincide with the Panama Canal Expansion Project. With these improvements in place, this terminal will be the largest single container handling facility in the Nation with more than 1,200 acres of terminal space, 9,000 feet of berth, 33 post-Panamax size cranes, and two on-site intermodal transfer facilities serviced by two major rail lines. The facility, at full build out, will have a throughput capacity of 6.5 million Twenty-Foot Equivalent Units (TEUs).

Navigation improvements at Savannah Harbor present the opportunity to reduce future waterborne transportation costs and to enhance efficiency in international trade associated with larger, more efficient vessels. Garden City Terminal infrastructure improvements and off-terminal landside transportation infrastructure improvements to increase the container handling efficiency of the terminal are ongoing.

United States Army Corps of Engineers (USACE) project planning follows the six-step process first described in the Principles and Guidelines[1] (P&G [1983]) adopted by the Water Resources Council and promulgated by Executive Order and further elaborated in the Planning Guidance Notebook, ER 1105-2-100 (22 April 2000). Although presented in series, these steps are applied in an iterative process, which focuses emphasis on succeeding steps. Steps in the plan formulation process include:

- The specific problems and opportunities to be addressed in the study are identified, and the causes of the problems are discussed and documented. Planning goals are set, objectives are established, and constraints are identified.

[1] The Water Resources Council's P&G (February 3, 1983) are comprised of two parts: The Economic and Environmental *Principles* for Water and Related Land Resources Implementation Studies and The Economic and Environmental *Guidelines* for Water and Related Land Resources Implementation Studies.

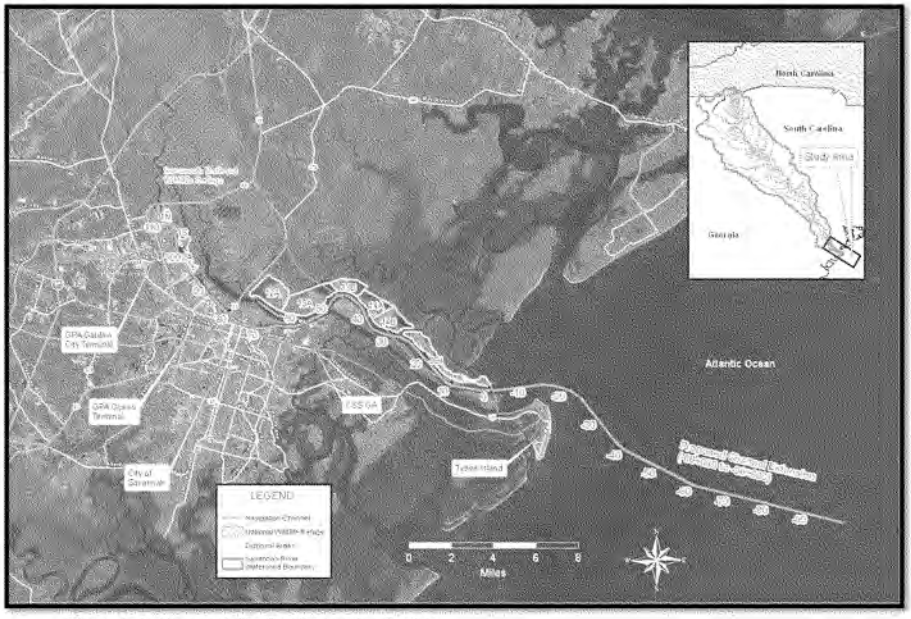


Figure 1–1: Savannah Harbor Expansion Project

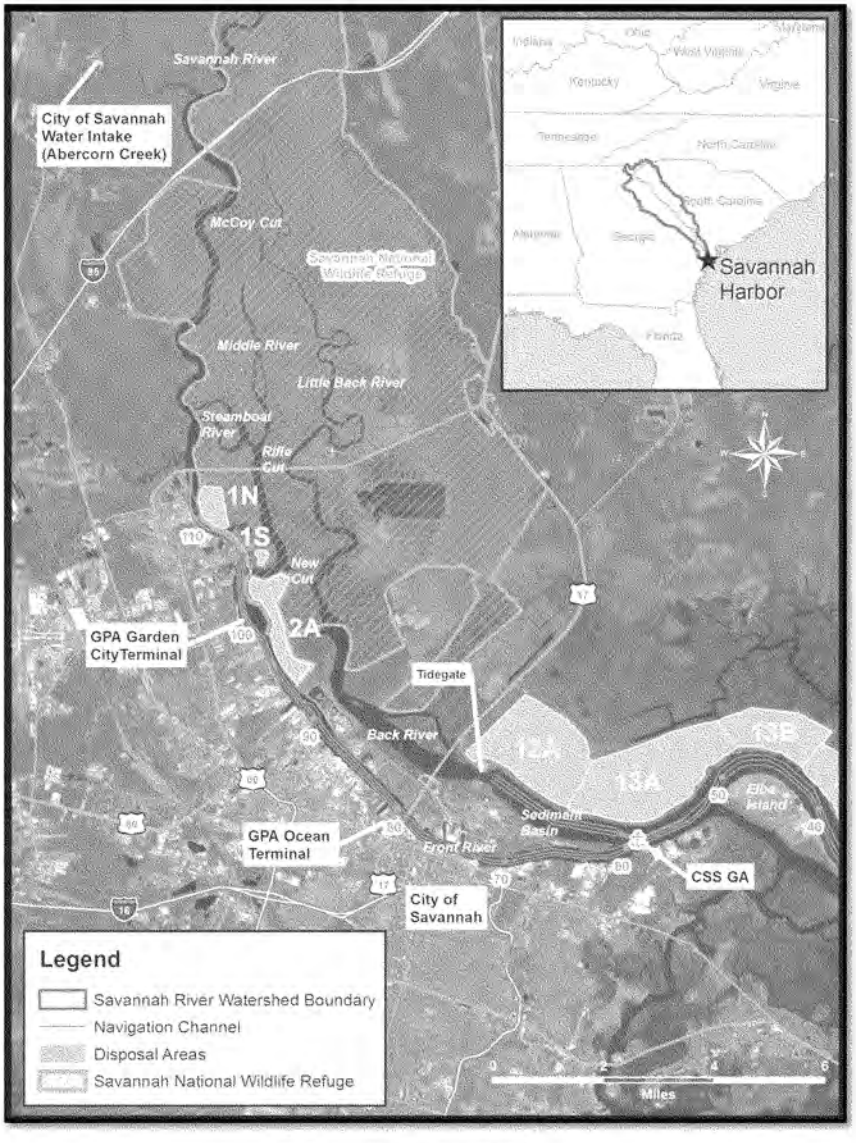


Figure 1-2: Inner Harbor

- Existing and future without-project conditions are identified, analyzed, and forecast. The existing condition resources, problems, and opportunities critical to plan formulation, impact assessment, and evaluation are characterized and documented.

- The study team formulates alternative plans that address the planning objectives. A range of alternative plans is identified at the beginning of the planning process and screened and refined in subsequent iterations throughout the planning process.

- Alternative project plans are evaluated for effectiveness, efficiency, completeness, and acceptability. The impacts of alternative plans are evaluated using the system of accounts framework specified in the Principles and Guidelines and ER 1105-2-100.

- Alternative plans are compared. Contributions to National Economic Development (NED) are used to prioritize and rank alternatives. The public involvement program is used to obtain public input to the alternative identification and evaluation process.

- A plan is selected for recommendation, and a justification for plan selection is prepared.

The USACE Civil Works planning community employs definitions for problems, opportunities, goals, objectives, and constraints that have specific meanings in the Federal water resources planning process. Problems are defined by the planner as the undesirable conditions or characteristics that need to be changed. Opportunities are conditions or characteristics which may be exploited to address or resolve the problems identified in the planning process. Opportunities often include the means to favorable outcomes which would result from plan implementation. Planning study objectives describe the favorable outcomes of a successfully implemented plan. Objectives are developed so as to solve the problems and take advantage of the opportunities. Alternative plans are formulated to achieve policy level goals, such as contribute to NED, and meet planning study objectives. Constraints are restrictions which limit the set of potential alternative plans. Alternative plans are formulated to avoid violating planning constraints.

This document describes the planning process and technical investigations used in the analysis of potential navigation improvements at Savannah Harbor.

1.1 Location and Setting

Savannah Harbor is a deep-draft harbor located on the South Atlantic U.S. coast, 75 statute miles south of Charleston Harbor, South Carolina, and 120 statute miles north of Jacksonville Harbor, Florida. The harbor comprises the lower 21.3 miles of the Savannah River (which, with tributaries, forms the boundary between Georgia and South Carolina along its entire length of 313 miles) and 11.4 miles of channel across the bar to the Atlantic Ocean.

Within the harbor limits, the Savannah River is generally divided into two channels by a series of islands. From the Atlantic Ocean to River Mile 10, where the river converges, the harbor is separated into South and North Channels. Within this area, the navigation channel is maintained in the North Channel. After divergence of the river into Front and Back Rivers at River Mile 11, the navigation channel is maintained in the Front River and passes by the business district of the City of Savannah. The navigation channel is maintained in the Front River to the upper limits of the harbor at River Mile 21.3. The Atlantic Intracoastal Waterway (AIWW) crosses the navigation channel approximately 5.5 miles upstream of the entrance to the harbor. The Savannah River Below Augusta Project, which is a shallow-draft navigation channel authorized for 9 feet deep and 90 feet wide, extends upstream from the harbor (River Mile 21.3) to River Mile 202.6 at Augusta, Georgia.

1.2 Authorizations

Below is a list of Federal actions in Savannah Harbor ending with the Water Resources and Development Act of 1999, which conditionally authorized the deepening of the Savannah Harbor Navigation Project:

- 1793 – Commissioners and Pilotage authorized to "turn and alter"
- 1826 – Rivers & Harbors Act (Deepen the Back River at a cost between $3,250 and $10,833)
- 1873 – (22 feet), 1907 (26 feet), 1917 – 1935 (30 feet), 1945 – 1954 (34 feet), 1965 (38feet), 1986 (Widening)
- 1994 – Savannah Harbor Deepened to 42 feet
- 1998 – The Georgia Ports Authority (GPA) completed a feasibility study under Section 203 of the Water Resources Development Act (WRDA) of 1986
- 1999 – Congress conditionally authorized deepening the Savannah Harbor Navigation Project to a maximum controlling depth of 48 feet (14.6 meters) within the river channel contingent upon completion of an Environmental Impact Statement (EIS), a final mitigation plan, and an incremental analysis of the channel depths from 42 to 48 feet below mean lower low water (MLLW).

The applicable provision in WRDA 1999 (Public Law 106-53 – August 17, 1999) states as follows:

"SEC. 101. PROJECT AUTHORIZATIONS.
(b) PROJECTS SUBJECT TO A FINAL REPORT.—The following projects for water resources development and conservation and other purposes are authorized to be carried out by the Secretary substantially in accordance with the plans, and subject to the conditions, recommended in a final report of the Chief of Engineers if a favorable report of the Chief is completed not later than December 31, 1999:
(9) SAVANNAH HARBOR EXPANSION, GEORGIA.—
(A) IN GENERAL.—Subject to subparagraph (B), the project for navigation, Savannah Harbor expansion, Georgia, including implementation of the mitigation plan, with such modifications as the Secretary considers appropriate, at a total cost of $230,174,000 (of which amount a portion is authorized for implementation of the mitigation plan), with an estimated Federal cost of $145,160,000 and an estimated non-Federal cost of $85,014,000.
(B) CONDITIONS.—The project authorized by subparagraph (A) may be carried out only after—
(i) the Secretary, in consultation with affected Federal, State of Georgia, State of South Carolina, regional, and local entities, reviews and approves an environmental impact statement for the project that includes—
(I) an analysis of the impacts of project depth alternatives ranging from 42 feet through 48 feet; and
(II) a selected plan for navigation and an associated mitigation plan as required under section 906(a) of the Water Resources Development Act of 1986 (33 U.S.C. 2283(a)); and
(ii) the Secretary of the Interior, the Secretary of Commerce, the Administrator of the Environmental Protection Agency, and the Secretary approve the selected plan and determine that the associated mitigation plan adequately addresses the potential environmental impacts of the project.
(C) MITIGATION REQUIREMENTS.—The mitigation plan shall be implemented before or concurrently with construction of the project."

1.3 Study Purpose and Scope

The Savannah District of the USACE in conjunction with the USACE Deep-Draft Navigation Planning Center of Expertise has developed this GRR to determine the feasibility of improvements to the Federal navigation project at Savannah Harbor. This GRR and accompanying Environmental Impact Statement (EIS) have been developed to fulfill the conditions of the conditional authorization granted in WRDA 1999, and together, assemble the information and analysis required by the National Environmental Policy Act of 1969 (NEPA). The conditional authorization was based

on the 1998 feasibility study of navigation improvements to Savannah Harbor conducted by the Georgia Ports Authority under the authority of Section 203 of the Water Resources Development Act of 1986 (P.L. 99-662) and was based on the concurrent Tier I EIS. This GRR and EIS provide documentation of the technical and plan formulation analyses conducted in the development of a recommended plan for navigation improvement and environmental mitigation. The GRR and EIS assess mitigation plans for alternative channel depths. The GRR includes a final mitigation plan and an incremental analysis of alternative channel depths from -42 to -48 feet, as required by the conditional authorization.

A GRR is a reanalysis of a previously completed study, using current planning criteria and policies, which is required due to changed conditions and/or assumptions. The results may affirm the previous plan, reformulate and modify it, as appropriate; or find that no plan is currently justified.

Tiering is recommended by the CEQ NEPA regulations when a broad (Tier I) EIS has been prepared. A Tier II EIS is prepared later on an action included within the scope of the initial, broader (Tier I) EIS.

The 1998 Feasibility Study Report and Tier I EIS was prepared by GPA and provided to the Corps and to Congress for authorization. After Congress conditionally authorized the project, the Corps completed its review of the documents. The Corps determined that the project was not formulated in accordance with applicable US Army Corps of Engineers planning procedures, and that an acceptable mitigation plan was not determined. Analyses included in the SHEP Tier I EIS only evaluated the potential impacts for a -50-foot MLW channel depth. The Corps required a special report and EIS be prepared to indentify the NED Plan and the appropriate mitigation. This EIS was prepared to fulfill the environmental portion of those requirements. It should be noted that the Draft EIS was referred to as a Tier II EIS, but, as discussed, the Final EIS is more appropriately considered a full EIS.

The Corps prepared a full EIS (not tiered) in this phase of the project to reconsider methods that may be available to meet the needs for the project, more completely identify and evaluate the potential impacts of project alternatives, develop acceptable mitigation plans, and conclusively determine the NED plan. These include refinement of the hydrodynamic and water quality models, and obtaining agreement from USACE and the natural resource agencies in the models' ability to reasonably predict the impacts of the proposed project alternatives, including mitigation features. In-depth investigations were performed of issues identified through the NEPA scoping process. The findings and conclusions of these additional evaluations are complete, and the information is included in the Final GRR and EIS.

Since the last major navigation improvements were completed by the USACE in April 1994, Savannah Harbor has experienced significant growth in containerized cargo volume, vessel traffic, and the size and frequency of container ships calling at the Port. The 1994 navigation improvements were designed to accommodate a class of newly

built container ships with a dead weight tonnage of approximately 60,000 tons and a maximum TEU (Twenty-foot Equivalent Unit) capacity of 4,024 TEUs. The design vessel for the 1994 improvements had a length of 951 feet, a maximum operating draft of 42.6 feet, and a Panamax beam (106 feet). The largest vessels currently calling at the Port are rated at more than 8,100 TEUs, with a dead weight tonnage of 85,900 tons, an overall length of 984 feet, a Post-Panamax beam of 131 feet, and a maximum operating draft of 48 feet. Over the intervening years, the Georgia Ports Authority has made major investments in landside infrastructure to accommodate increasingly larger vessels and burgeoning trade growth at the Port and the region it serves. At the present time, Savannah Harbor is the second busiest container port on the U.S. east coast, and the fourth busiest in the Nation.

Potential navigation improvements include deepening and widening of navigational channels, Kings Island Turning Basin expansion, and channel wideners. The purpose of these potential improvements is to increase the efficiency of cargo vessel operations and to accommodate larger container ships, which are already calling at the Port and which are projected to use the Port in larger numbers in the very near future. The improvements are aimed at alleviating the draft restrictions which impact container ship operations in the harbor. In 2008, approximately 82% of the container ships that called on the Port of Savannah had design drafts that were too deep to allow unrestricted access to the channel. These vessels were required to light-load, use tidal advantage, or both.

This study identifies and evaluates alternatives that will:

- Reduce congestion in the river channel;
- Accommodate recent and anticipated future growth in containerized cargo and container ship traffic;
- Improve the efficiency of operations for container ships within the Savannah Harbor Navigation Project; and
- Allow larger and more efficient container ships to use the Port.

Environmental mitigation actions address expected adverse impacts to tidal wetlands (including freshwater, brackish, and salt marshes), levels of dissolved oxygen in the harbor, endangered Shortnose sturgeon habitat, Striped bass spawning and nursery areas, and periodic increases in chloride levels at the City of Savannah water intake. Additionally, a cultural resource mitigation plan is included for the CSS *Georgia*, a site listed on the National Register of Historic Places. These actions would mitigate all significant adverse impacts from the proposed project.

1.4 Existing Navigation Project

1.4.1 Navigation Channel

The authorized deep-draft navigation channel (Table 1-1) is 44 feet deep and 600 feet wide from deep water in the ocean (mile 11.4B with the letter B indicating that section

of the channel is part of the outer bar channel and not part of the inner harbor channel) to the channel between the jetties (mile 2.6B), thence 42 feet deep and 500 feet wide to the harbor entrance (River Mile 0.0) and on to the upstream end of the Kings Island Turning Basin (River Mile 19.5). The channel is 36 feet deep and 400 feet wide from mile 19.5 to the upstream end of the Argyle Island Turning Basin (River Mile 19.9). The upper end of the harbor from River Mile 19.9 to its upstream limit at River Mile 21.3 is maintained at 30 feet deep and 200 feet wide.

Table 1-1: Savannah Navigation Channel Dimensions

Feature	Station	River Miles	Authorized Depth (ft below MLLW)	Authorized Width (ft)
Atlantic Ocean	-60+000B	11.4B *		
To		(8.7 miles)	44	600
Entrance Channel	-14+000B	2.7B *		
To		(2.7 miles)	42	500
Harbor Entrance	0+000	0.0		
To		(19.5 miles)	42	500
Kings Island Turning Basin	103+000	19.5		
To		(0.4 miles)	36	400
Argyle Island Turning Basin	105+500	19.9		
To		(1.4 miles)	30	200
Upstream limit of authorized Project	112+500	21.3		
Total Miles		32.7 miles		

Note: Station Numbers are measured in feet from the harbor entrance (Sta. 0+000). Currently maintained width from Station 58+000 to 59+000 is 400 feet to avoid the CSS *Georgia*. * Indicates section is part of the outer bar channel.

1.4.2 Advance maintenance

Advance maintenance dredging extends the length of time during which authorized channel depths are available, reduces the frequency of dredging, reduces annual maintenance costs, and by concentrating the sediment to be removed at these locations, allows the dredge to operate at a higher efficiency. This sediment management technique is accomplished by enlarging the channel cross-section to provide storage for deposited sediments outside or at depths greater than the authorized channel dimensions (Figures 1-3 and 1-4). Under present USACE policy, a District office must request approval for all advance maintenance from USACE Division offices. Decisions to implement advance maintenance can be made at any time based upon performance and review of dredging cost analyses and sediment accumulation records, and they are effective until future information indicates they are no longer necessary or economically justified. Environmental clearances must also be obtained prior to implementation of authorized advance maintenance features.

Due to the rapidity of shoaling development and the large quantity of annual shoaling in the Savannah Harbor (6.2 million cubic yards), nearly every channel reach in the Savannah Harbor receives some degree of advance maintenance. Table 1-2 presents Savannah Harbor's existing advance maintenance areas. Table 1-2 also includes allowable overdepth, which is typically a dredging allowance of an additional two feet of dredged depth that will be paid for to account for the inaccuracies of dredging and ensure that the authorized depth is achieved. In addition, there may be a maximum three-foot depth of disturbance, which is the depth that a cutterhead dredge might influence or disturb below the Maximum Sediment Removal Depth. The material within the disturbance depth is not being removed. No advance maintenance is presently performed between Stations 58+000 and 59+000 to reduce potential impacts to CSS *Georgia*, which is located along that reach.

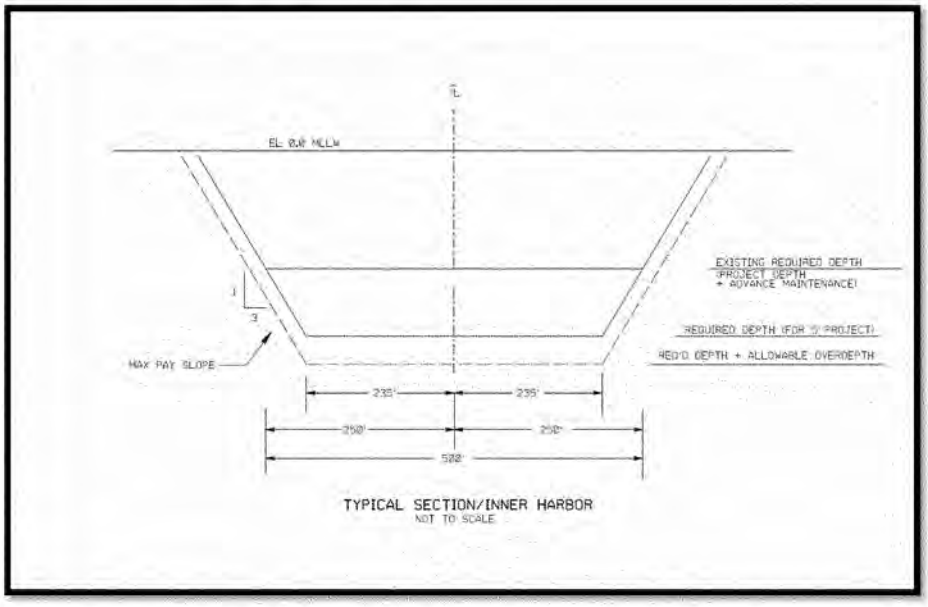


Figure 1-3: Typical Dredging Section – Inner Harbor

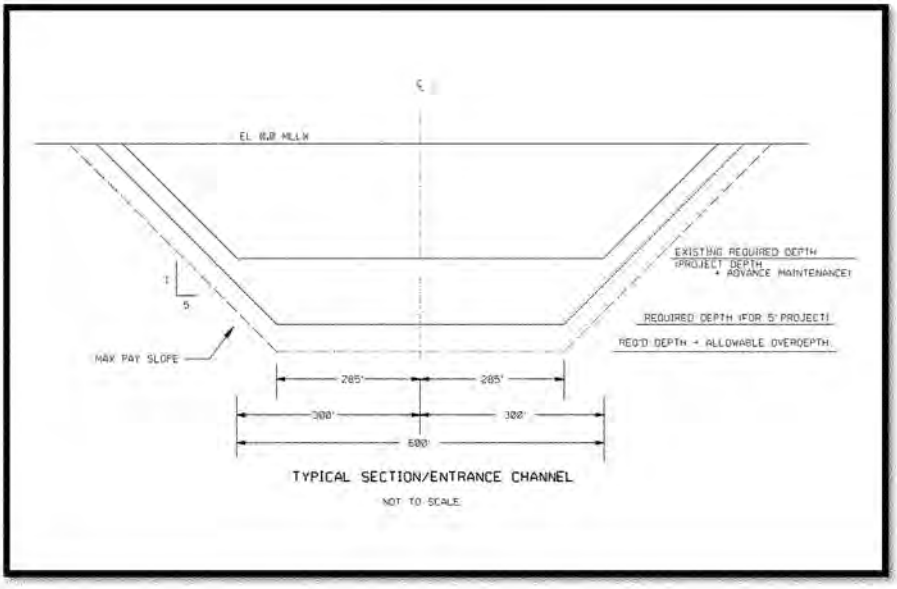


Figure 1-4: Typical Dredging Section – Entrance Channel

Table 1-2: Advance Maintenance Areas (feet below MLLW)

Station (1000 ft)	Authorized Depth	Advanced Maintenance	Sediment Removal Depth
112.5 to 105.5	30	2	32
105.5 to 103	36	2	38
103 to 102	42	0	42
102 to 70	42	2	44
70 to 37	42	4	46
37 to 35	42	6	48
35 to 24	42	4	46
24 to 0	42	2	44
0 to 14B	42	2	44
14B to 60B	44	0	44
Oysterbed Island TB	40	0	42
Fig Island TB	34	4	40
Marsh Island TB	34	0	36
Kings Island TB	42	8	52
Argyle Island TB	30	0	32
Port Wentworth TB	30	2	34
Sediment Basin	40	0	40
Sediment Basin Throat	38	0	38

Note: Sediment removal depth includes advance maintenance. A maximum allowable over-depth of an additional two feet is permitted to allow for inaccuracies in the dredging process; Depths are shown in feet MLLW EPOCH 1983-2001.

1.4.3 Turning Basins

Five authorized turning basins (Table 1-3 and Figure 1-5) are located within the reaches proposed for deepening to allow ships to be turned before transiting the harbor. There is also a private turning basin at Elba Island between Oysterbed and Fig Island turning basins, which is not presently maintained by the USACE.

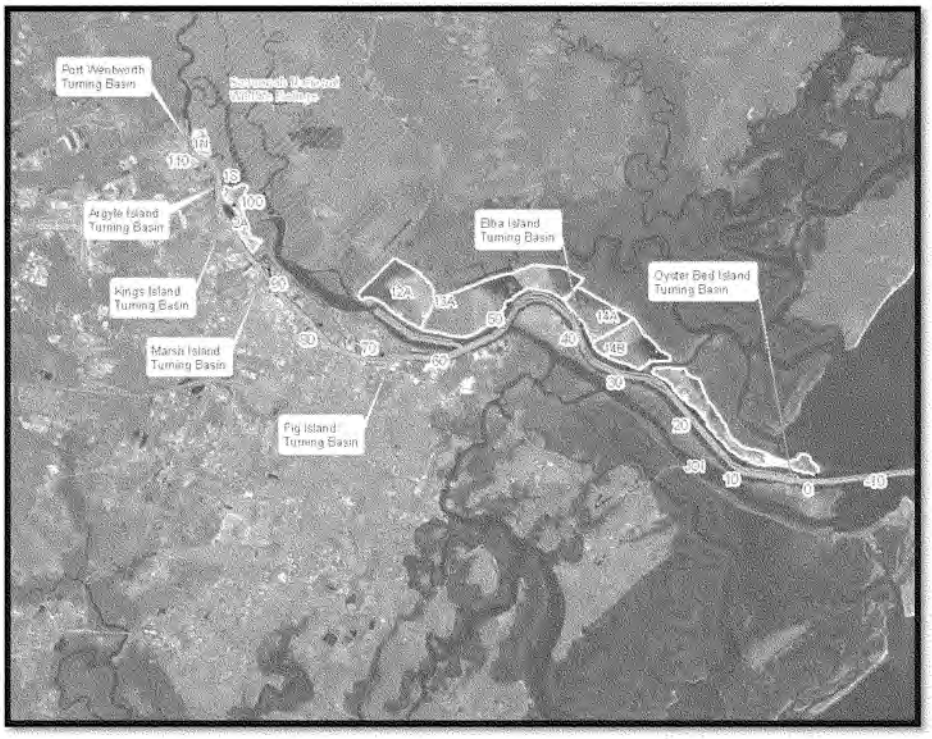


Figure 1-5: Savannah Harbor Turning Basins

Table 1-3: Turning Basin Locations and Dimensions

Name	Length (Ft)	Width (Ft)	Authorized Depth	Sediment Removal Depth*	River Mile	Station
Port Wentworth	600	600	30	32	20.9	111+363 to 109+757
Argyle Island	600	600	30	30	19.6	104+185 to 103+085
Kings Island	1,600	1,500	42	50	18.8	101+298 to 97+750
Marsh Island	900	1000	34	34	17.1	91+610 to 89+485
Fig Island	1500	1000	34	38	13.0	69+740 to 67+386
Elba Island (LNG Private)	2,300	1,500	48**	48	6.8	
Oysterbed Island	1050	1200	40	40	0.7	4+395 to 2+345
Rehandling Basin	5,000	300	40	40		10+175 to 4+395

*Includes approved advance maintenance. A maximum allowable over depth of an additional two feet is permitted to allow for inaccuracies in the dredging process.
**Elba Island Turning Basin is not part of the Federal Project. Depth is authorized to 48' but currently dredged to 40' Depths measured in feet below MLLW

1.4.4 Sediment Control Works

Construction of the Sediment Basin Project was authorized by Public Law 89-298, enacted by the 89th Congress, on October 27, 1965. Authorized sediment control works in the harbor consist of the Tidegate structure across Back River (Figure 1-6) and a sediment basin immediately downstream of the Tidegate. These structures were designed to concentrate sedimentation outside the navigation channel in a location close to confined disposal areas. Both the concentration of sediment and the short pumping distance that the shoaling location provided a reduction in the cost of sediment removal in the harbor. The Sediment Basin was authorized at a 40-foot depth, 600-foot width and approximately 2-mile length, with an entrance channel 38 feet deep and 300 feet wide. The Tidegate became operative in May 1977 but was taken out of service in March 1991due to adverse environmental impacts. A drainage canal, known as New Cut, located across Argyle Island was constructed along with the Tidegate. New Cut was closed in March 1992 to reduce salinity levels in the Savannah National Wildlife Refuge, restore approximately 4,000 acres of freshwater marsh, and reduce the flushing of Striped bass eggs and larvae into the Front River, thereby improving the Striped bass fishery in the Savannah River. Closure of New Cut and discontinued operation of the Tidegate, which remains in place although not in operation, has resulted in a significant increase in the cost of maintaining adequate depths in the harbor. Maintenance dredging of the sediment basin continues; however, the sediment trap operates at reduced efficiency without a functioning Tidegate.

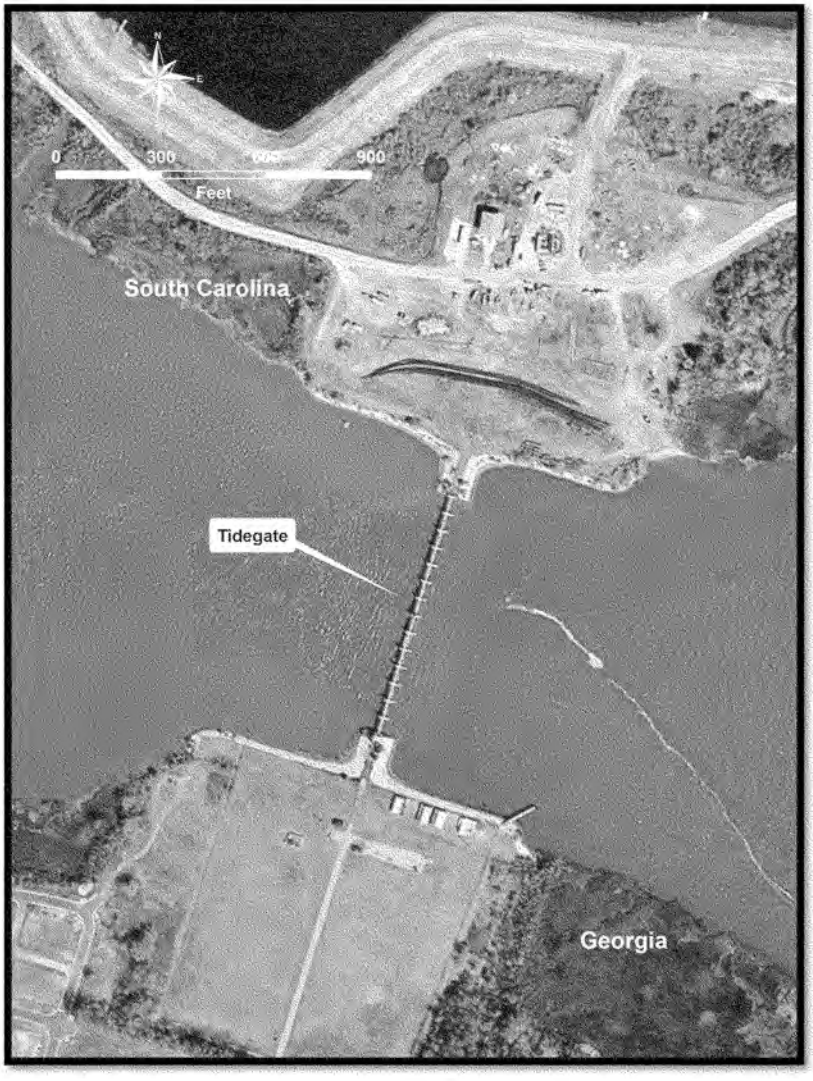


Figure 1-6: Tidegate

1.4.5 Freshwater Control Works

During the development of the Tidegate/Sediment Basin project and harbor deepening in 1970, it was recognized that the saltwater wedge would move further upstream as a result of the project. A freshwater supply system (Freshwater Control Works) was included in the project (Figure 1-7) to provide freshwater at the Savannah National Wildlife Refuge intake off Little Back River and to offset impacts to tidal freshwater marshes. This system had the following five components:

1. A 5,500-foot long canal through McCoys Cut to provide freshwater to the Savannah NWR. The canal was constructed with a 200-foot bottom width at EL -7' Mean Lower Low Water (MLLW) using EPOCH 1982 – 2001 datum and 2H:1V side slopes. The design flow through McCoys Cut was 4,000 CFS.
2. A channel in Middle River with a 90-foot bottom width at EL -6' MLLW and 2H:1V side slopes. The design flow in Middle River was 1,500 CFS.
3. A channel in Little Back River with a 200-foot bottom width at EL -5.1' MLLW and 2H:1V side slopes. The design flow in Little Back River was 2,500 CFS.
4. A 28,000-foot long freshwater supply canal with a 28-foot bottom width at EL -4' MLLW, 2H:1V side slopes, and water control structures.
5. A 3,700-foot long connecting canal with a 6-foot bottom width at EL -4' MLLW, 2H:1V side slopes.

Congress also authorized a freshwater canal extending from the Savannah NWR to private lands located north of the US Highway 17A Bridge on the South Carolina side of the river. That canal was designed with a 6-foot bottom width at EL -4' MLLW and 2H:1V side slopes.

The Federal Government is responsible for maintenance of the Diversion Canal (McCoys Cut), the channels in Little Back River and Middle River, and the canals and control works for the Refuge. For reasons related to funding and agency coordination, maintenance of these features has not been regularly performed. However, the Corps recently completed (December 2011) repairs to system components on Federal lands. Non-Federal interests are responsible for the canal serving private lands southeast of the Refuge. Originally, Chatham County and the Corps obtained easements from private land owners, provided water control structures, and conducted routine maintenance of the dikes. In 1982, the County entered into a supplemental agreement with the private property owners, transferring responsibility for normal dike maintenance to those property owners.

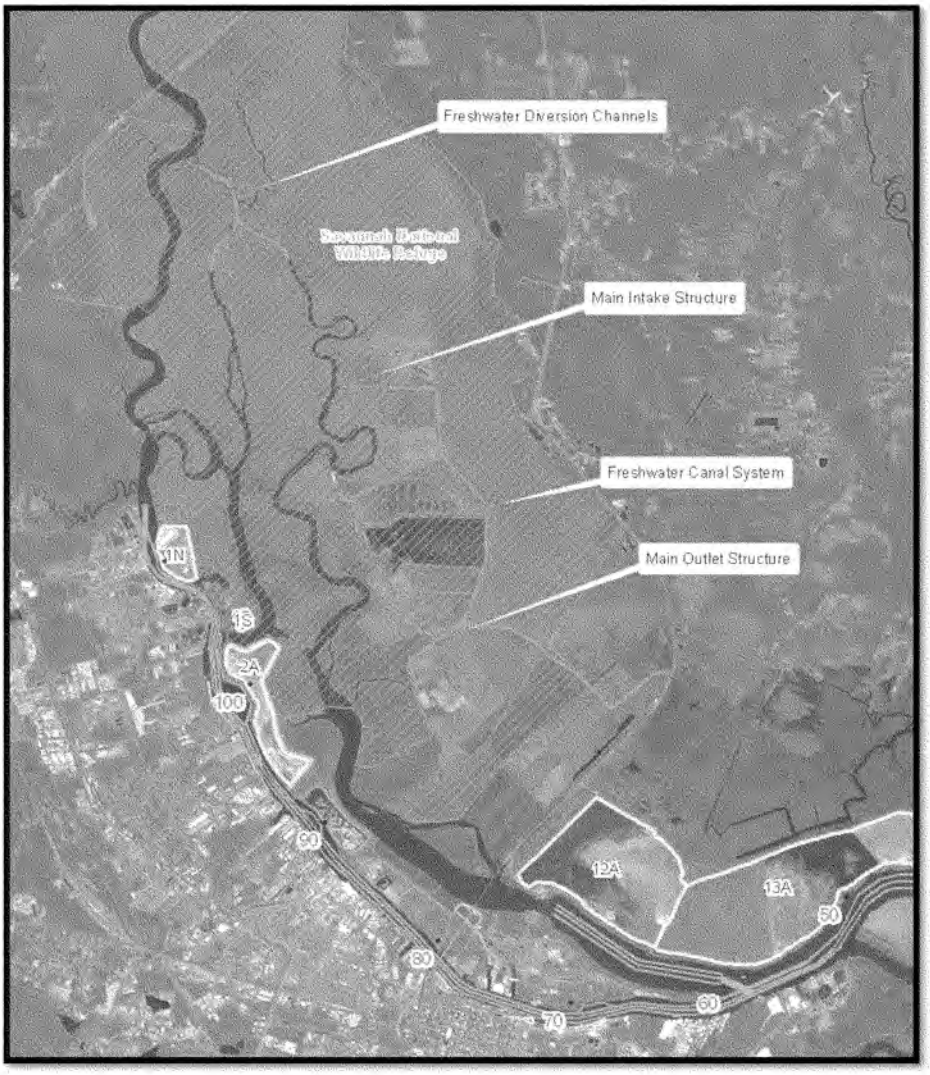


Figure 1-7: Freshwater Control Works

1.4.6 Long Term Management Strategy

Savannah District completed a Long-Term Management Strategy (LTMS) study for Savannah Harbor in 1996 in response to House and Senate Reports on the Energy and Water Resources Appropriations for Fiscal Year 1993 (P.L. 104-303). The LTMS identifies numerous structural and operational management measures, which are being implemented to maintain environmental quality throughout the Savannah Harbor Navigation Project. The LTMS also identifies restoration measures (increasing fish and wildlife habitat) which were constructed and are currently maintained. In addition, the LTMS provides the District's initial Dredged Material Management Plan (DMMP) for the harbor. The LTMS documents specific commitments by the Savannah District concerning maintenance, operation, and any other new work associated with the Savannah Harbor Navigation Project. An EIS documented the environmental analyses that were performed as components of the Savannah Harbor LTMS Study. A Record of Decision (ROD) was signed in February 1997 documenting the final environmental decisions made in the LTMS Study and outlining how the Savannah Harbor Navigation Project would be operated and maintained. The Savannah Harbor Navigation Project continues to be operated and maintained in accordance with the LTMS. A Dredged Material Management Plan Update was completed in April 2003 (revised September 2003) to implement the provisions of the Water Resources Development Act of 1996 for cost-sharing in the construction of dredged material confined disposal areas needed for the Savannah Harbor Federal Navigation Project.

1.4.7 Dredged Material Management Plan

The Corps performed a limited update to the Savannah Harbor DMMP in 2003. The document updated and implemented cost sharing for new disposal areas as defined in WRDA 1996 and extended the disposal area rotational time frame from 2- to 3-years. The Corps has published Annual Work Plans that supplement the DMMP in 2006, 2007, 2008, and 2010.

According to the Planning Guidance Notebook (ER 1105-2-100), all Federally maintained navigation projects require the preparation of a DMMP to demonstrate that there is sufficient dredged material disposal capacity for a minimum of 20 years. The assessment is required for all Federal navigation projects to document the continued viability of the project and the availability of dredged material disposal capacity sufficient to accommodate 20 years of maintenance dredging.

The Savannah Harbor dredged material disposal area system design, which includes a series of dredged material containment areas (DMCAs), was begun in the 1970's by the USACE Waterways Experiment Station (now the Engineer Research and Development Center). The DMCAs encompass over 8,000 acres predominantly in South Carolina. There are approximately 5,038 acres available in the existing floor areas of the DMCAs in Jasper County, SC. The DMCAs are paired based on their location within the inner harbor. Under the LTMS and 2003 DMMP, DMCAs 12A

and 12B/13A are paired, DMCAs 13B and 14A are paired, and DMCAs 14B and Jones/Oysterbed are paired. In 2010, the cross dike between DMCAs 12B and 13A was removed to create a larger DMCA called 13A (at this point DMCA 12B ceased to exist).

When each of the paired DMCAs is in use (accepting dredged material), the others are being dried. Each DMCA has two bird islands (each approximately 1 acre in size) constructed within it. When that DMCA is in use, being actively disposed into, the DMCA is managed to keep those bird islands surrounded by water to decrease predator access to nesting and feeding birds, and beyond that a percentage of the disposal DMCA is kept moist for feeding water birds. The other DMCAs are being dried so that the dewatered dredged materials can be reclaimed and incorporated into the dike structures themselves, thus increasing the capacity in the most economic manner possible. Using the dewatered dredged materials for dike raising ultimately reduces the need for additional disposal areas in sensitive wetland areas and provides for perpetual use of existing areas. DMCAs are dried on a 3-year rotational basis.

The DMCAs are a haven for birds and animals that inhabit the manmade environment adjacent to the marsh. Alligators, wild hogs, otters, deer, and over 250 species of birds have been recorded there.

The USACE currently holds easements for deposition of dredged sediment on DMCAs 2A, 12A, 13A, 13B, 14A, 14B, and Jones Oysterbed Island. These perpetual disposal easements encumber the land for the maintenance of the Federal channel. Two upstream areas, DMCAs 1N and 1S, are owned by the US Fish and Wildlife Service, and they have been used in the past under a right of access easement. These areas have very limited capacity. There are no plans to use DMCA 1N in the foreseeable future, and DMCA 1S has not been used for disposal of dredged material in many years. Disposal Area 1S is a part of the SHEP mitigation plan. Dredged material deposits would be graded down to allow marsh restoration on approximately 40.3 acres of what is currently known as Disposal Area 1S.

The DMMP Annual Work Plan – FY 10 for the Savannah Harbor Navigation Project is based on the requirement to remove 6.2 million cubic yards (MCY) of dredged material from the inner harbor and 1.0 MCY from the bar channel on an annual basis. The quantity anticipated for the inner harbor is expected to remain constant for the 20-year period covered by the DMMP. To accommodate the inner harbor maintenance sediment, a 3-year rotational plan for DMCAs in the middle harbor was developed as part of the harbor operations "Base Plan". Table 1-4 presents the Savannah Harbor Navigation Project DMCAs. Figure 1-8 presents the DMCA locations. Use of DMCA 2A, the only DMCA available in the upper harbor, was minimized to keep it available for the entire 20-year period covered by the DMMP. That DMCA would not be used during a harbor deepening. The mitigation plan developed in the LTMS would continue to be implemented.

Table 1-4: Savannah Harbor Navigation Project Dredged Material Containment Areas

Containment Area	Location (Station)	Acreage
1N	107+500 to 112+500	130
2A	93+000 to 103+000	240
12A	6+500BR to 10+500BR	1040
13A	47+800 to 6+600BR	1307
13B	43+000 to 47+000	540
14A	37+000 to 47+000	647
14B	28+000 to 37+000	703
Jones/Oysterbed	10+000 to 27+000	890

Note: Acreage is measured from the inside toe of the surrounding dikes

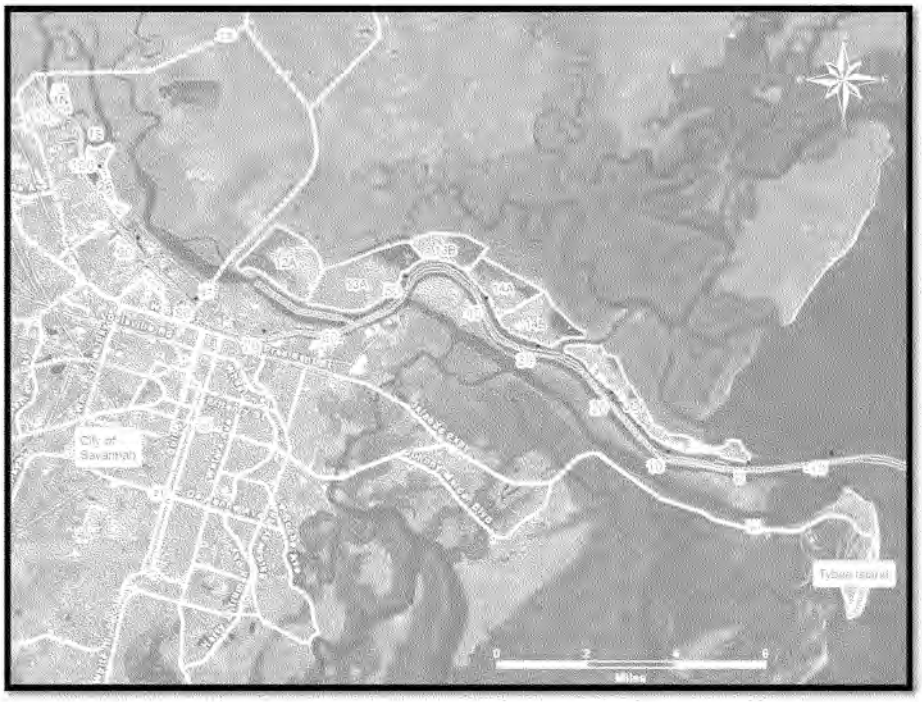


Figure 1-8: Savannah Harbor Disposal Areas

Sediment removed from the Bar Channel (Stations 0+000 to -60+000B) is placed in the EPA-approved Ocean Dredged Material Disposal Site (ODMDS). The ODMDS is a 4.26 square mile site is centered at 31 56' 54" N and 80 45' 34" W (Figure 1-9). The

site is used for placement of the 1 million cubic yards of sediment that is removed by hopper dredges each year from that channel reach. The final designation of the site as an ODMDS was made by EPA on August 3, 1987. A Management Plan for the site is included as Appendix I of the LTMS. That plan includes periodic site management and monitoring work performed by the USACE.

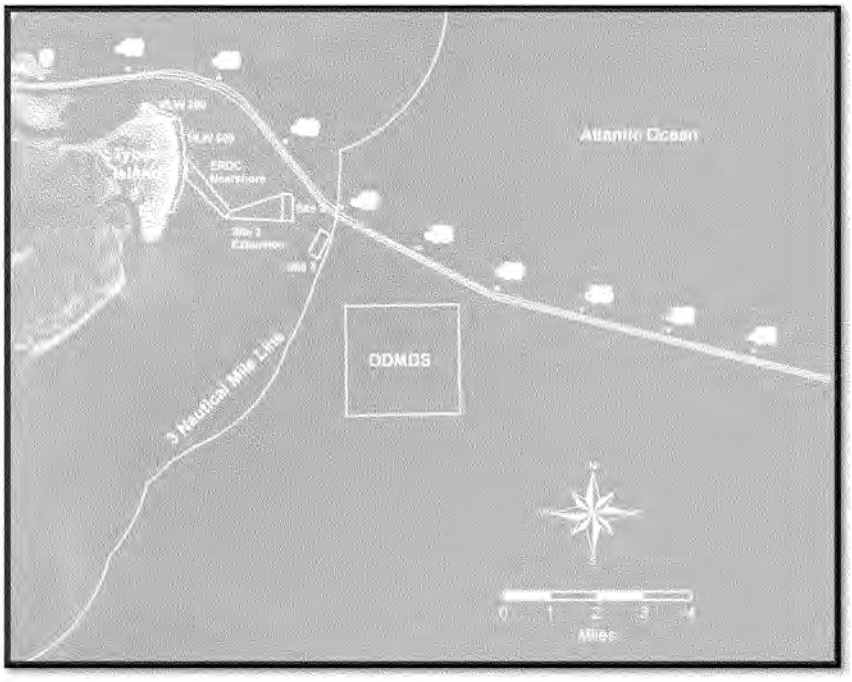


Figure 1-9: Approved Unconfined Placement Areas for Maintenance Material

In addition to the ODMDS, there were seven sites where maintenance material could have been deposited to construct submerged feeder berms which were developed as part of the LTMS pursuant to Section 404 of the Clean Water Act. These sites were located on the south side of the entrance channel 2,000 feet away from the channel, in water averaging 15 feet deep. These sites would effectively serve as nearshore placement areas for use by dredges working in the bar channel. These sites would provide a cost effective place for the dredges to deposit the dredged material since they are located relatively close to the channel. If constructed, the berms would be constructed with 200,000 to 300,000 CY of material to provide a berm that is elliptical in shape and oriented away from the channel so that tidal currents which converge and

diverge away from the channel are not significantly restricted. Sediment placed on these berms would replenish littoral drift.

Since the DEIS was published, the EPA informed the Corps that they consider any dredged material placement site beyond the 3-mile line to be an ocean dredged material disposal site which would require their authorization pursuant to Section 103 of the Marine Protection, Research and Sanctuaries Act. Consequently, any sites beyond the 3-mile line would require the appropriate Section 103 site designation studies and EPA approval as ocean dredged material disposal sites. Based on the EPA determination, only the ODMDS, Site 2, Site 3, and other designated placement sites (See Figure 1-9 above) can be used for maintenance material from the entrance channel.

In addition to the placement sites adjacent to the entrance channel, the LTMS also authorized suitable maintenance material to be placed into the nearshore off Tybee Island. As shown in Figure 1-9, suitable maintenance material can also be placed into the areas designated as MLW 200, MLW 500, ERDC Nearshore and Site 2 Extension. Material placed into these sites would be used to construct feeder berms to benefit the beach of Tybee Island. The LTMS also authorized the placement of suitable maintenance material directly onto the beach at Tybee Island.

The Base Plan (most cost effective and environmentally acceptable) for maintenance of the Savannah Harbor entrance channel is to place the material into the Jones-Oysterbed Island DMCA, the ODMDS, or Sites 2 and 3. Consequently, any placement of maintenance material into the nearshore sites off Tybee Island or directly onto the beach at Tybee Island would require a non-Federal sponsor willing to pay the additional costs of placing material into these areas.

Maintenance sediments from the bar channel may be placed in these nearshore sites. Maintenance sediments from Stations 0+000 to 28+000 may also be placed in these sites when the average fines content does not exceed 15 percent. If the SHEP is constructed, maintenance material from the area of the bar channel extension (Station -60+000B to -97+680B) may also be suitable for these sites.

1.5 Public Involvement

This study was conducted as a partnership between the USACE Savannah District, as the lead Federal agency, representatives of three other Federal agencies that need to approve the project (EPA Region 4, NMFS-Southeast Regional Office, and the USFWS-Southeast Region), and the Georgia Ports Authority (for their shipping expertise). Representatives from the Cooperating Agencies met on a periodic basis to reach decisions on technical work to be conducted and review results of evaluations.

The P&G requires that USACE planning include coordination with State and local agencies, interested and affected groups, and individuals. Plan evaluation must also be consistent with all applicable Federal laws, such as NEPA. The Record of Decision

for the Tier I Environmental Impact Statement was completed in 1999 (Chapter 2.2; Savannah Harbor Deepening Feasibility Report (Section 203) and Tier I EIS 1998).

A Notice of Intent (NOI) to prepare a Draft EIS for this project was filed with the USEPA on January 22, 2002. Within the NOI, the public and agencies were notified that a scoping meeting would be conducted for the proposed project. On February 21, 2002, a scoping meeting was held for the proposed action at the Savannah International Trade and Convention Center.

The Stakeholders Evaluation Group (SEG) is a public body that was created to advise the Georgia Ports Authority, the non-Federal interest, on issues related to this proposed harbor deepening project and to develop a consensus mitigation plan which could be used for the development of a Federal EIS.

USACE used several methods to ensure the entire public was aware of the project and project-related studies. The District prepared and distributed brochures that described the environmental field work that was being conducted and discussed the project at local professional and community groups such as the American Society of Civil Engineers. The hydrodynamic modeling approach, wetland impact evaluation approach, and the project in general have been the subject of presentations at the Georgia Water Resources Conference in 2001, 2003, 2005, and 2007. Interim plan formulation results (Formulation of Alternatives Report) were approved by USACE Headquarters and distributed for public comment in 2005.

Agency involvement includes the South Carolina Department of Health and Environmental Control (SC DHEC), the Georgia Department of Natural Resources (GA DNR) Coastal Resources Division, GA DNR Wildlife Resources Division, GA DNR Environmental Protection Division, and the City of Savannah. Cultural resources investigations and reconnaissance have been coordinated with the South Carolina Division of Archives and History, Underwater Archaeology Unit, and with both the Georgia and South Carolina State Historic Preservation Officers. Additional discussion of public involvement in the project, including identification of investigations conducted in response to agency and public comments on the November 2010 Draft GRR and DEIS is presented in Chapter 13: Public Involvement, Review and Consultation.

1.6 Planning Process and Report Organization

The planning process employed by the Savannah District in the development of the GRR has followed the Corps of Engineers' six step planning process as described in the Corps' Planning Guidance Notebook (ER 1105-2-100, dated 22 April 2000). These steps include:

- Specify water resources problems and opportunities;
- Inventory, forecast, and analyze the water and related land resource conditions within the study area;

- Formulate alternative plans which address the identified problems and take advantage of the opportunities;
- Evaluate the effect of alternative plans;
- Compare alternative plans; and
- Select the recommended plan.

The P&G guide the formulation and evaluation of Federal water resource projects. P&G requires that the plan recommended for Federal action will be the alternative plan with the greatest net economic benefit consistent with protecting the Nation's environment (the NED plan), unless the Secretary of Army grants an exception to this rule.

Planning for navigation improvements and environmental mitigation has been a dynamic process resulting in multiple iterations of the six-step planning process. Through these iterations, the study has been refined and has resulted in a selected plan for Federal action that is consistent with the P&G and ER 1105-2-100. A final recommended plan will be included in the final GRR and EIS. The remainder of this report documents the results of the six step planning process.

The remainder of the GRR is organized as follows:

Chapter 2 – Prior Studies, Reports, and Existing Projects

Chapter 3 – Problems and Opportunities

Chapter 4 – Inventory of Existing Conditions

Chapter 5 – Forecast of Without-Project Conditions

Chapter 6 – Formulation of Alternative Plans

Chapter 7 – Alternative Plan Evaluation: Benefits

Chapter 8 – Alternative Plan Evaluation: Environmental Impacts

Chapter 9 – Alternative Plan Evaluation: Mitigation Planning

Chapter 10 – Alternative Plan Evaluation: Costs

Chapter 11 – Plan Comparison

Chapter 12 – Uncertainty Consideration

Chapter 13 – Public Involvement, Review, and Consultation

Chapter 14 – Plan Selection

Chapter 15 – Plan Implementation Requirements

Chapter 16 – Conclusions

Chapter 17 – Recommendation

2 Prior Studies, Reports, and Existing Water Projects

This chapter describes studies and analyses concerning the Federal navigation project at Savannah Harbor, which have been conducted prior to this analysis. The information contained in these studies and analyses is used as background material to better understand existing and potential future conditions.

2.1 Savannah Harbor Deepening Feasibility Report, 1991

The Savannah District of the U.S. Army Corps of Engineers published the final interim feasibility study for navigation improvements to Savannah Harbor in 1991. The report recommended deepening the inner harbor and the entrance channel inside the bar (Stations 103+000 to -14+000B) from -38 feet MLLW to –42 feet MLLW, and deepening the entrance channel outside the bar (Stations -14+000B to -60+000B) from -40 feet MLLW to -44 feet MLLW. The recommended plan, which was the locally preferred plan at two feet deeper than the NED plan, was constructed in 1994. Dredged material from the entrance channel was placed at the existing ocean disposal area and at the beach on Tybee Island. Material from the inner harbor was placed at the existing Dredged Material Containment Areas. The channel improvements constructed in 1994 remain as the existing and without-project channel conditions assessed in this feasibility report.

2.2 Savannah Harbor Expansion Reconnaissance Report, 1996

The August 1996 report identified waterborne transportation inefficiencies, which could be remedied by modifying the Federal navigation channel. The analysis investigated traffic movements, operation, and capacity at Garden City Terminal. The analysis found that existing conditions and projected future conditions indicated that NED benefits could be accrued by deepening the channel. The reconnaissance level economic analysis resulted in positive net benefits for a -44 and a -45-foot channel. Environmental impacts were addressed through a mitigation plan. The Reconnaissance Report concluded with a recommendation that a feasibility study of navigation improvements of Savannah Harbor be conducted under the existing study authority.

2.3 Savannah Harbor Deepening Feasibility Report (Section 203) and Tier I EIS 1998

In 1998, the Georgia Ports Authority conducted a feasibility study of navigation improvements to Savannah Harbor under the authority of Section 203 of the Water Resources Development Act of 1986 (P.L. 99-662). The legislation authorizes non-Federal entities to conduct feasibility studies of harbor or inland harbor projects. The Section 203 feasibility study recommended the following navigation improvements, which are identified as the "48-foot alternative":

- Deepening the existing entrance channel up to -50 feet MLLW from the ocean to Station -14B+000, up to -48 feet MLLW from Station -14B+000 to Station

0+000, and the inner harbor up to -48 feet MLLW from Station 0+000 to Station 103+000;
- Widening bends in the entrance channel at two locations and in the inner harbor channel at eight locations;
- Enlarging the Kings Island Turning Basin to a width of 1,600 feet;
- Raising dikes from 2.6 feet up to 5.5 feet in disposal areas 12A, 14B, and Jones/Oysterbed Island; and
- A mitigation plan which includes cultural resource mitigation, natural resource mitigation, and an impact avoidance plan.

The Tier 1 EIS assessed the potential impacts of the "maximum impact" project alternative, which is the "50-foot alternative" (two feet deeper than the recommended plan). Impacts to the following resources were assessed: wetlands; endangered species; fisheries; benthic communities; birds; marine mammals; water quality; historic properties; potable surface and groundwater. Major impacts to biological resources were evaluated using a hydrodynamic model that predicted changes to salinity and dissolved oxygen due to the 50-foot alternative. Detailed analysis of the impacts of the recommended plan was deferred to another EIS to be conducted during the Continuing Engineering and Design phase of the project. Development of the final mitigation plan would also be assessed in the Final EIS.

2.3.1 Chief's Report on Savannah Harbor Deepening Feasibility Study (Section 203)

The Chief's Report (signed by the Chief of Engineers, Department of the Army on 21 October 1999) recommended implementation of the authorized project, under recognition that Congress had authorized the project but that additional studies were still needed. The Congressional authorization is conditioned on (1) approval of the selected plan by the Secretary of the Interior, Secretary of Commerce, the Administrator of the Environmental Protection Agency, and the Secretary of the Army, and (2) their determination that the mitigation plan adequately addresses the environmental impacts of the project. The EIS must analyze the impacts of alternative depth alternatives, develop an acceptable mitigation plan, and conclusively determine the NED plan and cost sharing for mitigation features. The Chief's Report states that the signing of a favorable Chief's Report for this project does not allow the project to be constructed, but instead only authorizes further planning and design work for the project in order to achieve eventual compliance with all applicable environmental laws.

2.3.2 Record of Decision on Savannah Harbor Deepening Feasibility Study (Section 203)

The Record of Decision (ROD), which completes the National Environmental Policy Act compliance process for authorization of the project, was signed by the Deputy Commander for Civil Works on 22 December 1999. The ROD states that the conditional Congressional authorization provides sufficient safeguards so that the project would not be implemented until the Chief of Engineers determines that it is in accordance with all applicable US Army Corps of Engineers policies, procedures, and

regulations and that it includes an acceptable mitigation plan. The ROD recommends implementation of the authorized project after additional review by the Corps of Engineers and approval by the Chief of Engineers to ensure that construction of the project complies with all applicable laws and policies, and includes cost sharing for mitigation features determined to be appropriate by the Chief of Engineers.

2.4 Savannah Harbor Dredged Material Management Plan-2011 Annual Work Plan

The existing DMMP for the Savannah Harbor Navigation Project is the Base Plan or Federal Standard. This plan is defined as "the dredged material disposal alternative or alternatives identified by the Corps which represent the least costly alternatives consistent with sound engineering practices and meeting the environmental standards established by the Section 404(b)(1) evaluation process (Clean Water Act of 1972) or ocean dumping criteria (Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972, as amended)." This standard establishes the benchmark for Corps involvement in future operation of the harbor and the baseline for cost sharing purposes. If requested, additional actions could be made a component of the harbor's normal management program, but those additional actions would need to be funded by an organization other than the Corps of Engineers.

The Base Plan consists of the combined use of multiple dredged material disposal plan alternatives, which were evaluated during the formulation of the DMMP. These alternative plans include rotational use of the DMCAs, underdrains, the ODMDS, etc. The Base Plan for maintenance of the inner harbor channel is to place the material into the existing DMCAs. The Base Plan for the entrance channel is to place the material into the Jones-Oysterbed Island DMCA, the ODMDS, or Sites 2 and 3.

The disposal location to be used for a specific dredging contract will be decided based on identification of the least cost, environmentally-acceptable option at that time. If disposal at a certain location is found to be more desirable for environmental or other reasons but would be more costly than one of the other acceptable options, it could be pursued with appropriate cost sharing using Section 933 (WRDA 1986) or Section 204 (WRDA 1992) authorities.

The DMMP Annual Work Plan was developed under the guidelines of the LTMS; therefore, further NEPA documentation was not required. By following the guidelines of the LTMS, impacts to other environmental or cultural resources are not expected. Therefore, the actions proposed in the DMMP Annual Work Plan are within the scope of the environmental compliance obtained through the LTMS EIS. Appendix E, LTMS Synopsis, details the LTMS environmental compliance. The ROD for the LTMS was signed on 3 February 1997 (LTMS EIS, Appendix A).

The Base Plan for Savannah Harbor includes the following dredged material management operations:

- Rotational use of the confined disposal areas located in South Carolina;

- Installing and using underdrains;
- Using the ODMDS or Sites 2 and 3;
- Identifying opportunities for public education concerning project operations including such items as harbor maintenance, navigation safety, environmental and archaeological programs.

The Base Plan for Savannah Harbor also includes the following environmental mitigation commitments:

- Implementation of an area rotational use plan and water management strategy within the South Carolina DMCAs.
    - Current Status: Completed
- Clearing and maintenance of a 26-acre bare ground nesting area on Jones/Oysterbed Island.
    - Current Status: Commitment fulfilled. After the site was constructed, poor nesting performance led natural resource agencies to concur that maintenance as bare ground habitat was not warranted.
- Construction and maintenance of bird nesting islands within the seven South Carolina DMCAs.
    - Current status: Partially implemented.
- Construction and maintenance of a nearshore bird island (LTMS EIS, Appendix G, G.3.07 c).
    - Current Status: Completed
- In-kind salt marsh mitigation.
    - Current status: Commitment fulfilled. Georgia DOT transferred funds to SC DHEC to acquire and preserve salt marsh.
- Improve fisheries habitat through installation of a second water control structure at an impoundment with the Savannah National Wildlife Refuge.
    - Current status: Commitment fulfilled. Georgia DOT transferred funds to the Savannah National Wildlife Refuge to install the second water control structure.
- Sediment Testing and Contaminant Evaluation.
    - Current status: Completed.

The DMMP for the Expansion Project is consistent with the current Base Plan. Dredged material from the inner portions of the harbor will be placed in historically

used containment areas. Dredged material from outer portions of the harbor will be placed in the Jones /Oysterbed Island DMCA, ODMDS, or Sites 2 and 3.[2]

2.5 Environmental Improvement (Section 1135) Study

The Savannah District of the US Army Corps of Engineers conducted a study to evaluate environmental improvements to the Savannah Harbor Navigation Project under authority provided by Section 1135 of the Water Resources Development Act of 1986. The approved modifications closed New Cut with hydraulic fill and ceased Tidegate operation. These actions were designed to reduce salinity levels in Back River and eliminate the flushing of Striped bass eggs and larvae through New Cut. The Section 1135 report, including environmental assessment, was completed in 1991. Construction of the modifications was completed in 1992, and the desired improvements have been realized.

2.6 Savannah Harbor Long Term Management Strategy

The LTMS (1996) identifies numerous structural and operational management measures, which are being implemented to maintain environmental quality throughout the Savannah Harbor Navigation Project. The LTMS also identifies environmental restoration measures which have been constructed and are currently maintained. In addition, the LTMS provides guidance for development and updating of the DMMP.

The LTMS identifies specific commitments by the Savannah District concerning the maintenance, operation, and any new work associated with the Savannah Harbor Navigation Project. Commitments in the following areas have been developed by the Savannah District in coordination with the appropriate state and Federal agencies and assessed through the NEPA process:

- Endangered Species;
  - Sea Turtles: Dredging and beach nourishment operations restrictions,
  - Right Whales: Dredging operations restrictions,
  - Manatees: Dredging operations restrictions,
- Fisheries;
  - Striped bass: Dredging operations restrictions,
- Migratory Birds;
  - Disposal area dike maintenance and dredging operations restrictions,
- Ocean Disposal;
  - Source material restrictions,

[2] An earlier (November 2010) version of the DMMP for new work material included beneficial placement of offshore material at Sites 11 and 12 for the purpose of supporting the littoral system; however, the City of Tybee Island requested that the material not be placed at these near shore sites.

- Management of the Savannah Ocean Dredged Material Disposal Site;
  - Material suitability restrictions,
  - Disposal placement technique restrictions,
  - Disposal monitoring and technical analyses,
- Wetland Impacts due to disposal areas;
  - Mitigation for wetland impacts due to diking area 14A,
  - Mitigation for wetland impacts due to construction of access road to area 2A,
- Stormwater runoff;
  - Use of Best management Practices,
  - Monitoring,
- Erosion Control and Sedimentation Plan;
  - Dredged Material Containment Areas: maintenance and operations restrictions and monitoring,
- Cultural Resources;
  - Development of a Cultural Resources Management Plan,
  - Signing of a Programmatic Agreement between the Savannah District, the Georgia State Historic Preservation Officer, the South Carolina State Historic Preservation Officer, and the Advisory Council on Historic Preservation concerning numerous actions and analyses to be conducted by the Savannah District,
  - Assess impacts of Savannah Harbor Navigation Project on Old Fort Jackson,
  - Assess impacts of Savannah Harbor Navigation Project on CSS Georgia,
  - Maintenance of a 100-foot stand-off around the CSS Georgia,
  - Conduct cultural resource surveys at all proposed new disposal areas,
- Mitigation of impacts in South Carolina due to disposal area operations;
  - Water level management for bird use,
  - Clearing and maintenance of a bird nesting area on Jones/Oysterbed Island,
  - Construction of nesting islands within disposal areas,
  - Construction of a bird nesting island offshore of Turtle Island,
  - Establishment of an escrow account with the SC OCRM for in-kind mitigation,

- Construction of a water control structure at the Savannah NWR for fisheries benefits,

- Mitigation of impacts in Georgia due to disposal area operations:
  - Restoration of 6.4 acres of tidal marsh in the harbor area,

- Freshwater supply to the Savannah National Wildlife Refuge:
  - Maintenance of the Diversion Canal, the channels in Little Back River and Middle River, and the canals and control works for the Refuge.

2.7 Lower Savannah River Basin Environmental Restoration Project

In 1996, the Savannah District of the US Army Corps of Engineers completed a final interim feasibility report for environmental restoration of the lower Savannah River Basin. The recommended plan included an 80-foot diversion structure at the upstream of Navigation Cut #3, which forces water back into an old oxbow previously cut off for navigation, opening the channel to Bear Creek, and realigning the mouths of both Bear and Mill Creeks. The plan restored more natural flow into an area which includes a major portion of the Savannah National Wildlife Refuge. Construction was authorized under Section 102 of the 1996 Water Resources Development Act. Construction of the project was completed in 2003.

3 Problems and Opportunities

This chapter describes the existing problems and opportunities at Savannah Harbor. The identification of problems and opportunities is the first step in the six-step planning process described in the P&G. Water resource-related problems at Savannah Harbor occur under existing conditions and are projected to continue to occur in the future under without-project conditions. The problems are related to container ship operations in the Federal navigation channel leading to the Garden City Terminal. The opportunities described in this chapter include potential improvements to navigation efficiency, which address the federal objective, and opportunities developed by Federal agencies, stakeholders, and the public during the study process.

3.1 Problems

The primary problems identified in this analysis relate to the inefficient operation of containerships in the Federal channel at Savannah Harbor, which affect the Nation's international trade transportation costs. The following problem statements describe these inefficiencies:

1. Existing shippers are experiencing increased/ inflated operations costs due to light loading and tidal delays.

2. Light loading and tidal delays will increase as present harbor users increase their annual tonnage and as larger, more efficient ships replace older, smaller ones;
3. Existing ships are experiencing problems associated with turning capabilities and overall maneuverability in certain reaches of the inner harbor;
4. The severity of problems associated with turning capabilities and overall maneuverability in certain reaches of the inner harbor will increase as vessel size increases.

3.2 Opportunities

A number of opportunities were identified in the initial and subsequent steps and iterations of the planning process. Opportunities identified in terms of the Federal interest include:

- Reduce the transportation cost of import and export trade through Savannah Harbor and contribute to increases in national net income (NED); and
- Reduce operations and maintenance costs for the Federal channel.

Opportunities were also developed that reflect priorities and preferences of the Federal Government, the non-Federal sponsors and other groups participating in the study process. These opportunities include:

- Beneficial placement of new work sediments (Tybee Island and other locations);
- Development of new upper harbor disposal area with new work material;
- Enhance the natural resources in the project area;
- Advance the understanding of the natural resources in the project area;
- Contribute to the preservation of historically significant resources in the project area;
- Contribute to other agencies environmental decision making resources through development of state of the art modeling tools;
- Reduce constraints of harbor pilot operating practices;
- Identify the cumulative environmental impacts from past harbor development and operation; and
- When consistent with the USACE authorities and policies, include appropriate actions in the plan alternatives.

4 Inventory of Existing Conditions

This chapter provides an inventory of critical resources (physical, demographic, economic, social etc.) relevant to the problems and opportunities under consideration in the planning area. The inventory of critical resources is a component of the second step of the planning process.

4.1 Overview of Existing Navigation Resources

Garden City Terminal at Savannah Harbor is currently the second largest container port on the US east coast (by TEU volume) and the fourth largest in the Nation. Garden City Terminal is a port of call for more than 40 container ship services, which call weekly on a fixed day schedule (liner services). However, Savannah Harbor also currently has the shallowest controlling depth for a major port. Although the 42-foot controlling depth and 38-foot unrestricted access depth at Savannah are similar to current constraints at the Panama Canal (39 feet), the Panama Canal Expansion Project will be fully operational by 2014, which will allow passage for vessels with up to 50 feet of draft. The Georgia Ports Authority has planned and funded improvements at Garden City Terminal to coincide with the Panama Canal Expansion Project. With these improvements in place, this terminal will be the largest single container handling facility in the Nation with more than 1,200 acres, 9,000 feet of berth, 33 Post-Panamax size cranes, and two on-site intermodal transfer facilities serviced by two major rail lines. The facility, at full build out, will have a throughput capacity of 6.5 million TEUs.

The existing Federal channel was designed for a 4,000 TEU vessel with a 106-foot beam, but vessels in the 6,600 to 8,000 TEU range with beams greater than 130 feet are currently using the channel. These large vessels operate in Savannah Harbor's Federal channel in a constrained manner. Inadequate channel dimensions cause inefficiencies in import and export trade, which increase the cost of the Nation's international trade. The cost impacts of inadequate channel dimensions are projected to increase in the future as the size of container vessels that call at the port becomes increasingly larger and more depth constrained.

Navigation of these large vessels is more restricted during wind conditions than navigation of smaller vessels because of the additional leeway the larger vessels require when navigating channel bends. Ship simulation studies were conducted using the design vessel *Susan Maersk*, which is an 8,200 TEU vessel with a beam of 140 feet, overall length of 1,138 feet. Widening of three channel bends was required for safe transit of the design vessel during the simulations. Under future without-project conditions, many more of the container ships using the channel are projected to be large Post-Panamax vessels with dimensions similar to those of the *Susan Maersk*. Panamax vessels are generally defined as being able to pass through the Panama Canal, with its 1,050-feet length, 110-feet width, and 38-foot depth limits. Post-Panamax vessels are generally defined as being too large to pass through the Panama Canal.

Carriers have adapted to Savannah Harbor's existing Federal channel constraint by modifying liner service operations. Alternative actions taken by the carriers include:

- By-pass Savannah Harbor;
- Service Savannah Harbor with smaller vessels;
- Light load to reduce vessel operating draft; or
- Use tidal advantage.

Carriers calling at Savannah Harbor have recently exercised one or more of these alternative actions and are projected to continue to do so over the 50-year planning horizon. For example, Mediterranean Shipping Company's (MSC) Golden Gate Service was calling at Garden City terminal with vessels in the 6,700 TEU range but left Savannah for Charleston after having incurred regular delays and light loads. The service returned to Savannah after less than a year in Charleston, but due to recurring delays and light loading has again returned to Charleston. This service is now deploying 8,500 TEU vessels and calls at Charleston but not at Savannah.

Landside operators, such as importers and exporters, also adjust to constraints at Savannah Harbor. One of the larger local Georgia exporters has been unable to find adequate space on vessels calling at Garden City Terminal. As a means of dealing with vessel capacity constraints at Garden City terminal, the shipper is trucking export containers to Charleston, where deeper drafts and more vessel space is available.

4.2 Existing Container Ship Industry Operations

The economic analysis of potential navigation improvements at Savannah Harbor mostly focuses on containerized trade and container ship operations. Container shipping is very competitive and adaptable to changing market conditions. Recent trends in the container shipping industry include:

- Increases in the amount of containerized cargo in world trade;
- Increases in vessel size, and capacity;
- Consolidation of carriers; and
- Slot sharing, which allows a carrier to use space on another carrier's vessel.

The impetus for these trends is increased economic efficiency, which typically results from using large vessels at high levels of utilization. The major trade lanes and major ports are all serviced by multiple carriers on multiple services, so competition on these trade lanes is strong. In this competitive environment, carriers often collaborate through alliances, conferences, and slot sharing agreements to maintain high vessel utilization rates.

In 2007, more than 50 liner services included regularly scheduled calls at Garden City Terminal. Some services handled more than 100,000 TEUs at Garden City, others only a few hundred. Savannah Harbor is typically one of multiple US east coast ports called on by a liner service. Vessels on a liner service are typically of similar size in order to provide a consistent port service. A typical liner service to the US east coast loads goods bound for the US east coast at a number of foreign ports (as few as two or as many as six) then calls at two, three, or more US east coast ports to discharge imports and pick-up exports. The vessel then returns to the same foreign ports-of-call serviced on the in-bound leg.

Liner services may also have more complicated itineraries. Liner services from Asia may stop at US west coast ports before calling at the US east coast. Liner services

from the Mediterranean and Europe may call at many ports before arriving at the US east coast, and may also include US Gulf ports in the rotation. Some services from Asia call at the US east coast then continue on to Europe before coming back to the US east coast on the return trip to Asia, thereby connecting Asia, the US east coast, and Europe in a single liner service. Another feature of liner service operations is transshipment, which occurs when a container terminal is used as a transfer point from one liner service to another. For example, MSC uses Freeport, BS (port depth -51 feet) as a transshipment terminal. MSC liner services from Asia to the US east coast and MSC liner services from Europe to the US east coast include a stop at Freeport where European goods bound for Asia and Asian goods bound for Europe can switch liner services. Transshipment terminals are also used for transfer of cargo from larger long haul vessels to smaller feeder vessels.

The container shipping industry has been evolving towards greater efficiency ever since the inception of containerized cargo in the 1950's. Greater efficiency involves moving more loaded boxes per voyage, which in turn has led to larger vessels. However, there are a number of constraints on vessel size, which include most importantly the physical dimensions of the Panama Canal and the physical dimensions of the major container ports. Over the years, the industry has addressed the physical limitations of the Panama Canal by increasing the number of TEUs that can be loaded on a Panamax size vessel. In 1991, the Panamax vessel used as the design vessel for the most recent Savannah Harbor deepening was a 4,000 TEU vessel, which was still under construction at the time. The most recently built Panamax vessels are rated at just over 5,000 TEUs with design drafts of 42 feet or more. The largest vessels being built are rated for more than 14,000 TEUs and design drafts of 48 feet.

At the major container ports, the limiting factor on container ship size is typically channel depth. Figure 4-2 presents the existing depths of the major international trading partner ports with service to Garden City Terminal. Savannah Harbor's controlling depth of -42 feet MLLW and unrestricted access operating draft no deeper than -38 feet are less than most other US east coast ports and less than all of Savannah's major foreign trading partner ports. Savannah's depth is on par with the existing Panama Canal constraint but will be a shallow depth outlier once the Panama Canal expansion is completed in 2014.

Continued competition among carriers requires transportation cost efficiency, which includes greater use of larger, more efficient vessels. The container ships calling at Garden City Terminal have been increasing in size, such as Post-Panamax vessels arriving via the Suez Canal. The container ship fleet calling on the major US east coast ports is currently shifting from being predominantly Panamax size vessels to include substantially more Post-Panamax size vessels. The industry-wide expectation is that this trend will increase and accelerate after completion of the Panama Canal Expansion Project. The Panama Canal and most major ports on the US east coast, in Europe, and in Asia are either currently able or will be able by 2014 to accommodate vessels with operating drafts in excess of 46 feet without requiring the use of tidal advantage (Table 4-1; Figure 4-1).

Table 4-1: Controlling Depths at Major US East Coast Ports, the Panama Canal, and Major Foreign Trading Partner Ports

Port	Existing (Feet below MLLW)	Planned Depth - Date (Feet below MLLW)
Savannah Harbor	42	42 (Without Project)
Port of New York & New Jersey	45	50 (2014)
Baltimore	50	50
Norfolk	50	50
Charleston	45	Study Underway
Miami	42	50 (2012)
Jacksonville	40	Study Underway
Port Everglades	44	49 (2012 Pending)
Panama Canal	39	50 (2014)
Freeport, BS	51	51
Antwerp, BG	49	49
Felixstowe, UK	49	49
Hamburg, GR	54	54
Bremerhaven, GR	48	48
Le Havre, FR	48	48
Busan, KO	52.5	52.5
Shanghai, CH	52.5	52.5
Hong Kong, CH	51	51
Yantian, CH	52.5	52.5

Source: Containerization International On Line (www.ci-online.uk)

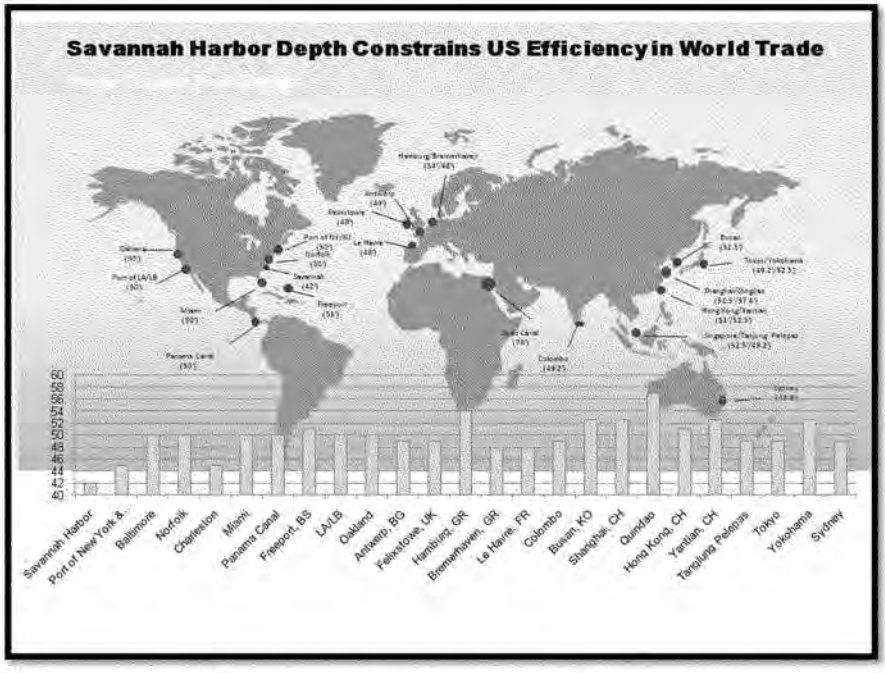


Figure 4-1: Selected World Harbor Depths Comparison

4.3 Existing World Container Ship Fleet

The world fleet currently (July 2010) consists of 4,805 container ships of various sizes and ages. Approximately one-third of the world's container ship fleet is Panamax size or larger. Panamax vessels are those which are sized to the dimensions of the Panama Canal. Historically, the defining constraint of the Panama Canal has been the 106 feet maximum vessel beam. Many Panamax vessels built since the 1990's, typically with TEU capacities greater than 4,500 TEUs, have been built with an operating draft capacity which exceeds the Panama Canal draft constraint (approximately 39 feet).

Seven hundred forty-one vessels in the current world fleet are Post-Panamax size, which in terms of vessel TEU capacity is typically greater than 5,100 TEUs. Table 4-2 categorizes current world fleet by TEU capacity. The minimum TEU capacity for a Panamax vessel is approximately 2,500 based on the dimensions and TEU capacities of vessels in the current fleet. These low volume Panamax vessels are typically among the oldest Panamax vessels.

Table 4-2: Current World Containership Fleet (July 13, 2010)

	Total	Percentage
Post-Panamax	741	15%
Panamax	1,334	28%
Smaller than Panamax	2,720	57%
All ships	4,795	100%
Panamax or larger	2,075	43%
Greater than Panamax Draft*	988	21%

* Includes Post-Panamax vessels and Panamax vessels with TEU capacity greater than 4,500
Source: Containerisation International On-line (www.ci-online.co.uk)

The first Post-Panamax vessels were built in 1995. Since that time, 20% of all container ships built have been Post-Panamax size and 29% built since then are Panamax size. Overall, for vessels built since 1995, 49% are Panamax size, or larger. More importantly for the Savannah Harbor deepening project, at least 25% of all container ships built since 1995 have sailing draft capabilities greater than the 39 feet Panama Canal constraint. Note that some Panamax size vessels have draft capabilities of 44 feet or more. Overall, 78% of active container ships and 88% of current TEU capacity have been built since 1995. Less than 12% of the current world container ship fleet is more than 20 years old, and just 7% are more than 25 years old.

As of July 10, 2010, there are 670 new container ships scheduled to enter the world fleet between the remainder of 2010 and 2014. It is important to note that orders under consideration but not contractually confirmed are not presented in the table, indicating that additional vessels may be delivered, especially in the out-years (2013 – 2014) Table 4-3 presents the current delivery schedule.

Table 4-3: World Container Ship Orderbook by Scheduled Delivery Date

	2010	2011	2012	2013	2014	Total
Post-Panamax	94	118	76	13	4	305
Panamax	82	78	40	7	0	207
Smaller than Panamax	120	32	4	2	0	158
All ships	296	228	120	22	4	670
Panamax or larger	176	196	116	20	4	512
Greater than Panamax Draft*	109	154	82	17	4	366

* Includes Post-Panamax vessels and Panamax vessels with TEU capacity greater than 4,500
Note: 2010 includes deliveries scheduled after Jun10
Source: Containerisation International On-line (www.ci-online.co.uk)

Table 4-4 presents the projected 2013 fleet based on the assumption that all scheduled deliveries are completed. Although many small container ships are scheduled to be added to the world fleet, nearly twice as many Panamax or larger vessels will enter the fleet over the next five years.

Table 4-4: 2013 World Container Ship Fleet (July 13, 2010)

	Total	Percentage
Post-Panamax	1,046	19%
Panamax	1,551	28%
Smaller than Panamax	2,878	53%
All ships	5,475	100%
Panamax or larger	2,597	47%
Greater than Panamax Draft*	1,354	25%

* Includes Post-Panamax vessels and Panamax vessels with TEU capacity greater than 4,500
Source: Containerisation International On-line (www.ci-online.co.uk)

Another perspective on the ongoing changes to the world container ship fleet is the increasing size of the Post-Panamax fleet. Table 4-5 presents the existing world Post-Panamax fleet and the current order book for Post-Panamax vessels. The table reveals that the existing Post-Panamax fleet mostly falls within size categories from 5,100 TEUs to 8,999 TEUs. Less than 10% of the existing Post-Panamax fleet is larger than 9,000 TEUs. The current order book for Post-Panamax vessels consists largely of vessels greater than 8,000 TEUs. The current order book adds nearly 200 vessels larger than 9,000 TEUs, which is equivalent to 45% of all new Post-Panamax vessels ordered. It is especially important to notice that by 2013, the world fleet will have more than 300 vessels ranging in size from 8,000 to 9,999 TEUs. Vessels in this size range have been identified by carriers and the Panama Canal Authority as the new standard for post-expansion Panama Canal traffic. Vessels as large as the 12,000 TEU range, and perhaps some 13,000 TEU vessels, will be able to transit the expanded Panama Canal.

The importance of these Super Post-Panamax vessels (greater than 10,000 TEUs) for containerized trade at the US east coast and for Savannah Harbor is that as these vessels are moved into the largest volume trade lanes (Asia – Asia and Asia - Europe), they will displace the existing Post-Panamax fleet. The displaced fleet of Post-Panamax vessels (6,000 TEUs to 9,999 TEUs) will shift to the next tier of trade lanes which includes the Asia to North America trade.

Table 4-5: World Fleet Existing and Ordered Post-Panamax Vessels (number of vessels)

TEU Capacity	Existing	Order Book	Total
5,100 – 5,999	246	20	266
6,000 – 6,999	177	43	220
7,000 – 7,999	31	22	53
8,000 – 8,999	191	53	244
9,000 – 9,999	54	9	63
10,000 – 10,999	13	21	34
11,000 – 11,999	10	7	17
12,000 – 12,999	0	44	44
13,000 – 13,999	9	75	84
14,000+	10	11	21
Totals	741	305	1,046

Source: Containerisation International On-line (www.ci-online.co.uk)

4.4 Existing Savannah Harbor Operations

The Georgia Ports Authority operates two terminals at Savannah Harbor: Ocean Terminal and Garden City Terminal (see Chapter 4.4.1 Garden City Terminal Operations and Infrastructure for a detailed discussion of Garden City Terminal). Ocean Terminal is a break-bulk and Roll-on/Roll-off facility owned and operated by the GPA. A range of shipments, including forest and solid wood products, steel, industrial and farm equipment, automobiles, project shipments, and heavy-lift cargoes move through this 208-acre, 10-berth facility every day. The facility features 6,674 linear feet of deepwater berthing, 1.5 million square feet of covered storage, and 83 acres of open storage. Ocean Terminal is located 10 miles from Interstate 95 and 1.2 miles from Interstate 16. Norfolk Southern Railroad provides switching services on-terminal. Line-haul services are provided by Norfolk Southern Railroad and CSX Transportation. Additional land is available for future expansion of this facility.

Other Savannah Harbor operations include Willamette Industries, Savannah Electric Power Generating Station – Southern Company, Atlantic Wood Industries, Savannah Food and Industries, Vopak, National Gypsum Company, SIT, Citgo Asphalt Refinery, Georgia Kaolin International, Savannah Steel Corporation, Colonial Oil Industries, Savannah Marine Services, Crescent Towing Services, Moran Towing, Liberty Terminal, East Coast Terminals/Woodchip Exporting Corporation, Georgia Pacific Gypsum, Nustar, Conoco Phillips, Tronox, and Southern LNG.

Waterborne Commerce of the United States, Calendar Year 2008 (USACE, 2010) reports that freight traffic tonnage at Savannah Harbor nearly doubled between 1999 and 2008 to 35.394 million short tons (Table 4-6 and Figure 4-2). The largest volume of commodities (by weight) in 2008 were exported clay (2.423 million short tons), imported liquefied gas (2.955 million short tons), and unclassified imported

manufactured products (2.002 million short tons). Clay is exported from Savannah Harbor's Ocean Terminal and Garden City Terminal. Imported manufactured products are largely landed at Garden City Terminal.

Table 4-6: Savannah Harbor Waterborne Freight Traffic: 1995 – 2009 (thousands of short tons)

Year	Total	Year	Total
1995	17,380	2003	23,369
1996	17,598	2004	28,177
1997	17,929	2005	30,114
1998	17,711	2006	33,971
1999	18,156	2007	36,486
2000	19,517	2008	35,394
2001	19,392	2009	32,339
2002	20,664		

Source :Waterborne Commerce of the United States, Calendar Years 2005 - 2009. USACE, 2010

Figure 4-2: Savannah Harbor Historical Commodity Growth with Trendline

Imported liquefied natural gas (LNG) is handled at the Elba Island LNG import terminal located in Chatham County, Georgia approximately five miles south of the City of Savannah. Elba Island is operated by Southern LNG, which is a wholly owned

subsidiary of El Paso Energy Company. The facility includes two buried 30-inch pipes, which cross under the Savannah River. Consultation with Southern LNG concluded that a -48-foot channel could be constructed without requiring relocation of the existing pipes. In 2003, the Federal Energy Regulatory Commission issued an order authorizing the expansion of the Elba Island facility, which included adding a second and third docking berth, a fourth cryogenic storage tank, and associated facilities. The proposed expansion will increase the Elba Island facilities' working gas capacity from 4.0 billion cubic feet of gas equivalent (Bcfe) to 7.7 Bcfe.

The recent completion of a new double berth slip will allow LNG vessel calls at Savannah Harbor to increase from 60 to 120 projected for 2015. A third phase of expansion at Elba Island is currently being constructed. The third phase expansion is projected to increase the number of Elba Island LNG vessel calls to as many as 167 LNG vessel calls per year (2030). LNG vessels arrive loaded to an operating draft of 35 to 37 feet, with 36 feet being the typical operating draft. These vessels are 940 to 960 feet long with a beam ranging from 135 to 145 feet.

The US Coast Guard enforces a one mile "regulated navigation area" around inbound LNG vessel traffic in the harbor. As a part of Savannah Harbor's standard operating procedures, LNG vessels enter the harbor at high tide so as to arrive at the berth at high water slack tide. Despite coordination between harbor users, pilots, and the US Coast Guard, container ships and LNG vessels have been delayed due to the combined constraints of limited controlling depth (38 feet unrestricted) and LNG security and safety related operations.

4.4.1 Garden City Terminal Infrastructure and Operations

The Garden City Terminal is a secured, dedicated container terminal owned and operated by the Georgia Ports Authority. The terminal is the fourth-largest container port in the United States and the largest single-terminal operation in North America. The facility's single-terminal design supports flexible and efficient operation, as well as increased security, due to the concentration of all manpower, technology, and equipment in one massive container operation.

The terminal covers 1,200 acres with 9,693 continuous linear feet of waterfront. Garden City Terminal is equipped with 23 ship-to-shore container cranes with capabilities ranging from 128 feet of outreach (Post-Panamax vessels) to 192 feet of outreach (Super Post-Panamax vessels). The facility currently operates with 96 rubber-tired gantry (RTG) cranes, each with a lifting capacity of 50 tons.

Garden City terminal berths run in a line that follows the Savannah River navigational channel. The linear berth space is divided into four segments as follows:

- Container Berth 1: 1,600 feet;
- Container Berths 2-3: 2,300 feet;
- Container Berths 4-5-6: 2,300 feet; and

- Container Berths 7-9: 3,276 feet.

In 2011, Garden City Terminal operated at a volume of just over 2.95 million vessel lifts, or about 2.3 million TEU's per year. This is being accomplished with 8,300 feet of berth and approximately 407 acres of net container storage area, resulting in facility productivities of:

- 278 TEU's per foot of berth per year, and
- 5,650 TEU's per net container storage acre per year

Terminal facilities include the James D. Mason Intermodal Container Transfer Facility (Norfolk Southern Railway), which includes 12,500 feet of working track, 7,500 feet of storage track, and a 25 acre facility area. The Mason ICTF moves an average of 17 double stack trains to Atlanta each week. A second on-terminal ICTF facility, Chatham Yards (CSX), commenced operations in 2009. Chatham Yards includes 6,435 feet of working track, and 12,406 feet of storage track. Approximately 20% of Garden City Terminal's throughput moves by rail.

Truck traffic is serviced by 37 lanes through three separate gates. Recent improvements to gate and yard automation include development of an Automated Terminal Asset Management System, which became fully operational in 2008. The terminal also includes 1.3 million square feet of warehouse area and more than one mile of rail siding.

The Georgia Ports Authority has developed a 10-year, $1 billion capital improvement plan, which includes equipment purchases and upgrades, transportation infrastructure improvements, and container storage area expansion. A $56.5 million bond resolution was passed in 2007 in support of the capital improvement plan.

4.4.2 Regional Landside Transportation Infrastructure

Garden City Terminal is a strategic gateway to rail and road distribution networks providing access to markets across the U.S. Southeast and Midwest. The on-terminal Mason Intermodal Container Transfer Facility (Mason ICTF) is served by Norfolk Southern Railroad, providing overnight service to Atlanta, with two to four day delivery to inland destinations of Charlotte, North Carolina; Chicago, Illinois; Dallas, Texas; and Memphis, Tennessee. The new Chatham Yard ICTF, operated by CSX, services Florida and other destinations. Additionally, immediate interstate access is available via Interstates 95 (North/ South) within 5.6 miles and 16 (East/ West) within 6.3 miles. In 2011, state financing ($140 million) was approved for a 3.1 mile, four-lane highway extension from I-95 to the Bourne Street approach to the container terminal gates. Construction is planned to begin in 2013 and the roadway will be completed and opened in 2015. Garden City Terminal's regional landside transportation infrastructure has been instrumental in attracting international trade and is an important consideration for distribution center placement decision making.

4.5 Existing Garden City Terminal Cargo

Savannah Harbor has been the fastest growing US container port since 1995, with an average annual growth rate (1995 – 2006) of 12.5% (MARAD, 2007). This growth in TEU volume at the port has occurred even though average annual population growth in the Savannah MSA was approximately 1% during that time and growth in the 40-mile "trade radius" around Savannah grew at only slightly more than 2% per year. Savannah's share of TEUs among the four largest USEC ports (PONYNJ, Norfolk, Charleston, and Savannah) has grown from 13.1% in 1995 to 19.1% in 2005 (MARAD, 2007). The large volume of trade growth at Savannah Harbor is attributable to the port's favorable infrastructure configuration, transportation network, and local development of new distribution centers.

Annual total TEU volumes have grown continuously since 1987 at Garden City Terminal. Between 1987 and 2007, Garden City Terminal experienced an average annual TEU volume growth rate of 10%. During that 20-year time span, total TEU volume has increased more than seven-fold. Loaded import TEU volume has increased by more than 830%. Loaded export TEU volume has increased by more than 580%. Garden City Terminal currently operates at a balance between import and export TEUs: 53% exports and 47% imports in 2009. Imported TEUs typically contain retail goods, and exports are largely paper and paperboard, wood pulp, food, fabric, and clay. These export commodities are loaded heavily into boxes, which causes outbound drafts to often be deeper than inbound drafts. Table 4-7 presents Garden City Terminal TEU volumes for recent years and the interim average annual growth rates. Figure 4-3 graphically presents the historic growth in annual Garden City Terminal loaded TEU traffic.

Table 4-7: Garden City Terminal TEU Volumes (1995 – 2010)

	Imports	Exports	Total
1995	196,136	227,918	424,054
1996	195,182	245,101	440,283
1997	241,209	283,571	524,780
1998	294,821	240,169	534,990
1999	349,940	251,100	601,040
2000	396,563	260,437	657,000
2001	413,445	284,451	697,896
2002	536,510	339,013	875,523
2003	602,107	388,361	990,468
2004	679,215	649,516	1,328,731
2005	803,693	701,857	1,505,550
2006	862,763	774,056	1,636,819
2007	1,070,018	998,516	2,068,534
2008	1,072,075	1,079,421	2,151,496
2009	883,013	1,024,279	1,097,292
2010	1,050,466	1,144,554	2,195,020

Source: GPA

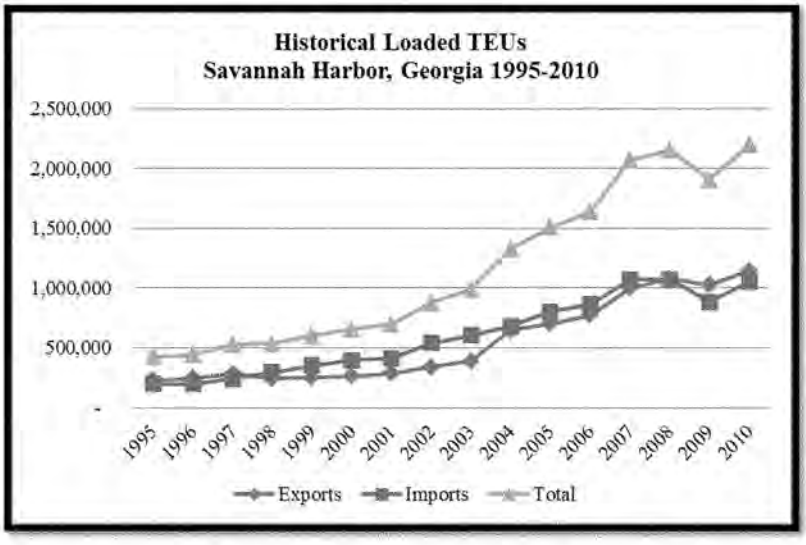


Figure 4-3: Garden City Terminal Historical Loaded TEUs

4.5.1 Hinterland and Regional Distribution Centers

Savannah Harbor's domestic hinterland (area served by the port; both imports and exports) generally consists of the area from Norfolk, VA, southward along the coast through Florida, west to Texas, and northward through all the mid-western states. The Georgia Ports Authority marketing department considers this area as Garden City Terminal's "Port Range". Within this Port Range, and generally in close proximity to Garden City Terminal, retail chain distribution centers have been developed on former farmland in Chatham and surrounding counties. Large scale distribution centers have developed at Savannah Harbor because of the availability of large tracts of undeveloped land and the proximity to road, rail, and waterborne transportation infrastructure.

Distribution centers are typically located within a one-day's drive of the local retail stores. One distribution center may hold inventory for a dozen, or more, local retail stores. The very large distribution centers located near Garden City Terminal may also supply regional distribution centers located in the hinterland, which in turn supply local retail stores. Large scale distribution centers reduce the amount of inventory that needs to be kept at the local retail stores. The use of large scale distribution centers also reduces the risk that an inappropriate volume of inventory would be sent to a local retail store. The economic efficiency of large scale distribution centers, and hence their recent expansion at all major US ports, is due to smaller inventories at local stores and the flexibility to provide the right inventory at the right time.

The 24 largest distribution centers using Garden City terminal have a combined warehouse area of 19.7 million square feet (GPA, 2007). The Savannah/Chatham County industrial real estate inventory for warehouse/distribution facilities, light manufacturing buildings, and flex/business service space has more than doubled from 1998 to 2007, increasing from 11.0 million square feet in 1998 to 28.3 million square feet in 2007. Additions to the industrial real estate inventory are currently expanding beyond Chatham County into nearby Bryan, Effingham, and Liberty Counties. Build-out of sites acquired and in the planning stage would add an additional 25 million square feet to the inventory (Neely/Dales, 2007).

4.6 Existing Garden City Terminal Vessel Operations

Operating draft data for 3,372 inbound and outbound container ship transits of Savannah Harbor, in 2007, confirms that carriers are typically averse to waiting for tidal advantage. Less than 12% of all container ship transits were at drafts greater than -38.00 feet. Container ship operating drafts cluster at the threshold of unrestricted access. Nearly 42% of all container ship transits (41.9%) were at drafts ranging from -35.00 to -37.99 feet. It is also important to note that the drafts of outbound vessels exhibit this trend even more strongly than inbound vessels. This is due in part to the fact that export boxes typically weigh more than import boxes and because of the importance of unrestricted channel access for vessels scheduled for a Panama Canal crossing. Table 4-8 presents 2007 container ship operating drafts at Savannah Harbor. Figure 4-4 presents the same information graphically. The information presented

below is based on vessel drafts reported by the shipping agent, which closely track but are not identical to pilot's data.

Table 4-8: 2007 Savannah Harbor Container Ship Arrival and Departure Drafts (number of calls)

Draft (feet)	Arrival	Departure	Total	Percentage
<30.00	224	150	374	11.1%
30.00 to 30.99	60	41	101	3.0%
31.00 to 31.99	98	53	151	4.5%
32.00 to 32.99	169	106	275	8.2%
33.00 to 33.99	146	122	268	7.9%
34.00 to 34.99	206	181	387	11.5%
35.00 to 35.99	209	198	407	12.1%
36.00 to 36.99	215	294	509	15.1%
37.00 to 37.99	198	300	498	14.8%
38.00 to 38.99	57	45	102	3.0%
39.00 to 39.99	39	51	90	2.7%
40.00 to 40.99	31	55	86	2.6%
41.00 to 41.99	29	32	61	1.8%
42.00 to 42.99	21	42	63	1.9%

Source: Georgia Ports Authority

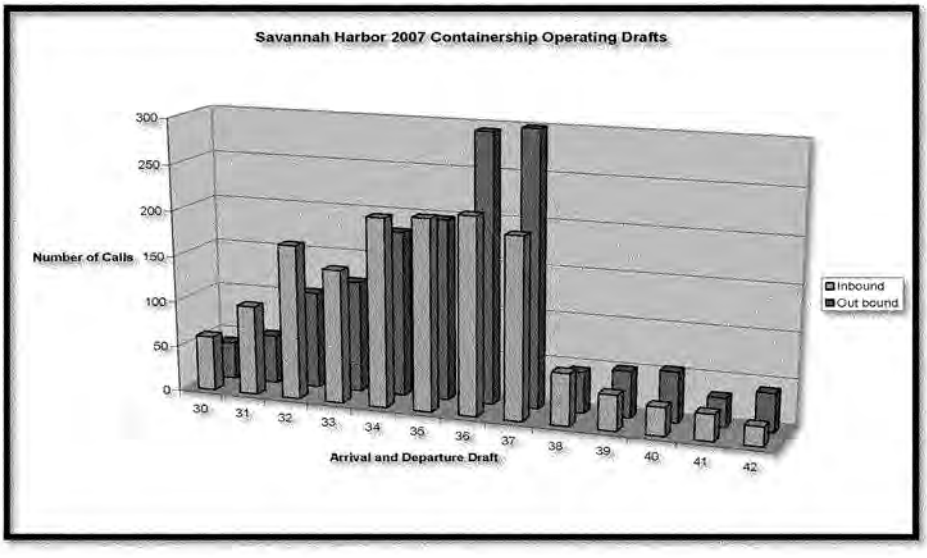


Figure 4-4: Garden City Terminal 2007 Arrival and Departure Drafts

Operating restrictions for container traffic transiting the Savannah Harbor are based on existing channel depth and width. With the exception of two Post-Panamax vessels, it is the usual practice to meet container ships in the straight channel segments. Container vessels can also pass empty LNG vessels. When a loaded LNG vessel is entering the channel, the channel must be clear within a 1 mile radius of the vessel. Pilots typically require container ships to operate with a minimum of 4 feet of underkeel clearance. Any vessel with a reported sailing draft of more than 38.0 feet is effectively using the tide to gain sufficient underkeel clearance. The tidal range at Savannah is approximately 6.9 feet.

The presentations in Figure 4-4 and Table 4-8 indicate that carriers are responding to existing operating draft restrictions by loading vessels so as to maintain unrestricted access to the channel (operating drafts no deeper than -38 feet). The constrained condition identified in the recent historical data continues through the present. In the first half of 2010, 80% of vessels that called at Garden City Terminal were considered depth constrained, and 20% of transits relied on tidal assistance.

Waiting for the tide is a costly operational inefficiency for schedule-driven liner service carriers for two reasons. The first reason is that, for inbound vessels, waiting adds to the operational cost of the voyage by increasing the vessel's time at sea. Outbound vessels waiting for the tide must spend more time at the dock and may delay the arrival of a vessel scheduled to use the same berth. Vessels may increase speed between ports to make up time lost waiting for the tide, which also adds to the cost of the voyage. The second reason that carriers are averse to waiting for the tide is that the additional time spent getting into or out of Savannah Harbor disrupts the vessel's scheduled arrival time at the next and following ports. Vessels may be subject to penalty fees for missing their scheduled time slot at the Panama Canal or may need to pay overtime fees due to a late port arrival. In addition, the deeper the vessel draft, beyond -38.00 feet, the narrower the tidal window required for transit. A vessel loaded to the channel's maximum operating draft of 42 feet has only a one hour window before and after each high tide. This narrow window increases the risk that the vessel may miss the opportunity for transit due to LNG vessel operations or cargo related delays.

The largest container ships to have recently called at Savannah Harbor are Post-Panamax vessels on two of MSC's trans-Atlantic services, which have a TEU capacity of more than 6,700 TEUs and maximum operating drafts of nearly 48 feet. MSC began bringing these vessels to Savannah Harbor in 2006 in typically light loaded condition, at or slightly greater than the unrestricted 38-foot constraint. In mid-2006 and early 2007, MSC began bringing these vessels in at drafts greater than 40 feet and often at the maximum draft of 42 feet. However, the reduced access window due to the depth constraint caused significant disruptions to MSC's schedule.

MSC's recent experience illustrates another response to Savannah Harbor's channel constraint. Instead of continually arriving light loaded, MSC began skipping Savannah as a port of call on these services in late 2007 and continued to call at

Savannah with these vessels only intermittently in 2008. Discussions with MSC indicate that MSC has decided to continue loading those vessels to 42 feet but will not bring them to Savannah Harbor at that draft. Cargo which would have been delivered directly to Savannah is being offloaded at Charleston and trucked to Savannah or is being transshipped at Freeport, BS onto smaller MSC vessels calling at Savannah Harbor. Exports out of Savannah are being delayed by the lack of vessel space, due to the large MSC vessels dropping Savannah as a port-of-call.

4.7 Existing Socio-Economic Profile

Savannah Harbor is included within the US Census Bureau's delineation for the Savannah, GA Metropolitan Statistical Area (MSA, 42340). Savannah is the principal city within this MSA, which also includes Bryan, Chatham, and Effingham counties. The 2010 American Community Survey Profile (www.census.gov) for Savannah, GA indicates that the MSA household population is 348,689. The median age is 34.4 years with 29% of adults having graduated high school, 23% having some college, 7% having achieved an Associates degree, 19% a Bachelors degree, and 10% having a Graduate or Professional degree. The median income is $46,755.

The largest industries by employment in the MSA are Education, Health, and Social Services (23%), Retail Trade (13%), and Public Administration (10%). The following lists employment distribution by industry category:

- Agriculture, forestry, fishing, hunting, and mining – 0%;
- Construction – 6%;
- Manufacturing – 10%;
- Wholesale trade – 3%;
- Retail trade – 13%;
- Transportation, warehousing, and utilities – 6%;
- Information – 1%;
- Finance, insurance, and real estate – 5%;
- Professional and business services – 10%;
- Education, health, and social services – 23%;
- Leisure and hospitality – 10%;
- Public administration – 6%; and
- Other services – 5%.

In 2010, the University of Georgia, Terry College of Business conducted an economic impact analysis of Georgia's deepwater ports on the state's economy for fiscal year 2009. The analysis found that Savannah cargo-based activity was responsible for 76% of the economic impact generated by the state's deepwater port industry. Table 4-9 presents a synopsis of the Savannah cargo-based economic impact. Activity related to containerized cargo at Garden City Terminal generated more than 85% of Savannah Harbor's cargo-related impact.

Table 4-9: Savannah Harbor Economic Impact – 2009 (millions of 2009 dollars)

	Direct	Indirect & Induced	Total
Revenue/Output	$1,575	$842	$2,417
Income	$561	$276	$873
Gross State Product	$775	$412	$1,186
Employment*	14,131	7,499	21,628

Source: The Economic Impact of Georgia's Deepwater Ports on Georgia's Economy in FY 2009, J.M Humphreys, April 2010. Note that totals may be affected by rounding. *Employment is shown in full- and part-time jobs.

4.8 Existing Environmental Resources

The Savannah River and its tributaries form the border between the states of Georgia and South Carolina. At 313 miles in length, the Savannah River has a drainage area of approximately 9,850 square miles. Its width varies between 2,000 feet near its mouth to about 1,000 feet at the Kings Island Turning Basin (near Station 100+000). Savannah Harbor and the deep-draft navigation channel are located along the lower 21.3 miles of the River and out 11.4 miles into the Atlantic Ocean. The inner Harbor is from just below the Georgia Highway 25 Crossing to about Fort Pulaski (Stations 112+500 to 0+000) and the outer Harbor is from Fort Pulaski into the Atlantic Ocean Station 0+000 to -60+000B.

Three Federal reservoirs, Hartwell, Richard B. Russell, and J. Strom Thurmond, and the New Savannah Bluff Lock and Dam at Augusta, are operated by the Savannah District Corps. This system of reservoirs and dams controls much of the freshwater flow within the River. Tidal fluctuations average 6.8 feet at the mouth of the harbor with the upper limit at approximately 7.9 feet. Salinity levels range from 0 ppt above the Garden City terminal to 35 ppt (sea strength) in the ocean bar channel.

4.8.1 Geology and Sediments

Eastern Chatham County is underlain by approximately 2,000 feet of sedimentary Coastal Plain sediments ranging in age from Holocene to Cretaceous. From land surface to a depth of about 500 feet, these sediments consist of unconsolidated to somewhat indurated beds of sand and clay of recent (Holocene) and Miocene age to indurated limestones of Oligocene and Eocene age. The Oligocene and Eocene limestones comprise what is commonly referred to as the Upper Floridan aquifer. In the Savannah Harbor area, the geologic formations can be grouped into three broadly defined hydrogeologic units: the Upper Floridan aquifer, the Miocene confining unit, and the surficial aquifer.

Within the study area, the elevation of the top of the Oligocene unit, the uppermost unit of the Upper Floridan aquifer, ranges from roughly –95 feet MLLW near Tybee Island to approximately –200 feet MLLW near downtown Savannah. The top of the Miocene unit occurs at an average of –45 feet MLLW and is generally level within the

study area, and unit thickness ranges from less than 30 feet near Tybee Island to 160 feet near downtown Savannah.

The uppermost recent sediments consist of varying mixtures of sands, silts, and clays of varying density and consolidation. Generally, soils at the river bottom exhibit lower consistency than the deeper recent soils. The bottom soils are often very loose and semi-liquid and can extend from the bottom of the river channel to only a few inches to several feet deep. The underlying Miocene-aged soils comprise a significant portion of the proposed new work material and consist of consolidated silty sands, clayey sands, high liquid-limit silts, and low liquid-limit and high liquid-limit clays. In general, relative to recent sediments, the Miocene soils are characterized by a significant density increase, uniform consistency, and cohesiveness.

Sediment testing conducted in 2006 revealed the presence of naturally-occurring cadmium in Miocene sediments within elevation ranges that include potential new work sediments. The highest concentrations of cadmium (average 21.45 mg/kg) were found in the sediments between Stations 24+000 and 45+000. None of the other ranges had an average cadmium concentration of greater than 6.89 mg/kg, which was above the Effects Range Low (ERL) of 1.2 mg/kg and well below the Effects Range Median (ERM) of 9.6 mg/kg. For concentrations less than the ERM but greater than the ERL, contaminant concerns for environmental impact potential should be low, but not zero.

4.8.2 Water Resources

The Upper Floridan aquifer is the primary source of groundwater and supplies Chatham County and the study area. It provides about 30 percent of the total water supply for the County. The Floridan aquifer, which underlies parts of Alabama, Georgia, South Carolina, and Florida, supplies approximately 50 percent of the groundwater in the State of Georgia. Groundwater can be found at various depths in the project vicinity, while subsurface drinking water is taken only from depths more than 100 feet below the surface. Clay lenses of 40 to 70 feet in thickness separate the various groundwater bearing strata.

The long-term withdrawal of water from the Upper Floridan aquifer has resulted in radial flow directed toward the center of pumping and a cone of depression beneath Savannah. Vertical leakage of water through the Miocene confining unit contributes nearly half the aquifer water budget for the Savannah area, or 40 million gallons per day (MGD). The *Aquifer Effects Evaluation Supplemental Study* (see Engineering Appendix, Supplemental Studies DVD) examines the impact of the proposed dredging on the rate of vertical intrusion, which consists of both fresh and salt water, and the resulting groundwater impacts in the Upper Floridan aquifer. Input from various agencies including the United States Geological Survey (USGS), Georgia Department of Natural Resources, Environmental Protection Division (GA DNR-EPD), South Carolina Department of Health and Environmental Control (SC DHEC), the SEG, and GPA was used to develop scopes for work for the investigations included in the Supplemental Study. Investigations included additional sub-bottom seismic surveys,

marine and land drilling, geographic information system (GIS) analysis, and 3-D numerical groundwater modeling.

The additional investigations provided increased understanding of the geologic and hydro-geologic framework underlying the navigation channel. The overall results of the investigations indicate that Savannah area withdrawals from the Floridan aquifer are the dominant force contributing to the downward movement of salt water through the Miocene protective layer to the aquifer. If the pumping rate remains at present levels, breakthrough of seawater will occur at some downstream locations in approximately 100 to 300 years regardless of the proposed harbor deepening. The proposed deepening would contribute only about 3 to 4 percent increase in total downward flow through the confining layer into the Upper Floridan aquifer and with the much larger lateral flow of freshwater, would have negligible impact on water quality in production wells in the Savannah area.

The City of Savannah operates an Municipal and Industrial Water Supply (M&I) raw water intake on Abercorn Creek. The City's M&I raw water intake is located along Abercorn Creek approximately 1 mile upstream of the confluence of the creek with the Savannah River, which is located at River Mile 29 or about 9.8 miles above the limits of the proposed Expansion Project. Presently, the City withdraws water from Abercorn Creek for both industrial and municipal uses. In the past, the City's contracts with its industrial customers included a provision that the water provided must possess a chloride concentration not greater than 12 mg/l. That provision is not in the City's present contracts, but industries experience higher maintenance costs associated with pipe scaling and boiler corrosion when the City delivers water with higher chloride levels. Chlorides in municipal water supplies must be under the 250 mg/l drinking-water standard established by the Georgia Department of Natural Resources. Seawater has a chloride concentration of about 19,400 mg/l.

South Carolina Department of Health and Environmental Control, has specified the following water quality classification for the Savannah River:

- From the headwaters of Lake Russell to the Seaboard Coastline Railroad (RM 27.4);
    - Class FW (suitable for primary and secondary contact recreation and as a source for drinking water supply after conventional treatment in accordance with the requirements of the Department. These freshwaters are suitable for fishing and the survival and propagation of a balanced indigenous aquatic community of fauna and flora. They are suitable also for industrial and agricultural uses),
- From the Seaboard Coastline RR to Fort Pulaski (RM 0.0);
    - Class SB (tidal saltwater suitable for primary and secondary contract recreation, crabbing, and fishing, except harvesting of clams, mussels, or oysters for market purposes or human consumption), and
- From Fort Pulaski to the Atlantic Ocean;

- Class SA waters (tidal saltwater suitable for primary and secondary contact recreation. Suitable also for uses listed in Class SB, with the same exception).

In addition, a fish consumption advisory due to mercury concentrations has been issued by the South Carolina Department of Health and Environmental Control.

The GA DNR classifies the Savannah River from Station 0+000 (mile 0) at Fort Pulaski to the open sea (including the littoral waters of Tybee Island) as Recreation waters. From Fort Pulaski (Station 0+000) to the Seaboard Coastline RR Bridge (about Station 144+672 or Mile 27.4), the river is classified as Coastal Fishing. The harbor from Highway 17 to South Channel is listed as not fully supporting the designated use of coastal fishing due to the violation of fecal coliform, copper, and dissolved oxygen criteria. In 2002, the GA DNR, Environmental Protection Division included a portion of the Savannah River on the State's Section 303(d) list from State Road 25 (Old US Highway 17) to the Elba Island Cut.

In 2009, following EPA disapproval of state dissolved oxygen (DO) standards for Savannah Harbor, the State of Georgia revised its DO standard. These criteria are applicable to protecting estuarine resources within the harbor and for permitting and Clean Water Act compliance purposes. The new standard calls for a daily average in the dissolved oxygen to be no less than 5.0 mg/l throughout the year, with an instantaneous minimum of 4.0 mg/l. These new standards apply throughout the water column, and they match the South Carolina standard for waters of the same use classification.

4.8.3 Air Quality

The ambient air quality for Chatham County, Georgia and Jasper County, South Carolina is in compliance with the National Ambient Air Quality Standards, and both counties have been designated as attainment areas.

4.8.4 Marine and Estuarine Resources

Savannah Harbor is in a moderately stratified estuary in which tidal action forces mixing of fresh and salt waters. Each spring and fall, the main Savannah River, Back River, Middle River, and the numerous interconnecting tidal streams are hosts for the migration of three members of the herring family: American shad (Alosa sapidissima), Hickory shad (Alosa mediocris), and Blueback herring (Alosa aestivals), and the Striped bass (Morone saxatilis), which are very important game fish. The American shad is the most valuable commercial anadromous fish in the southeast. The Shortnose sturgeon (Acipenser brevirostrum), which has been listed as endangered since 1967, is also present in the harbor. Other commercial and recreational species found in the river include blue crabs, oysters, and brown and white shrimp. Twenty-eight Essential Fish Habitat species have been identified for the riverine and estuarine areas of South Carolina and Georgia.

As part of the Savannah Harbor Expansion Project, the USGS Georgia Cooperative Fish and Wildlife Research Unit conducted a two year study from 2000-2001 to analyze the current condition of fishery resources within the Savannah River estuary. The study is documented in a report titled "Temporal and Spatial Distribution of Estuarine-Dependent Species in the Savannah River Estuary" by Jennings and Weyers in 2003. Over the course of the study, 91 different fish species and 67,826 individuals were collected. This study reported that Bay anchovy, Atlantic menhaden, Atlantic croaker, and spot were the most abundant species in the SRE and comprised 81% of the catch. The report noted that fish density and species richness to be low in the fall and higher in late winter and summer. The report documented that commercial and recreational species in the SRE "included marine/estuary species such as gray snapper, red drum, spotted seatrout, striped bass, weakfish, ladyfish, tarpon, Spanish mackerel, jack crevalle, and striped mullet and freshwater species such as largemouth bass, catfishes, black crappie, sunfishes, and carp." The authors indicated that the majority of the fish communities were able to tolerate a wide range of salinities (5.0 to 15 ppt). The recreational fishery for Striped bass was recently reopened in the harbor, as a response to restored population levels. Recent studies have indicated that historically the Savannah River was the location of Georgia's most important Striped bass fishery.

In 2006, the University of Georgia, Marine Extension Service received a grant from the National Aquatic Invasive Species Council to monitor for aquatic invasive species in the Port of Savannah. Invasive species can be spread through several pathways including ballast water and boat hulls. Three invasive species have been documented to occur on Tybee Island, the green porcelain crab (*Petrolisthes armatus),* the green mussel (*Perna viridis),* and the titan acorn barnacle (*Megabalanus coccopoma).*

4.8.5 Terrestrial Resources

Three wildlife resource areas have been designated within the study area:

- Savannah National Wildlife Refuge;
- Tybee National Wildlife Refuge; and
- Turtle Island Wildlife Management Area.

The Savannah National Wildlife Refuge is located in the upper portion of the harbor and consists of 25,600 acres of freshwater marshes, tidal rivers and creeks, and bottomland hardwoods. Its location across the river from highly developed port facilities and its original purpose as a freshwater refuge present significant challenges to harmonious operation of the harbor with adjacent landowners. The Refuge's extensive un-impounded wetlands along the Savannah, Middle and Back Rivers have been impacted by previous channel deepening projects. Channel deepening allows saline water to travel further upriver, which has caused a decline in freshwater vegetation. The Corps constructed a Freshwater Control System on the Refuge in 1977 to mitigate for the salinity increase expected from the harbor deepening and from sediment control features authorized in 1965. The Tidegate was removed from

operation in March 1991 and New Cut was closed in 1992 to alleviate impacts caused by sediment control structures, which were constructed in the late 1970's.

The Savannah National Wildlife Refuge includes 5,700 acres of diked impoundments for waterfowl habitat. Those impoundments include 3,000 acres of freshwater pools. Two management schemes are primarily used for the impoundments; draw-down pools and permanently flooded pools. The draw-down pools are drained annually between March 15 and May 15 and manipulated to promote growth of emergent waterfowl food plants. These areas are flooded in the fall of each year. Permanent pools remain flooded all year to promote growth of submerged aquatic plants and to provide wood duck brood-rearing and alligator habitat. Permanently flooded pools are drained, dried, burned, and mowed when undesirable vegetation becomes a problem or productivity of desirable plants decreases. These pools may require additional water at any time to make up for transpiration and evaporation. An adequate supply of freshwater was available under normal river flow conditions for management of the impoundments. Removal of the gates on the Tidegate structure in 1990 decreased salinity in Back River so that freshwater is available for flooding of the impoundments under all expected flow conditions.

The Tybee National Wildlife Refuge was established in 1933 as a breeding area for migratory birds and other wildlife. The Refuge consists of 400 acres of wetlands and diked low lands located at the mouth of the Savannah River across from the Fort Pulaski National Monument. Much of the site is diked and is used for placement of sediments dredged from the Savannah Harbor Navigation Project. The vegetated portions of the upland areas are densely covered with red cedar, wax myrtle, and groundsel. Salt water marsh borders much of the island. The low tide shoreline provides feeding and resting areas for shorebirds and migratory birds. The site is closed to public use.

Turtle Island Wildlife Management Area (WMA) is located on the northern side of the Tybee Refuge along the ocean coast and is operated by the SC Department of Natural Resources. The 1,700-acre island was donated to the State in 1976 for waterfowl management purposes. The site is within Unit SC10P of the Coastal Barrier Resources System, so it receives protection from development specified in the Coastal Barrier Resources Act. The WMA contains 1,170 acres of low salt marsh, 90 acres of palm/palmetto forest with a wax myrtle and yaupon understory, and 50 acres of beach and dunes. High ground is situated in roughly parallel strips which encircle 420 acres of high salt marsh. The high salt marsh provides the best habitat for waterfowl management and hunting. Public use includes waterfowl hunting, marsh hen hunting, beachcombing, fishing, bird watching, picnicking and camping (designated areas only). Public use is generally low because access is available only by boat.

In addition, the majority of the undeveloped uplands found in the project area consist of DMCAs used for harbor operations. The DMCAs are generally located on the north side of the Savannah River and are inhabited by numerous species of wildlife similar to those found at the Savannah NWR and surrounding areas. Nesting terns and

plovers can be found on the more sandy areas during spring and summer. Nesting islands have been created within each DMCA in South Carolina (except DMCA 13B where they are scheduled but not yet constructed). These 1-acre islands provide rare isolated bare ground habitat for colonial nesting birds. Along the edges of flooded areas and along canals and inner ditches, wading birds and shorebirds congregate and feed. Depending on the amount of water available and time of year, large numbers of waterfowl can be found in these impoundments. A portion of the Jones-Oysterbed Island DMCA is located on the Tybee Island National Wildlife Refuge. The 400-acre site serves as a resting spot for pelicans, seagulls, egrets, herons, and other birds. DMCA 1N and a portion of DMCA 2A are located within the Savannah National Wildlife Refuge. Feral hogs, deer, raccoons, opossums, otters, rodents, and other mammals are also found on the DMCAs.

4.8.6 Wetlands

The 2008 Draft Fish and Wildlife Coordination Report for the Savannah Harbor Comprehensive Study dated November 2008 identified 22,719 acres of emergent wetlands consisting of a mixture of freshwater and salt-tolerant species. The Report also identified 8,577 acres of forested wetlands consisting largely of Cypress-Gum and Scrub-Shrub species.

The USFWS has identified tidal freshwater marshes as being a critical resource in its consideration of the acceptability of the proposed harbor deepening. The extent of those marshes has decreased substantially over time as the harbor has been deepened and salinity has moved further upriver. Other development activities such as diking, filling, and agriculture have further reduced the acreages of tidal freshwater marshes within this estuary.

4.8.7 Special Status Species and Resource Areas

There are currently 23 Federally Threatened and Endangered Species potentially present in Chatham County, Georgia and Jasper County, South Carolina. These species include five Threatened and fifteen Endangered vertebrates, and three Endangered vascular plants.

The Georgia Department of Natural Resources has identified 24 Special Concern Animals, seven Special Concern Plants, and nine Conservation Areas in Chatham County, Georgia. The South Carolina Department of Natural Resources has listed 105 Rare, Threatened, and Endangered Species in Jasper County, which include 37 animal species and 68 plant species. The three separate listings (Federal, Georgia, and South Carolina) are not mutually exclusive, so some species may occur on multiple listings.

4.8.8 Recreational Resources

The Georgia DNR Coastal Resources Division indicates the area of the navigation channel commonly known as Tybee Roads and eastward (ocean-ward of Station

-18+000) is a popular location for recreational fishing for King and Spanish mackerel during the late spring and summer. One ocean fishing pier is located on Tybee Island (Tybee Pavilion Ocean Pier off 16th Street) and is considered an important recreational facility. This ocean pier, private recreational vessels, charter boats, and head boats that use the nearshore waters also contribute to the local economy. Recreational surf fishing is not extensive on Tybee Island since the natural water depth is shallow near the beach strand and very gradually deepens offshore.

The Savannah Harbor estuary supports several sport fisheries. Sport fishing within the navigation channel is low due to heavy vessel traffic and recurring maintenance dredging which removes bottom habitat and limits benthic communities. Several marine finfish taken around the mouth of the harbor include spotted sea trout, spot, croaker, and other bottom species. Cobia and tripletail provide sport fishing in the outer channel.

The ocean shoreline of Tybee Island is used extensively for recreational purposes. The beach receives high visitation numbers during the summer months of May through August. Tourism is a growth industry in the coastal area. The City of Savannah receives a large number of tourists, who visit the historic aspects of the City and its riverfront.

4.9 Existing Conditions: Cultural Resources

Significant Cultural resources within the study area include:

- The wreck of CSS *Georgia*;
- Fort Pulaski National Monument;
- Old Fort Jackson;
- Savannah National Historic District; and
- Savannah River Civil War Cribs

Also within the study are two National Register of Historic Places sites. The river lock and northern terminus of the Savannah and Ogeechee Canal (Station 79+000) is located on the south shore adjacent to the Highway 17 Bridge. The canal was constructed during the 1830s. It is listed in the National Register of Historic Places at the state level for architecture and archaeological research potential.

The Fig Island Channel Site (Station 72+000 to 73+500) is located on the north side slope and shore of the existing navigation channel. The site has been determined eligible for inclusion in the National Register of Historic Places at the state level for its archaeological research potential. The site area was once a channel between Fig and Hutchinson Islands. The channel was used for disposal of wrecked and derelict vessels during the eighteenth and nineteenth centuries.

4.9.1 The Wreck of the CSS Georgia

CSS *Georgia* is a Confederate ironclad constructed in Savannah in 1862. The vessel was scuttled in the Savannah River in 1864, approximately three miles below Savannah and 11 miles above the mouth of the river adjacent to the main navigation channel. The wreck of CSS *Georgia* was discovered in its current location (between Stations 59+000 and 58+000) during dredging operations in 1968. The wreck is un-protected from river currents and erosion in its location adjacent to the navigation channel. The wreck of CSS *Georgia* impedes full maintenance of the navigation channel, causing a pinch-point at its location.

The wreck of CSS *Georgia* is included in the National Register of Historic Places at the National level of significance for architecture, association with significant events, association with significant people, and archaeological research potential. The National Register boundary includes the channel side slope, the top of slope, and an area extending 50 feet into the authorized navigation channel. The boundary between South Carolina and Georgia runs through the wreck site. Since 1984, Savannah District has had an agreement with both states to avoid the site area during dredging by working no closer than 50 horizontal feet from the vessel for a distance of 1,000 feet along the channel. This stand-off became codified as the normal operating practice through its inclusion in the 1995 DMMP, and the subsequent environmental approvals for O&M of the harbor. Nonetheless, studies have demonstrated that past, present, and future operation and maintenance activities have, and will continue to have, an adverse effect upon the wreck site.

The navigation channel could not be substantially deepened without crossing a major portion of the wreck site. As a result, evaluation of the deepening alternatives included an *in-situ* archeological assessment of the present condition of the CSS *Georgia*. An extensive analysis of the wreck site was performed.

Using the new information, Savannah District reviewed the status of CSS *Georgia* in 2006 and concluded that past operation and maintenance dredging had severely impacted the wreck site. The wreck had become exposed and largely destroyed by a combination of factors including different river flow patterns, new work (primarily construction of the 4-foot advance maintenance section in 1983), maintenance dredging practices, and marine organisms. The data indicated that action should be taken to ensure the remaining archaeological information possessed by the remains of the wreck is obtained before the site degrades further.

The 2007 report documenting the *in-situ* archeological evaluation included recommendations for future actions. The evaluation recommended a systematic archeological salvage operation, which would include partial and full excavation conducted by divers working from a fixed platform. In light of the condition of the wreck at that time, the best plan consists of removing the remaining wreck and conducting archeological data recovery, which includes excavating, conserving, and curating. As a result of the likely impacts of the deepening alternatives on the site, the project includes performance of an archeological salvage operation as mitigation.

4.9.2 Fort Pulaski National Monument (GA)

Fort Pulaski National Monument (Station -2+000 to 8+000; GA) is a 5,623 acre park under the jurisdiction of the National Park Service. The park contains marsh, uplands, barrier islands, and the remains of the Civil War era fort constructed during the 1830s and 1840s. It is included in the National Register of Historic Places at the National level of significance for its architecture, association with significant events, association with significant people, and archaeological research potential. The park shoreline is well outside the channel side slope, and the fort itself is not near the shoreline. The park shoreline experiences erosion that is unassociated with channel maintenance dredging.

The Wilmington District of the Corps of Engineers conducted a Savannah Harbor Expansion Bank Erosion Study (Nov 2006) to assess the effects of wakes from vessel traffic on erosion at Fort Pulaski National Monument and Tybee Island, GA. The analysis concluded that shoreline erosion at Fort Pulaski National Monument averages 3.1 feet per year, of which 3.0 feet is attributable to flows, tides, and normal wave activity. The remaining 0.1 feet per year of erosion results from a combination of vessel traffic, rain events, and surface drainage events from existing drainage structures. In total, the analysis estimates that erosion due to vessel traffic amounts to 0.36 inch per year.

4.9.3 Fort James Jackson National Historic Landmark (GA)

Old Fort Jackson (Stations 59+000 to 58+000) is the oldest standing fort in the State of Georgia. Construction began in 1808 and the fort was in service during the War of 1812. The fort is located across the river from the current site of CSS Georgia. Old Fort Jackson is a national Historic Landmark and is listed on the National Register of Historic places at the national level of significance for its architecture and association with significant events and historic figures. It is owned by the State of Georgia and is operated and maintained as a historic site by the Coastal Heritage Society. In 2003, in accordance with a Memorandum of Agreement between Savannah District and the Georgia State Historic Preservation Office, the District completed a bank stabilization project to protect this property from harbor operation and maintenance activities.

4.9.4 Savannah National Historic Landmark District (GA)

The south shore of the navigation channel comprises the north border of the Savannah National Historic Landmark District (Stations 72+000 to 79+000). The district is listed in the National Register of Historic Places at the National level for its architecture. It is significant for its distinctive grid plan as well as its 18th and 19th century architecture. The district encompasses the original town plan laid out in 1733 by Gen. James E. Oglethorpe, founder of the British colony of Georgia. Today, Savannah retains much of this plan based on divisions also called wards, squares, and

"trustee lots." Most of the original squares remain and are surrounded by fine examples of buildings in the Georgian, Greek Revival, and Gothic styles.

All but one small shoreline area is protected by modern bulkheads, wharves, or rip rap. The exception is located near Station 75+500 where a brick-faced wharf constructed during the last quarter of the nineteenth century forms an alcove in the modern engineered shoreline. This area is used for small boat mooring.

4.9.5 Savannah River Civil War Cribs

Savannah Harbor and vicinity was the site of many war-time activities during the Civil War. Fortifications were built along the river, some of which remain today. Wooden cribs and pile dams were constructed in shallow areas to concentrate the flow of water The remains of a few of those structures still exist. Impacts to these structures are not anticipated since the channel would be being deepened within the existing side slopes, with excavation of the side slopes occurring in only a few locations.

5 Forecast of Without-Project Conditions

This chapter presents future conditions concerning Savannah Harbor and related resources as they are projected to exist without Federal involvement in addressing the problems and opportunities identified in Chapter 3. Under future without-project conditions, the Federal channel at Savannah Harbor would remain at a depth of -42 feet MLLW. Planned improvements to major port facilities would become operational, which includes the expansion of the Panama Canal. In addition, new US east and Gulf coast container terminals will be constructed. Larger vessels will continue to enter the container ship fleet calling at the US east coast.

5.1 Panama Canal: Deepening Existing Locks (2010) and Expansion (2014)

Currently, the 39.4 foot controlling depth at the Panama Canal is the major constraint on the all-water route from Asia to the US East Coast. On October 22, 2006, Panamanian citizens overwhelmingly approved the proposed Panama Canal expansion plan through a national referendum. The Panama Canal expansion will provide for a maximum sailing draft of 50' (tropical freshwater) within a new set of locks. The width of the new locks will be 180 feet and the length 1,400 feet[3]. These dimensions were selected to accommodate 8,000 TEU vessels (approximately 48 ft sailing draft), which are considered the "right size" for the industry by the Panama Canal Administrator Mr. Alberto Aleman Zubieta [4]. The Panama Canal expansion project will be operational by 2014. Table 5-1 presents the maximum vessel dimensions for the existing and expanded Panama Canal.

[3] See www.pan-canal.com for detailed information on the planned expansion.
[4] "Panama Canal Expansion will make Waterway a Shipping Hub" Nick Savvides. 23Oct06. Containerization International News Service. See www.ci-online.co.uk

Table 5-1: Panama Canal Maximum Vessel Dimensions

	Existing	Planned (2014)
Beam	32.3m (105.9 ft)	49m (160 ft)
Length	294.1m (964.6 ft)	366m (1,200ft)
Sailing Draft	12.0m (39.4 ft)	15m (50ft)

Source: www.pancanal.org

5.2 US East Coast and Gulf Coast Port Configurations and Capacities

Table 5-2 presents planned and proposed new container terminal facilities at the US east coast and US Gulf coasts. In 2008, an 800,000 annual TEU capacity container terminal opened in Mobile, AL.

Table 5-2: New, Planned, or Proposed Container Terminals U S East and Gulf Coasts

Year	Name	Location	TEU Capacity	Channel depth
2015[1]	Charleston Naval Base Terminals	Charleston, SC	1,400,000	-45 feet[2]
2015[3]	Bayport Container Terminal	Houston, TX	2,300,000	-45 feet
2016	Dames Point Hanjin Terminal	Jacksonville, FL	800,000	-45 feet[4]
2020	Craney Island Terminals	Norfolk, VA	1,500,000	-50 feet
2020[5]	Pelican Island Terminals	Galveston, TX	2,000,000	-40 feet

Notes:
[1] USACE permits approved but state permits challenged in court;
[2] Feasibility study underway to assess deepening
[3] The first 65 acres (out of 1,000 total) came into operation in 2007;
[4] Currently 40 feet but USACE has a feasibility study underway to assess at least 45 feet;
[5] Land is Port Authority property and MOU with Houston Port Authority withholds development until 2015

In addition to the new facility in Mobile and planned port facilities presented in the table, development of a new container terminal at Jasper County, South Carolina at the current dredged material disposal sites 14A and 14B (across from Elba Island) has been of interest to private developers and public agencies for a number of years; although, other sites have also been discussed. The potential for terminal development at Jasper County was re-kindled when the Governors of Georgia and South Carolina jointly issued a Term Sheet on March 12, 2007 for the purpose of increasing maritime port capacity. The Term Sheet requests the state legislatures to draft and ratify a bi-

state compact between the two states which would create a bi-state Port Authority to "promote the development of a marine terminal"[5] at Jasper County.

The Term Sheet also identifies a number of actions which must take place so that the land at Jasper County can be made available for development of a marine terminal. These necessary actions include:

- The easements used by the Army Corps of Engineers for placement of dredged material from the Savannah Harbor navigation channel must be removed, released, or modified;
- Legislative appropriation by each state for 50% of the costs associated with acquiring replacement dredged material disposal sites; and
- Transfer of property ownership of disposal site from the Georgia DOT to the Bi-State Port Authority.

NOTE: For the Corps of Engineers to release its dredged material disposal easements, it must determine that the tract is no longer needed by the Government. For the Corps to reach that conclusion, it looks to the non-Federal sponsor of the Savannah Harbor Navigation Project (grantor of the easement) to inform the Corps how it intends to keep the Federal costs the same to maintain the navigation channel (the purpose for having the easement).

The planning process for a Jasper County Terminal is currently in the conceptual stage. In January 2008, the Georgia Department of Transportation entered into an Intergovernmental Agreement with the South Carolina State Ports Authority and the Georgia Ports Authority about developing a Jasper Ocean Terminal. The agreement discussed establishing a Joint Project Office (JPO) to conduct studies to determine the feasibility of and plan development of a container terminal in Jasper County. The agreement stated that although the final location of a Jasper terminal had not yet been identified, that GA DOT would transfer ownership of a specific 1400-acre tract to both port authorities, acting as 50% tenants in common. GA DOT was also to pursue release of the Corps dredged material disposal easements on that tract.

Later in 2008, a market feasibility analysis was conducted by a contractor working for the State of South Carolina to assess whether there would be a demand for future container handling services at a Jasper terminal. The market feasibility analysis was based on a projected 6.7% average annual growth in containerized trade for the hinterland that would be serviced by a Jasper terminal for the years 2008 through 2025 and a growth rate of 5.3% from 2025 through 2050. This hinterland is identical to the hinterland currently serviced by Garden City Terminal. The analysis projected that by 2020, the demand for container handling services will be greater than the container handling capacity at US east coast ports. The analysis assumes that a Jasper terminal would service 50% of the unmet demand for container handling services.

[5] Term Sheet dated 12 Mar 07

The analysis concluded that a Jasper terminal could begin servicing the projected unmet demand for container handling services in 2020 by developing a terminal with a 1.5 million TEU capacity. The analysis further concluded that expansion of Jasper terminal would keep pace with projected growth of unmet container handling demand up to a full build-out container handling capacity of 4.5 million TEUs in 2028.

In March 2011, the Joint Project Office (JPO) provided a status update. It stated that in 2009/2010, the JPO and its engineering consultant had coordinated with the Corps of Engineers for guidance on the permitting process and a dredged material management plan, finalized capacity and economic studies, and developed a Preliminary Planning & Development Services Report to guide development of the new terminal. The status update said that despite recent and planned investments to upgrade and expand facilities in Charleston and Savannah, both ports were expected to reach their maximum container handling capacity between 2025 and 2030. The JPO's goal is for a Jasper terminal to handle the additional containers that would move through the region beyond that point. They envision the new terminal would handle Post-Panamax ships up to 12,000 TEUs (50-foot depth and 158-foot width). The JPO indicated that it believed that the total cost of the project (terminal infrastructure, transportation corridors, permitting, but not channel deepening) – is expected to be in excess of $4 billion.

In 2012, the JPO estimated that Phase I of the terminal would become operational by 2025, with 3 berths, having a total capacity of 500,000 TEUs, turning basin, utility, road and rail access and supporting infrastructure on 1,500 acres in Jasper County, SC. Additional phases would be brought on line as needed to meet market demands. The terminal would eventually have 10 berths and a capacity of 7M TEUs. The JPO estimated that the terminal and connecting land transportation corridors would cost around $4 billion.

The JPO has begun the engineering and environmental studies that would be needed. When those studies are sufficiently complete, the JPO would apply for a Section 404 permit from the Corps of Engineers for the proposed construction. That application would provide the information needed for the regulatory agencies and the public to review the proposed project and evaluate its expected environmental and social effects. If those effects are determined to be acceptable and the proposal meets all environmental criteria, its construction would be permitted. The developers would then need to obtain the funding to perform the construction.

As understood at this point, the permit application would include the JPO's plan for compensating the Federal Government for the increased costs that the Corps would incur when it releases the sediment disposal easements on the property. The Corps has informed the JPO that it will release those easements if the Federal Government's costs are not increased (the Government is "made whole") and all environmental requirements are met. This possibly could be accomplished by providing a substitute confined dredged material containment facility or through reimbursement of the increased dredging and sediment disposal costs.

There is still much uncertainty associated with a future Jasper terminal. The engineering studies are not yet complete, so the costs to construct the facility and needed infrastructure are not yet fully identified. The environmental studies are not complete, so the environmental impacts from construction and operation of the terminal are unknown and an assessment of their acceptability is still speculative. Neither state has yet approved the interstate compact that would be required for them to jointly construct the terminal. A similar container-port development project at Cape Fear, NC was recently shelved due to the economic downturn and environmental opposition. The port expansion project at the former Charleston Navy Base has been extensively delayed due to concerns over environmental and local impacts. These present uncertainties preclude a new terminal in Jasper County from being an element in the Savannah Harbor Expansion Project without-project condition. However, plan formulation analyses for the Savannah Harbor Expansion Project include sensitivity analyses which explore the potential impacts to the Savannah Harbor Expansion Project under various Jasper County marine terminal scenarios.

5.3 Garden City Terminal Infrastructure and Capacity

Completion of the existing capital improvement plan will increase Garden City terminal's container throughput capacity to 6.5 million TEUs annually. At full build-out in 2020, according to the current master plan, the GCT will have 9,700 feet of berth and 560 net acres of container storage area so that facility productivities are projected to be:

- 700 TEUs per berth foot per year, and
- 11,607 TEUs per net container storage acre per year.

Some portions of the plan have already been implemented, as the berth length has been increased from 8,300 to 9,700 feet. The projected increase in throughput capacity will result from planned purchases of additional equipment, increased storage area and berth length, and operational modifications. Planned improvements include:

- Increased berth productivity, from about 280 to 700 TEU's per berth foot per year;
- Increased container yard size, from 407 to 560 net storage acres;
- Increased storage density for loaded containers resulting from a transition from the current hybrid RTG(Rubber Tired Gantry)/Top-Pick operating mode to a pure RTG operating mode;
- Reduced dwell times for loaded containers due to construction of an additional eight lane gate and expansion of an existing gate from 15 to 24 lanes; and
- Significant reduction of dwell time for empty containers, based on off-site storage and effective demurrage charges, which would discourage on-site storage.

Increased berth productivity is projected to result from a combination of increased volume of TEUs per call, due in part to larger vessels calling in the future and the assignment of four cranes per vessel. Currently, vessels are typically assigned two cranes. The increase to four cranes per vessels will be possible because Garden City Terminal plans to have a full complement of 33 cranes by 2020. Increased storage efficiency would be accomplished through a fleet of 169 rubber tire gantry cranes.

5.4 Containerized International Trade Projections

The with-project and the with-out project conditions use the same commodity forecast, which assumes no project-induced cargo under with-project conditions. All of the commodity projections used in this analysis were conducted at the world trade route level of detail (Table 5-3). The commodity forecast was developed through five distinct steps:

1. The baseline (year-2010) for the commodity forecast was calculated from 2005 – 2010 observed operations at Garden City Terminal.
2. Projected annual containerized commodity tonnage for the South Atlantic Region and for Savannah Harbor was estimated by a 2008 Global Insight Inc. (GI) modeling effort.
3. Results from an updated 2010 GI South Atlantic Region annual containerized commodity tonnage forecast were obtained. Savannah's proportion of South Atlantic trade identified in the 2008 forecast was applied to the 2010 South Atlantic Region forecast to obtain an Updated Savannah Harbor Forecast.
4. The year-to-year rates of change (growth rates) calculated from the Updated Savannah Harbor Forecast were applied to the calculated baseline (year-2010) to develop the Final Savannah Harbor Commodity Tonnage Forecast used in the analysis. Annual commodity tonnage for years beyond 2028 were projected by applying the average annual growth rate for the last five years of the growth rate projection (2023 – 2028) to each year from 2029 – 2065.
5. The number of projected Garden City Terminal loaded TEUs (Section 5.4.5 Commodity Forecast: Garden City Terminal TEUs) was calculated from the commodity tonnage forecast developed in Step 4 above, using historical average TEU weights identified in historical port data and PIERS data. An adjustment for empty containers was conducted to project the total annual number of Garden City Terminal TEUs. The commodity forecast was capped in 2030, which is the year maximum Garden City Terminal throughput was forecast to be achieved.

Since cargo movements and container vessel capacities are often expressed in TEUs and not tons, these tonnage forecasts were converted into their TEU equivalents. As previously mentioned, the weight of containers can vary widely by trade route and by haul direction. For example, major products destined for the Mediterranean are heavier pulp and kaolin clay whereas imports from the Far East involve lighter manufactured goods and textiles. For each service, the historical average weight per TEU was

calculated and used for this conversion. Commodity forecast details are documented in Section 3.3 of the Economics Appendix.

The many container ship service routes that include Garden City Terminal exhibit unique characteristics such as cargo volume, cargo weight, ports of call, vessel types, mix of vessels, etc. The unique characteristics of each service route are due, in part, to the amount of containerized trade on that route; therefore, commodity forecasts were developed for each service route. These service routes are operated by many carriers and often overlap, such that multiple carriers are competing on the same service route. For this analysis, service routes were grouped by the world region that they serve. For example, there are a number of carrier services that call on various ports in the Far East (FE), transit the Panama Canal, proceed to ports along the east coast of the United States (ECUS), and then return to the Far East. Services that represent trade within this world area were grouped and entitled "FE (Panama) ECUS" according to the naming convention provided in Table 5-3:

Table 5-3: Savannah Harbor Container Ship Services

World Region	Acronym
East Coast United States (US) Africa	ECUS Africa
East Coast US Australia Pendulum (PEN)	ECUS AU PEN
East Coast US, West Coast and East Coast South America	ECUS WCSA-ECSA
East Coast US, Europe, Gulf of Mexico, PEN	ECUS EU GULF PEN
East Coast US, Mediterranean	ECUS MED
Far East, East Coast US, Europe Pendulum	FE ECUS EU PEN[6]
Far East, East Coast US, Mediterranean Pendulum	FE ECUS MED PEN
Far East, Panama Canal, East Coast US	FE (Panama) ECUS
Far East, Suez Canal, East Coast US	FE (SUEZ) ECUS
Round the World	RTW
Australia, East Coast US, Europe Pendulum	AU ECUS EU PEN

Figure 5-1 and Figure 5-2 are maps for the FE (Panama) ECUS and FE (SUEZ) ECUS services, respectively. These maps are provided as an example of the world areas covered by container ship services using the nomenclature identified in Table 5-3.

[6] "PEN" indicates a pendulum service. In the shipping world, a pendulum service generally involves a trans-oceanic string of ports structured as a continuous loop, much like a pendulum.

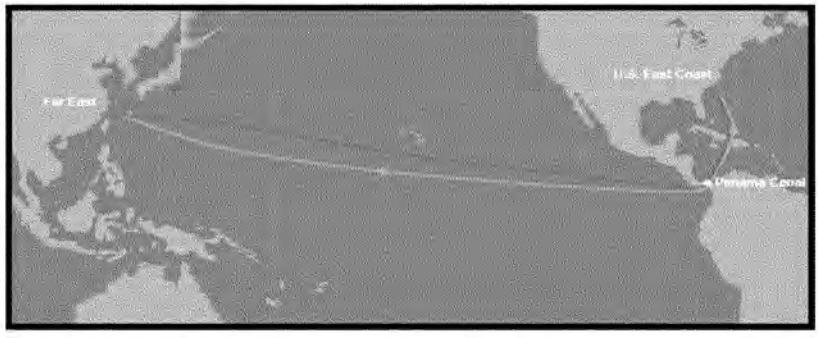


Figure 5-1: FE (Panama) ECUS Trade Map

As shown in Figure 5-1, the FE (Panama) ECUS service calls on Far East ports, crosses the Pacific Ocean, and transits the Panama Canal before calling on U.S. East Coast ports. After completing the vessel's ECUS port rotation, the ship returns to the Far East via the Panama Canal. Similarly, the FE (SUEZ) ECUS service calls on various ports in the Far East and Africa before transiting the Suez Canal and stopping at a Mediterranean port (Figure 5-2). After its Mediterranean port of call, the vessel crosses the Atlantic and calls on numerous East Coast U.S. ports before returning to the Far East by calling on many of the same ports visited during the first leg of its voyage.

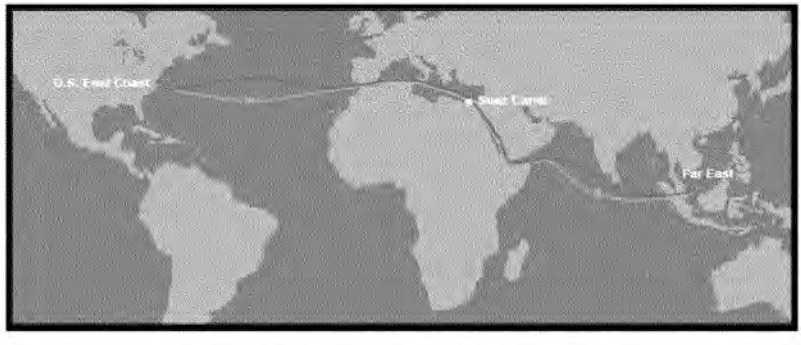


Figure 5-2: FE (SUEZ) ECUS Trade Map

Each service contains unique characteristics such as cargo volume, cargo weight, ports of call, vessel types, mix of vessels, etc. Commodity forecasts were developed for each service.

5.4.1 Commodity Forecast Baseline: Garden City Terminal

The commodity forecast baseline (Table 5-6) is based on a regression analysis of historical trade information from 2005 – 2010 (Tables 5-4 and 5-5). The 2005 – 2010 data capture both prosperous port years as well as the economic downturn which occurred in 2008-2009.

Table 5-4 presents historical containerized imports (metric tons), which moved through Savannah Harbor between 2005 and 2010, and the resulting calculated import baseline. Containerized imports grew from 5.3 million metric tons in 2005 to 7.3 million metric tons in 2010. Trade with Northeast Asia dominated Savannah's import market, followed by Southeast Asia and Northern Europe, respectively. Furniture has been the top import commodity since 2005 (in terms of TEU volume)[7]. Following furniture, Savannah's leading commodities include retail consumer goods; machinery, appliances and electronics; hardware and housewares; food; automotive; apparel; toys; minerals; and rugs, sheets, towels, and blankets.

[7] Georgia Ports Authority website –www.gaports.com

Table 5-4: Savannah Harbor Historical Containerized Import Tonnage

World Region	World Region Service	2005	2006	2007	2008	2009	2010	2010 Baseline
					(metric tons)			
Africa	ECUS AFRICA	16,857	1,406	-	-	-	-	3,044
Oceania	ECUS AU PEN AU ECUS EU	45,366	4,548	-	-	137,660	105,682	62,554
Oceania	PEN	4,953	175,523	310,910	426,778	66,878	84,803	228,208
ECSA/WCSA	ECUS WCSA-ECSA ECUS EU GULF	131,720	226,075	379,351	364,290	233,909	270,875	318,004
N Europe	PEN	19,546	114,500	145,366	55,173	148,582	464,815	317,883
MED	ECUS MED FE ECUS EU	281,827	310,637	324,140	200,750	263,771	303,187	269,491
NE Asia	PEN FE ECUS MED	800,447	733,373	767,942	1,309,812	1,033,754	700,211	700,211
NE Asia	PEN FE (Panama)	613,603	598,308	516,637	557,397	427,819	544,873	484,938
NE Asia	ECUS	2,608,255	2,723,926	3,266,646	2,837,208	2,247,652	2,277,866	2,277,866
NE Asia	RTW	185,344	233,667	139,354	-	315,103	793,893	502,729
SE Asia	FE (Suez) ECUS	593,443	676,684	1,309,872	1,511,875	1,133,068	1,737,311	1,681,126
Total		**5,301,363**	**5,798,647**	**7,160,219**	**7,263,284**	**6,008,197**	**7,283,516**	**6,846,053**

Source: GPA

Containerized exports grew from 7.4 million metric tons in 2005 to 11.8 million metric tons by 2010 (Table 5-5). As with imports, containerized trade with Northeast Asia dominated the Savannah Harbor's export market with just under one half of Savannah's exports destined for this world region. Savannah is one of the few ports in the U.S. in which its exports (expressed in metric tons) have historically exceeded its imports. However, since the cargo weight of exports are considerably higher than that of imports, the number of Savannah's TEU imports has exceeded the number of TEU exports.

From 2005 to 2010, wood pulp was the leading export commodity shipped from Savannah. In 2005 and 2006, clay was the next largest commodity group; however, by 2007, TEU volume for clay had fallen, placing it in fourth after paper and paperboard and food, a trend which continued through 2010. Other leading commodity exports during the 2005 to 2010 timeframe consisted of: retail consumer goods; chemicals; machinery, appliances and electronics; resins and rubber; automotive; fabrics including raw cotton; and other commodities.

Table 5-5: Historical Savannah Harbor Containerized Export Tonnage

World Region	World Region Service	2005	2006	2007	2008	2009	2010	2010 Baseline
					(metric tons)			
Africa	ECUS Africa	44,216	7,297	-	-	-	-	8,586
Oceania	ECUS AU PEN	112,681	12,018	-	-	392,018	438,094	253,538
Oceania	AU ECUS EU PEN	2,849	209,631	436,210	632,382	115,576	162,630	414,047
ECSA/WCSA	ECUS WCSA-ECSA	191,533	231,437	422,925	414,506	493,857	829,084	713,885
N Europe	ECUS EU GULF PEN	23,321	188,786	263,287	80,319	586,370	802,164	674,327
MED	ECUS MED	587,291	659,080	930,679	787,731	1,241,854	1,272,171	1,272,404
NE Asia	FE ECUS EU PEN	1,037,912	1,122,315	941,704	1,860,804	1,383,200	871,756	871,756
NE Asia	FE ECUS MED PEN	652,515	629,196	617,640	859,299	692,778	875,470	831,662
NE Asia	FE (Panama) ECUS	3,908,159	4,038,746	4,560,683	4,154,449	3,680,376	3,167,768	3,167,768
NE Asia	RTW	158,402	139,044	169,682	-	345,634	709,391	482,623
SE Asia	FE (Suez) ECUS	702,381	828,944	1,834,138	2,261,260	1,784,586	2,672,025	2,619,289
Total		**7,421,260**	**8,066,495**	**10,176,949**	**11,050,751**	**10,716,249**	**11,800,552**	**11,309,885**

Source: GPA

Table 5-6: Commodity Forecast Baseline (Year-2010) Tonnage

World Region	World Region Service	Imports	Exports
		(metric tons)	
Africa	ECUS Africa	3,044	8,586
Oceania	ECUS AU PEN	62,554	253,538
Oceania	AU ECUS EU PEN	228,208	414,047
ECSA/WCSA	ECUS WCSA-ECSA	318,004	713,885
N Europe	ECUS EU GULF PEN	317,883	674,327
MED	ECUS MED	269,491	1,272,404
NE Asia	FE ECUS EU PEN	700,211	871,756
NE Asia	FE ECUS MED PEN	484,938	831,662
NE Asia	FE (Panama) ECUS	2,277,866	3,167,768
NE Asia	RTW	502,729	482,623
SE Asia	FE (Suez) ECUS	1,681,126	2,619,289
Total		**6,846,053**	**11,309,885**

5.4.2 2008 Savannah Harbor Tonnage Forecast

In November 2008, containerized trade forecasts for Savannah Harbor were obtained from IHS Global Insight (GI). GI provides comprehensive economic and financial information on countries, regions and industries. When making global trade forecasts, GI employs macroeconomic models which contain all commodities that have physical volume. The commodities are then grouped into 77 categories derived from the International Standard Industrial Classification. GI tracks 54 major countries then groups the remaining world trade partners into 16 regions according to their geographic location. GI forecasts include 77 commodities among 70 countries or regions and include 270,000 trade flows.

Table 5-7 displays GI's import forecast for Savannah Harbor by world region over the period 2015 to 2028. The world region aggregate was developed by combining the tonnages from each country or region. Northeast Asia is projected to remain the major source of Savannah Harbor imports, growing from approximately 4.6 million metric tons in 2015 to 12.5 million in 2028. Southeast Asia is projected to remain in second place in terms of imported cargo tonnage going from 1.7 million metric tons of cargo in 2015 to 3.1 million in 2028.

Table 5-7: Global Insight's 2008 Savannah Harbor Containerized Trade Forecast – Imports (Metric Tons)

Service Region	2015	2020	2025	2026	2027	2028
Africa	30,729	35,155	42,498	43,417	45,647	46,661
East Coast South America	734,114	881,747	1,109,270	1,145,539	1,207,584	1,252,345
Mediterranean	1,237,171	1,444,858	1,732,464	1,769,677	1,842,109	1,896,237
Northeast Asia	6,460,416	8,271,695	10,761,609	11,229,087	11,934,618	12,466,810
Europe	911,307	1,076,378	1,284,336	1,319,408	1,376,644	1,416,841
Oceania	216,917	259,923	319,663	320,238	332,902	344,123
Southeast Asia	1,740,846	2,125,556	2,678,188	2,805,041	2,954,348	3,092,080
West Coast South America	210,839	242,562	304,335	310,491	325,478	337,886
Total Tonnage	**11,542,339**	**14,337,875**	**18,232,363**	**18,942,898**	**20,019,330**	**20,852,983**

Source: IHS Global Insight

Exports to the Northeast Asia region are forecast to total 8.2 million metric tons in 2015 and will grow to 11.2 million metric tons by 2028 (Table 5-8). Northeast Asia is forecast to receive nearly half of the exports shipped from Savannah Harbor. Southeast Asia and the Mediterranean are forecast to continue their relative importance in the overall commodity forecast, receiving approximately 3.3 million and 2.6 million metric tons, respectively, by 2028.

Table 5-8: Global Insight's 2008 Savannah Harbor Containerized Trade Forecast – Exports (Metric Tons)

Service Regions	2015	2020	2025	2026	2027	2028
Africa	191,997	224,634	253,220	261,651	268,826	275,806
East Coast South America	634,830	765,961	884,058	918,848	948,735	978,433
Mediterranean	1,995,832	2,262,243	2,470,427	2,540,529	2,595,571	2,645,603
Northeast Asia	8,229,779	9,222,053	10,431,617	10,619,153	10,886,165	11,150,995
Northern Europe	1,377,283	1,594,610	1,758,081	1,807,166	1,848,966	1,887,184
Oceania	466,315	551,593	635,367	654,845	674,433	693,632
Southeast Asia	2,311,052	2,692,970	3,022,767	3,109,093	3,196,722	3,266,979
West Coast South America	280,886	328,916	369,946	382,784	393,326	403,415
Total Export Tonnage	15,487,974	17,642,979	19,825,482	20,294,069	20,812,744	21,302,048

Source: IHS Global Insight

5.4.3 2010 Updated Savannah Harbor Tonnage Forecast

As previously mentioned, an Updated South Atlantic containerized trade forecast was obtained from GI during the fall of 2010. Since the GI forecast was for the South Atlantic region only, the relationship between the region and Savannah Harbor trade had to be established. It was assumed that for each forecast year, each respective Savannah world region route would comprise the same share of total South Atlantic commerce as had been assumed for each route in the 2008 forecast. For example, if in the original GI forecast, the ECUS MED world region route comprised 4% of imports forecast for the South Atlantic region in forecast year 2016, then in year 2016 of the updated forecast, it was assumed that the ECUS MED service would again comprise 4% of total South Atlantic imports. The same assumption was made for exports based upon each respective route's percent share, by year, in the 2008 export forecast.

Table 5-9 presents the Savannah Harbor tonnage forecast as calculated from the South Atlantic Region forecast. Table 5-10 presents the year-to-year rates of change (growth rates) calculated from the Updated Savannah Harbor Forecast, which were applied to the calculated baseline (year-2010) to develop the commodity tonnage forecast used in without and with-project condition transportation costs analyses.

Table 5-9: 2010 Savannah Harbor Import and Export Tonnage Forecast

	2010	2015	2017	2020	2025	2028
			(metric tons)			
Savannah Harbor Imports:						
ECUS Africa	18,064	23,988	22,547	27,658	33,996	37,790
ECUS AU PEN	6,217	8,050	8,482	9,722	12,157	13,250
AU ECUS EU PEN	124,544	161,280	169,916	194,774	243,556	265,448
ECUS WCSA-ECSA	519,133	737,651	717,136	884,562	1,130,811	1,287,894
ECUS EU GULF PEN	553,022	711,386	743,771	846,851	1,027,402	1,147,469
ECUS MED	716,602	965,763	974,452	1,136,756	1,385,880	1,535,721
FE ECUS EU PEN	588,462	861,347	912,171	1,111,511	1,470,334	1,724,456
FE ECUS MED PEN	431,702	631,893	669,178	815,416	1,078,652	1,265,079
FE (Panama) ECUS	2,289,050	3,350,541	3,548,238	4,323,648	5,719,427	6,707,935
RTW	136,201	199,361	211,124	257,261	340,312	399,129
FE (Suez) ECUS	983,708	1,358,943	1,386,919	1,672,302	2,142,410	2,504,209
Total Savannah Imports	**6,366,706**	**9,010,203**	**9,363,934**	**11,280,462**	**14,584,936**	**16,888,380**
Total South Atlantic Imports	**19,846,974**	**26,359,171**	**28,796,971**	**33,225,999**	**41,497,960**	**47,204,816**
	2010	**2015**	**2017**	**2020**	**2025**	**2028**
Savannah Harbor Exports:						
ECUS Africa	141,113	184,584	199,719	216,962	250,359	277,784
ECUS AU PEN	29,120	38,087	41,521	45,261	53,369	59,351
AU ECUS EU PEN	313,643	410,225	447,215	487,494	574,821	639,256
ECUS WCSA-ECSA	662,632	880,363	963,482	1,057,485	1,239,839	1,391,761
ECUS EU GULF PEN	1,065,229	1,324,110	1,469,546	1,540,151	1,738,221	1,900,722
ECUS MED	1,502,017	1,918,777	2,033,789	2,184,982	2,442,520	2,664,581
FE ECUS EU PEN	963,731	1,322,089	1,348,630	1,488,360	1,723,414	1,876,678
FE ECUS MED PEN	596,281	818,005	834,426	920,881	1,066,313	1,161,141
FE (Panama) ECUS	4,057,216	5,565,871	5,677,605	6,265,859	7,255,411	7,900,639
RTW	150,223	206,083	210,220	232,001	268,640	292,530
FE (Suez) ECUS	1,702,678	2,221,828	2,409,426	2,600,999	2,988,620	3,290,415
Total Savannah Exports	**11,183,884**	**14,890,022**	**15,635,579**	**17,040,435**	**19,601,526**	**21,454,860**
Total South Atlantic Exports	**22,513,608**	**29,902,537**	**31,873,150**	**35,137,493**	**41,134,349**	**45,109,858**

Table 5-10: Savannah Harbor Updated Tonnage Forecast Year-to-Year Rates of Change

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Rate of Change - Imports																		
Africa	11%	1%	4%	4%	10%	-2%	-4%	13%	3%	6%	5%	3%	1%	7%	5%	3%	6%	3%
Oceania	9%	3%	4%	5%	6%	3%	3%	5%	4%	5%	5%	3%	5%	3%	8%	1%	4%	4%
ECSA&WCSA	8%	6%	4%	7%	12%	-2%	-1%	11%	5%	6%	8%	2%	5%	4%	6%	3%	6%	4%
Europe	5%	6%	5%	4%	6%	2%	2%	5%	4%	4%	5%	2%	4%	4%	5%	3%	5%	3%
Mediterranean	7%	6%	4%	5%	8%	0%	1%	7%	4%	5%	6%	2%	5%	3%	5%	3%	4%	3%
Northeast Asia	8%	9%	8%	6%	9%	3%	3%	8%	6%	6%	7%	4%	5%	5%	7%	5%	7%	5%
Southeast Asia	6%	7%	6%	5%	9%	1%	1%	8%	5%	6%	6%	4%	5%	5%	5%	5%	6%	5%
Rate of Change - Exports																		
Africa	9%	5%	7%	4%	3%	4%	4%	2%	2%	4%	4%	2%	2%	4%	2%	4%	3%	3%
Oceania	9%	5%	7%	4%	3%	4%	5%	2%	3%	4%	3%	3%	3%	4%	3%	4%	4%	3%
ECSA&WCSA	9%	5%	8%	4%	3%	5%	5%	2%	3%	4%	4%	3%	3%	4%	3%	4%	4%	4%
Europe	8%	4%	8%	2%	1%	5%	6%	0%	2%	3%	2%	3%	1%	4%	2%	3%	3%	3%
Mediterranean	8%	5%	7%	3%	3%	3%	3%	2%	2%	4%	3%	2%	2%	3%	2%	3%	3%	3%
Northeast Asia	6%	7%	6%	5%	8%	-1%	3%	4%	3%	3%	6%	0%	3%	3%	4%	2%	3%	3%
Southeast Asia	8%	5%	7%	4%	3%	4%	4%	2%	3%	3%	3%	3%	2%	4%	3%	3%	3%	3%

5.4.4 Final Savannah Harbor Commodity Tonnage Forecast

The world region year-to-year rates of change calculated from the 2010 Updated Savannah Harbor Forecast were applied to the calculated year-2010 baseline to develop the Final Savannah Harbor Commodity Forecast. Note, port capacity was forecast to be reached in 2030; therefore, the long term forecast was constrained at that point. It is forecast that Northeast Asian trade will continue to dominate Savannah Harbor imports (Table 5-11) over the forecast period, growing from approximately 4 million metric tons in the 2010 baseline to just under 13 million metric tons in 2030. Imports from Southeast Asia will likewise grow from 1.7 million metric tons to 4.7 million metric tons in 2030.

Table 5-11: SHEP Containerized Trade Forecast - Import Metric Tons

World Region	SHEP Services	2010 Baseline	2015	2017	2020	2025	2030[8]
Africa	ECUS AFRICA	3,044	4,042	3,799	4,660	5,728	6,972
Oceania	ECUS AU PEN	62,554	81,005	85,343	97,828	122,330	143,580
Oceania	AU ECUS EU PEN	228,208	295,519	311,345	356,893	446,277	523,802
ECSA	ECUS WCSA-ECSA	318,004	451,862	439,295	541,855	692,699	865,792
N Europe	ECUS EU GULF PEN	317,883	408,912	427,527	486,779	590,561	712,110
MED	ECUS MED	269,491	363,192	366,460	427,497	521,184	620,286
NE Asia	FE ECUS EU PEN	700,211	1,024,916	1,085,391	1,322,585	1,749,548	2,291,526
NE Asia	FE ECUS MED PEN	484,938	709,816	751,698	915,970	1,211,667	1,587,020
NE Asia	FE (Panama) ECUS	2,277,866	3,334,170	3,530,901	4,302,522	5,691,481	7,454,598
NE Asia	RTW	502,729	735,857	779,276	949,575	1,256,120	1,645,244
SE Asia	FE (SUEZ) ECUS	1,681,126	2,322,391	2,370,200	2,857,911	3,661,311	4,748,979
Total Imports		**6,846,053**	**9,731,681**	**10,151,235**	**12,264,074**	**15,948,907**	**20,599,909**

The forecast method used for imports was repeated in developing Savannah Harbor export projections. Exports to Northeast Asia are forecast to grow from 5.4 million metric tons in 2010 to 11.1 million metric tons in 2030. As with imports, the FE (Panama) ECUS world region service is forecast to lead all other Savannah Harbor services in total trade volume. (Table 5-12).

Table 5-12: Savannah Harbor Containerized Trade Forecast - Export Metric Tons

World Region	SHEP Services	2010 Baseline	2015	2017	2020	2025	2030[9]
Africa	ECUS AFRICA	8,586	11,231	12,151	13,200	15,232	18,054
Oceania	ECUS AU PEN	253,538	331,611	361,513	394,073	464,665	554,566
Oceania	AU ECUS EU PEN	414,047	541,547	590,379	643,551	758,833	905,648
ECSA	ECUS WCSA-ECSA	713,885	948,457	1,038,005	1,139,279	1,335,738	1,612,215
NEurope	ECUS EU GULF PEN	674,327	838,207	930,273	974,968	1,100,353	1,276,659
MED	ECUS MED	1,272,404	1,625,454	1,722,883	1,850,964	2,069,132	2,380,355
NE Asia	FE ECUS EU PEN	871,756	1,195,915	1,219,922	1,346,318	1,558,939	1,799,535
NE Asia	FE ECUS MED PEN	831,662	1,140,912	1,163,815	1,284,397	1,487,239	1,716,770
NE Asia	FE (Panama) ECUS	3,167,768	4,345,685	4,432,924	4,892,217	5,664,833	6,539,108
NE Asia	RTW	482,623	662,084	675,375	745,351	863,062	996,262
SE Asia	FE (SUEZ) ECUS	2,619,289	3,417,916	3,706,505	4,001,209	4,597,500	5,389,006
Total Imports		**11,309,885**	**15,059,018**	**15,853,747**	**17,285,528**	**19,915,526**	**23,188,179**

[8]Year when port capacity is reached.
[9]Year when port capacity is reached.

5.4.5 Commodity Forecast: Garden City Terminal TEUs

Garden City Terminal throughput capacity is expressed in TEUs; therefore, projected tonnages were converted into their loaded TEU equivalents. For each service, the historical average weight per TEU was calculated and used for this conversion. Table 5-13 presents the average weights, which were derived from historical data provided by the GPA and from PIERS data.

Garden City Terminal throughput capacity includes empty and loaded containers. The historical percent of empty containers was used to forecast the future number of empty containers moving through Savannah Harbor.

Table 5-13: Container Box Weight by Service

Route	Metric Tons per TEU			
	Imports	Exports	Percent Empties Imports	Percent Empties Exports
ECUS-AU-PEN	10.98	8.67	62.11%	3.94%
AU-ECUS-EU-PEN	10.73	8.94	62.11%	3.94%
ECUS-WCSA-ECSA	10.10	10.14	76.62%	14.84%
ECUS-EU-GULF-FE-PEN	8.77	9.64	34.55%	7.31%
ECUS-MED	9.67	10.56	81.64%	8.11%
FE-ECUS-EU-PEN	7.12	9.83	15.31%	13.01%
FE-ECUS-MED-PEN	6.37	10.54	7.61%	29.74%
FE-(Panama)-ECUS	5.78	10.84	7.88%	56.53%
RTW	6.65	10.58	9.62%	99.45%
FE-(SEUZ)-ECUS	7.76	10.08	18.28%	27.18%

Table 5-14 shows the resulting TEU forecast for Savannah Harbor and Garden City Terminal.

Table 5-14: TEU Forecast for Selected Years

Year	Loaded Export TEUs	Loaded Import TEUs	Total Loaded TEUs[10]	Total Exports (loaded and empty)	Total Imports (loaded and empty)	Total TEUs[11]
2010	1,101,836	983,434	2,085,270	1,446,361	1,158,350	2,604,711
2017	1,544,968	1,470,981	3,015,949	2,028,305	1,722,487	3,750,792
2020	1,683,960	1,780,666	3,464,626	2,214,037	2,082,314	4,296,351
2025	1,940,501	2,324,044	4,264,545	2,552,885	2,710,699	5,263,584
2030	2,260,378	3,013,260	5,273,638	2,970,714	3,503,311	6,474,025

5.5 International Container Ship Fleet

The world fleet forecast and the Savannah Harbor fleet forecast focus on container ships as these vessels comprise nearly the entire population of large vessels calling on the Savannah Harbor that would benefit from channel deepening.

5.5.1 World Fleet

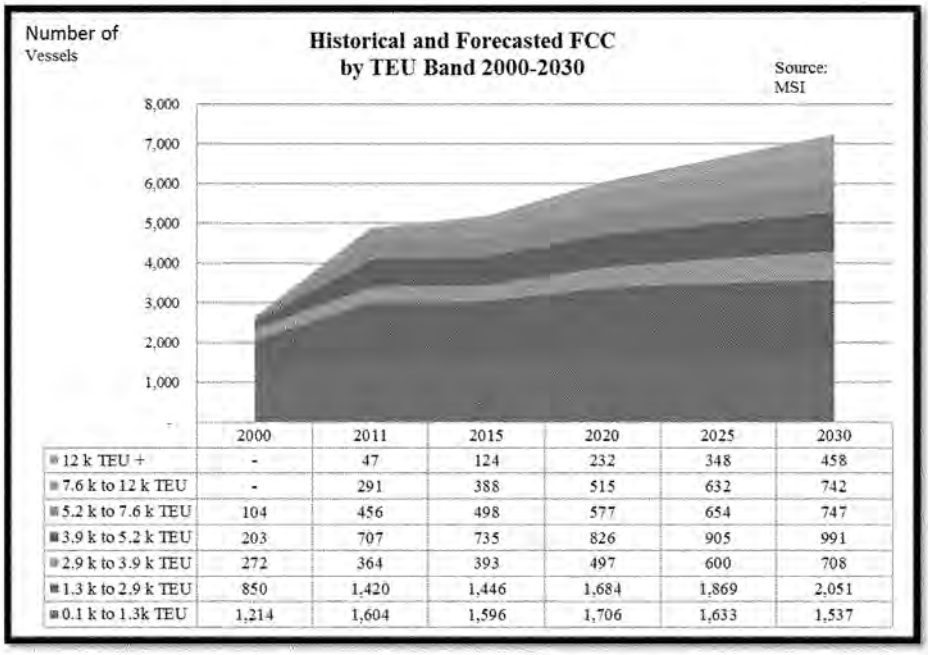
Maritime Strategies International, Limited (MSI) provided information related to the existing and forecast future world fleet of container vessels. MSI is a firm that specializes in vessel forecasting for each shipping sector and provides financial advice to ship owners, shipyards, brokers, investors, insurers, and equipment providers. In the course of analyzing the existing world fleet, MSI categorized the existing fleet into classes by design draft, vessel beam, and by haul (combined beam and draft).

MSI's forecasting technique begins with performing a detailed review of the current world fleet and how it is deployed on the trade routes of the world. Forecasting of the world fleet was made possible through MSI's proprietary Container Shipping Planning Service (CSPS) model, which applies historical and forecasted time series data from 1980 to 2030 for:

- Macroeconomic and trade variables;
- Global container trade and movements in TEU lifts by region;
- Sector-specific fleet dynamics;
- Sector-specific supply/demand balances;
- Time-charter rates and vessel operating costs;
- Freight rates; and
- New-building, second-hand (by age) and scrap prices for standard sizes.

[10] Calculated as the sum of Columns 2 and 3
[11] Calculated as the sum of Columns 5 and 6

Based on data for deliveries, scrapping, and the existing 2010 fleet, MSI projected the world fleet for the end of each forecast year (Figure 5-3).



	2000	2011	2015	2020	2025	2030
12 k TEU +	-	47	124	232	348	458
7.6 k to 12 k TEU	-	291	388	515	632	742
5.2 k to 7.6 k TEU	104	456	498	577	654	747
3.9 k to 5.2 k TEU	203	707	735	826	905	991
2.9 k to 3.9 k TEU	272	364	393	497	600	708
1.3 k to 2.9 k TEU	850	1,420	1,446	1,684	1,869	2,051
0.1 k to 1.3k TEU	1,214	1,604	1,596	1,706	1,633	1,537

Figure 5-3: Projected World Container Fleet by TEU Capacity

5.5.2 Savannah Harbor Fleet

The Lloyd's Shipping Economist (LSE) is an annual publication that details the fleet deployment on most containership service routes. The report details the number of vessels deployed on each service by TEU-band. MSI had access to these publications since 2000, and used those as an indicator of deployment for the year prior to publication.

MSI used LR Fairplay data to calculate the average vessel size within the LSE size bands for each year. This capacity estimate was used to estimate the nominal capacity deployed on each route. For the purpose of this study all the services calling North American ports were aggregated. The capacity deployed on each trade route was compared to the annual container volumes for the US using a simple regression technique. The fit showed a very high R-squared of 94 percent against the observed

data. This close relationship demonstrates how capacity is adjusted by operators to match demand.

Similarly, MSI preformed an analysis of port throughput at Savannah. TEU capacity of vessels calling at Savannah in each of the years between 1998 and 2008 was compared to TEUs at Savannah. Again, the R-squared value is very high at 98 percent, confirming that forecasted trade volumes could be used to forecast capacity deployed on services calling at Savannah in the future.

There is a strong relationship between the economic condition of a port and its total nominal vessel capacity. As an economy grows, exports from the port often increase (from the increased output) or demand for imports increase (from increased consumer purchasing power). Vessel deployment decisions respond accordingly to satisfy this increased level of trade. MSI examined the empirical relationship between the nominal capacity of the fleet calling Savannah and the historical tonnages moving through Savannah and found the variables to be nearly perfectly correlated, having an R-squared value of 0.978. This statistical relationship was then applied to the forecasted tonnages in order to estimate future nominal TEU vessel capacity calling Savannah. As the tonnage in Savannah grows over time, the nominal TEU vessel capacity, i.e., the total number of available container slots, grows linearly. Capacity is adjusted by operators to match demand. Once the forecasted nominal TEU vessel capacity at Savannah was determined, the future containers were allocated to various vessel classes (PPX, PX and SPX). The allocation to vessel classes was based on MSI's examination of historical shares, current trends in vessel design and orders and the world wide redeployment of vessels affected by the expansion of the Panama Canal.

The number of calls at Savannah by vessel class was estimated by dividing the estimated nominal capacity for each TEU band by the average vessel capacity for that TEU band. Post-Panamax vessels were represented by TEU bands 5.2 k to 7.6 k (PPX1) and 7.6 k to 12 k (PPX2). In the forecast of Post-Panamax vessels through the year 2030 (Figure 5-4) the larger, Generation 2 Post Panamax vessel becomes the more dominant type of vessel calling at Savannah from the year 2021 onward. It was apparent that most services would be receiving Post-Panamax vessels, particularly once the Panama Canal expansion is completed in 2014.

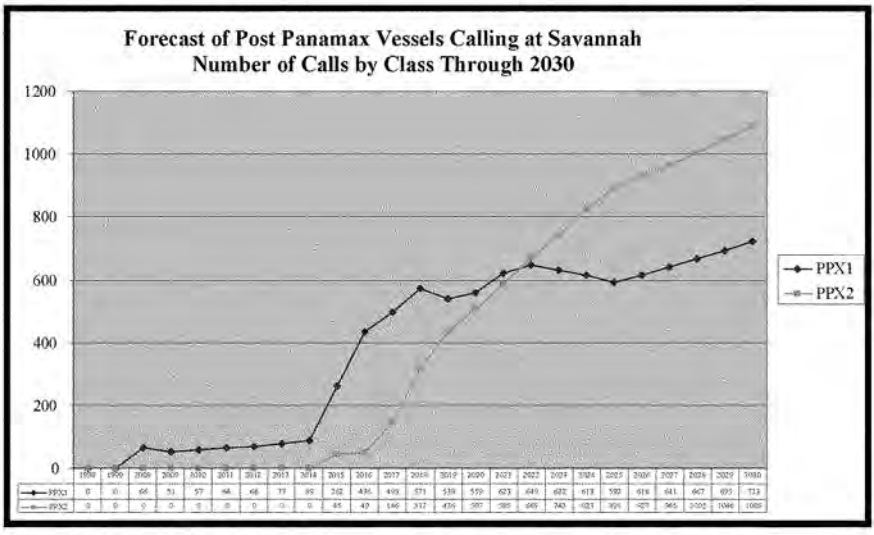


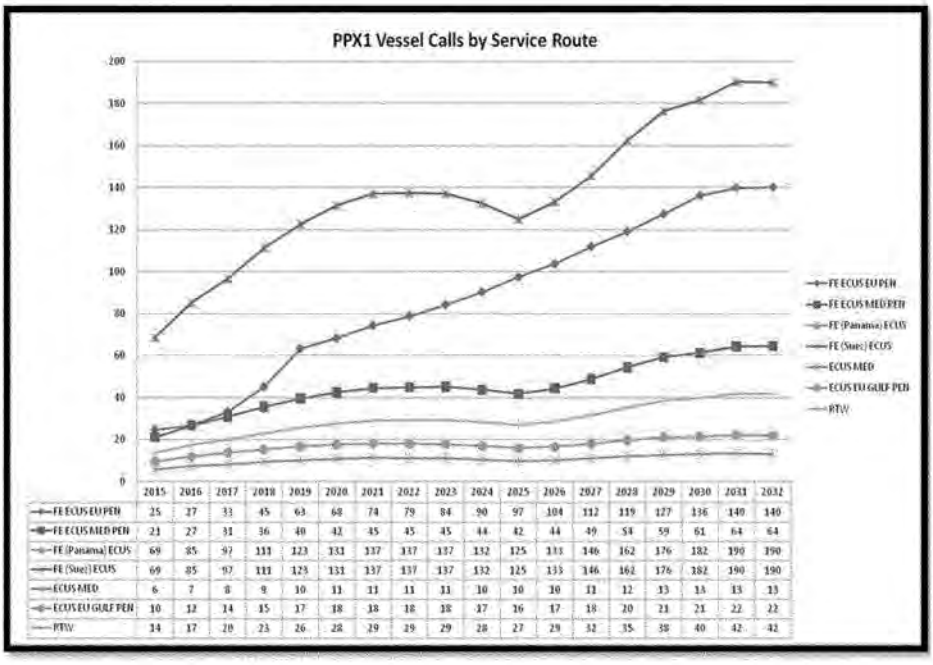
Figure 5-4: Projected Post Panamax Vessel Calls at Savannah

Once the number of Post-Panamax vessel calls was determined, these calls were then allocated to specific Savannah trade routes (Table 5-15 and Figures 5-5 and 5-6). The share for each route was based on the historical averages from 2005 to 2007 and indexed over time by the route specific growth rates reflected in the commodity forecast. Some trade routes, particularly those originating from the Far East, would receive a larger allocation of vessels to meet the high demand. Other trade routes such as the AU ECUS EU PEN, ECUS AU PEN, and ECUS WCSA ECSA do not expect any Post Panamax vessels to deploy at all throughout the study period. A large portion of cargo was projected to be moved on smaller, Sub-Panamax vessels; therefore, Sub-Panamax vessels were excluded from the transportation cost savings analysis. The fleet forecast assumed vessels behaving in an unconstrained channel (by channel depth)[12].

[12] When developing their forecast of fleet calling at North American ports, MSI assumed that ports around the world would make the necessary adjustments to satisfy the demand/capacity.

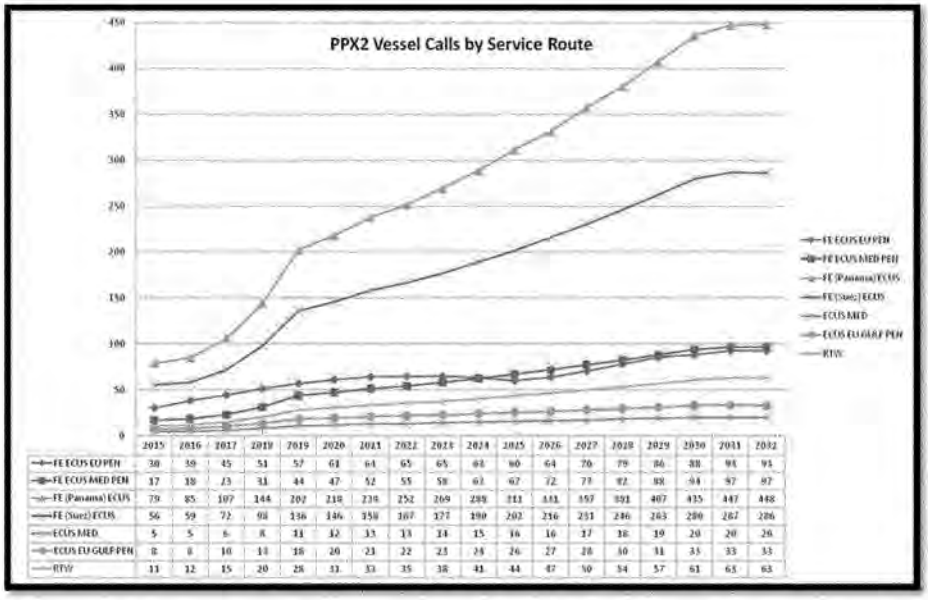
Table 5-15: Route Percent Share of Panamax and Post-Panamax Vessel Tonnage

SHEP Services	2015	2020	2025	2030	2032
FE ECUS EU PEN	12.4%	12.6%	12.8%	12.9%	12.9%
FE ECUS MED PEN	8.6%	8.7%	8.8%	8.9%	8.9%
FE (Panama) ECUS	39.5%	40.2%	40.8%	41.1%	41.3%
FE (Suez) ECUS	27.8%	27.0%	26.5%	26.4%	26.3%
ECUS MED	2.4%	2.2%	2.1%	1.9%	1.8%
ECUS EU GULF PEN	3.9%	3.6%	3.4%	3.1%	3.0%
RTW	5.6%	5.7%	5.7%	5.8%	5.8%
Total	**100%**	**100%**	**100%**	**100%**	**100%**



	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
FE ECUS EU PEN	25	27	33	45	63	68	74	79	84	90	97	104	112	119	127	136	140	140
FE ECUS MED PEN	23	27	31	36	40	42	45	45	45	44	42	44	49	54	59	61	64	64
FE (Panama) ECUS	69	85	97	111	123	131	137	137	137	132	125	133	146	162	176	182	190	190
FE (Suez) ECUS	69	85	97	111	123	131	137	137	137	132	125	133	146	162	176	182	190	190
ECUS MED	6	7	8	9	10	11	11	11	11	10	10	10	11	12	13	13	13	13
ECUS EU GULF PEN	10	12	14	15	17	18	18	18	18	17	16	17	18	20	21	21	22	22
RTW	14	17	20	23	26	28	29	29	29	28	27	29	32	35	38	40	42	42

Figure 5-5: Savannah Harbor First Generation Post-Panamax Vessel Calls by Service Route



	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
FE ECUS EU PEN	38	39	45	51	57	61	64	65	65	68	60	64	70	79	86	88	93	95
FE ECUS MED PEN	17	18	23	31	44	47	52	55	58	63	67	72	77	82	88	94	97	97
FE (Panama) ECUS	79	85	107	144	202	218	239	252	269	288	311	333	357	391	407	435	447	448
FE (Suez) ECUS	56	59	72	98	136	146	158	167	177	190	202	216	231	246	263	280	287	286
ECUS MED	5	5	6	8	11	12	13	13	14	15	16	16	17	18	19	20	20	20
ECUS EU GULF PEN	8	8	10	13	18	20	21	22	23	24	26	27	28	30	31	33	33	33
RTW	11	12	15	20	28	31	33	35	38	41	44	47	50	54	57	61	63	63

Figure 5-6: Savannah Harbor Second Generation Post-Panamax Vessel Calls by Service Route

5.5.3 Load Factor Analysis

The economic efficiencies of channel deepening and the projected deployment of Panamax and Post-Panamax vessels to Savannah Harbor are based on a Load Factor Analysis model (LFA). The LFA estimates the allocation of vessel space (and dead weight tonnage) to various vessel capacity attributes. The end result of the LFA is a projection of the amount of cargo loaded on the vessel and its operating draft. LFA results affect vessel costs, which in turn affect projected vessel deployments and the projected fleet mix calling at Garden City Terminal.

The LFA is based on estimates of the following attributes for each vessel class by trade route:

- Ballast stored;
- Bunkerage and fuel storage;
- Number of empty containers;
- Number of unused (vacant) container slots;
- Cargo weights calibrated so that projected vessel drafts would not exceed an estimation of the vessel's "maximum practical draft" on more than 15% of trips; and
- Empty container weight.

The LFA estimation calculations are as follows. For a given sailing draft, a calculation using vessel specific Tons per Inch Immersion (TPI) was made to determine capacity utilization at that sailing draft, i.e., how much space of the vessel was occupied by cargo, stores and other items having weight. This capacity utilized figure (metric tons) is then allocated to several factors based on the estimates assigned to the attributes listed above. An estimate of ballast weight is accounted for on a variable scale. Empty container weight (carriage weight) is accounted for by applying a historical percentage of empty containers for each vessel on a particular trade route. Container (lading) weight is accounted for, and finally the cargo itself. The remainder is the empty space on the vessel.

Table 5-16 depicts a LFA capacity allocation for a PPX2 vessel weighing a total of 107,000 DWT and with a design draft of 47.6 feet. The table reveals how LFA allocates capacity for the vessel at various operating drafts. There is no differentiation between in-bound and out-bound allocations because cargo weights have been calibrated. Vessel capacity is assigned to ballast, cargo, allocation for operations, weight of containers (empty and laden), and unallocated capacity. As this vessel loads more fully, its sailing draft increases. The amount of available deadweight tonnage decreases as cargo tonnage and carriage increase. Weight for operations and crew are fairly uniform whereas ballast weight rises slowly until it achieves a maximum allocation at about 12,500 DWT.

Table 5-16: Example Load Factor Analysis Capacity Allocation – 107,000 DWT Vessel

Draft	37	38	39	40	41	42	43	44	45	46	47	47.6
Variable Ballast	9,046	9,516	9,990	10,462	10,934	11,406	11,879	11,998	11,998	11,998	11,998	11,998
Cargo (Laden) Carriage Tonnage	10,371	11,038	11,706	12,373	13,040	13,707	14,375	15,042	15,709	16,377	16,504	16,504
Carriage Tonnage for Empty Containers	607	646	685	724	763	802	841	880	919	958	965	965
Allowance for Operations	11,463	11,463	11,463	11,463	11,463	11,463	11,463	11,463	11,463	11,463	11,463	11,463
Cargo (Laden) Tonnage	38,299	40,731	43,194	45,656	48,118	50,581	53,043	55,505	57,968	60,430	60,900	60,900
DWT Remaining	38,592	34,952	31,311	27,670	24,029	20,388	16,748	13,459	10,291	7,122	6,517	6,517
Total →	108,348	108,348	108,348	108,348	108,348	108,348	108,348	108,348	108,348	108,348	108,348	108,348

Vessel capacity allocations similar to the allocations presented in Table 5-16 are estimated for each vessel class and for each trade route. Capacity allocations are assumed constant throughout the period of analysis. The combination of assumptions and calculations used in the LFA are the determining factors for vessel deployment and vessel drafts used in the Transportation Cost Savings Model.

The results of the LFA provide maximum practicable sailing drafts by type of vessel, trade route and channel depth (Table 5-17). Although the LFA results can vary significantly for similar sized vessels on different routes, all vessels on all routes, including the largest ones, reach their maximum practicable sailing draft with a 47-foot channel. In other words, incremental increases in channel depth from -42 feet to -47 feet result in reallocation of vessel DWT from non-cargo-related capacity to cargo-related capacity. At a channel depth of -47 feet, all of the vessel's available space and

dead weight tonnage has been allocated, therefore; deepening to depths greater than -47 feet is projected to have no impact on future vessel loading or operating drafts.

Table 5-17: Projected Maximum Vessel Drafts: Savannah Harbor

World Region Service	Vessel Class	Sailing Draft (feet)					
		42	44	45	46	47	48
FE SUEZ ECUS	PX	40.51	40.51	40.51	40.51	40.51	40.51
	PPX1	42.80	44.80	45.40	45.40	45.40	45.40
	PPX2	42.70	44.70	45.70	46.70	46.94	46.94
ECUS MED	PX	43.00	44.02	44.02	44.02	44.02	44.02
	PPX1	42.80	44.80	45.80	46.05	46.05	46.05
	PPX2	42.70	44.70	45.70	46.70	47.64	47.64
FE (Panama)	PX	39.20	39.20	39.20	39.20	39.20	39.20
ECUS	PPX1	42.80	43.91	43.91	43.91	43.91	43.91
	PPX2	42.70	44.70	45.35	45.35	45.35	45.35
FE ECUS EU PEN	PX	39.90	39.90	39.90	39.90	39.90	39.90
	PPX1	42.80	44.71	44.71	44.71	44.71	44.71
	PPX2	42.70	44.70	45.70	46.20	46.20	46.20
FE ECUS MED	PX	40.90	40.90	40.90	40.90	40.90	40.90
PEN	PPX1	42.80	44.80	45.80	45.84	45.84	45.84
	PPX2	42.70	44.70	45.70	46.70	47.41	47.41
RTW	PX	42.42	42.42	42.42	42.42	42.42	42.42
	PPX1	42.80	44.80	45.80	46.05	46.05	46.05
	PPX2	42.70	44.70	45.70	46.70	47.64	47.64
ECUS EU GULF	PX	43.00	43.21	43.21	43.21	43.21	43.21
PEN	PPX1	42.80	44.80	45.80	46.05	46.05	46.05
	PPX2	42.70	44.70	45.70	46.70	47.64	47.64

Vessel deployments to Garden City Terminal were based on cargo capacities estimated by the LFA and unit cost estimates. Carriers were assumed to follow the cost advantage indicated by the unit cost analysis when making their deployments on every route except the FE (Panama) ECUS. For the FE (Panama) ECUS route service, both the PPX1 and the PPX2 vessel classes are already more efficient than the Panamax class vessels. Also, given the inherent uncertainty in the unit cost analysis, the PPX1 and PPX2 vessel classes can be considered identical in terms of economic efficiency. Based on unit cost alone, it may be that both PPX1 and PPX2 vessels will be deployed on this route at the existing project depth of 42 feet (i.e., following Panama Canal expansion).

It was concluded from an analysis of recent trends that the PPX2 vessels would likely be deployed first to ports when their economic advantage became clearly superior to rather than equal to a PPX1 vessel. Given these considerations, this analysis assumed that the PPX2 vessels would be deployed on the FE (Panama) ECUS route service at a 44-foot project depth and deeper. Based on the unit cost analysis (Table 5-18), the unit cost for that route drops from $2.04 to $1.82 for the PPX2 vessel; in other words, it is at that point where the greater depth allows the larger vessel to load more fully, thus reducing the overall transportation cost. For the ECUS MED route, the switch to

PPX2 vessels should not take place until the channel depth reaches 46 feet. For project depths of 45 feet and lower, unit costs are minimized using PPX1 vessels.

Table 5-18: Estimated Vessel Unit Costs

World Region Route	Vessel Classes	Channel Depths (feet)					
		42	44	45	46	47	48
FE (Suez) ECUS	PX MPD	$ 2.31	$ 2.31	$ 2.31	$ 2.31	$ 2.31	$ 2.31
	PPX1 MPD	$ 2.02	$ 1.85	$ 1.81	$ 1.81	$ 1.81	$ 1.81
	PPX2 MPD	$ 2.04	$ 1.87	$ 1.80	$ 1.73	$ 1.72	$ 1.72
ECUS MED	PX MPD	$ 2.07	$ 1.99	$ 1.99	$ 1.99	$ 1.99	$ 1.99
	PPX1 MPD	$ 2.02	$ 1.85	$ 1.78	$ 1.76	$ 1.76	$ 1.76
	PPX2 MPD	$ 2.04	$ 1.87	$ 1.80	$ 1.73	$ 1.67	$ 1.67
FE (Panama) ECUS	PX MPD	$ 2.46	$ 2.46	$ 2.46	$ 2.46	$ 2.46	$ 2.46
	PPX1 MPD	$ 2.02	$ 1.92	$ 1.92	$ 1.92	$ 1.92	$ 1.92
	PPX2 MPD	$ 2.04	$ 1.87	$ 1.82	$ 1.82	$ 1.82	$ 1.82
FE ECUS EU PEN	PX MPD	$ 2.38	$ 2.38	$ 2.38	$ 2.38	$ 2.38	$ 2.38
	PPX1 MPD	$ 2.02	$ 1.86	$ 1.86	$ 1.86	$ 1.86	$ 1.86
	PPX2 MPD	$ 2.04	$ 1.87	$ 1.80	$ 1.76	$ 1.76	$ 1.76
FE ECUS MED PEN	PX MPD	$ 2.27	$ 2.27	$ 2.27	$ 2.27	$ 2.27	$ 2.27
	PPX1 MPD	$ 2.02	$ 1.85	$ 1.78	$ 1.78	$ 1.78	$ 1.78
	PPX2 MPD	$ 2.04	$ 1.87	$ 1.80	$ 1.73	$ 1.69	$ 1.69
RTW	PX MPD	$ 2.07	$ 2.00	$ 2.00	$ 2.00	$ 2.00	$ 2.00
	PPX1 MPD	$ 2.02	$ 1.85	$ 1.78	$ 1.76	$ 1.76	$ 1.76
	PPX2 MPD	$ 2.04	$ 1.87	$ 1.80	$ 1.73	$ 1.67	$ 1.67
ECUS EU GULF PEN	PX MPD	$ 2.07	$ 2.06	$ 2.06	$ 2.06	$ 2.06	$ 2.06
	PPX1 MPD	$ 2.02	$ 1.85	$ 1.78	$ 1.76	$ 1.76	$ 1.76
	PPX2 MPD	$ 2.04	$ 1.87	$ 1.80	$ 1.73	$ 1.67	$ 1.67

The final consideration in the deployment scenario was determining the number of PPX2 vessels to replace the PPX1 vessels. It was assumed that a replacement ratio of 140% for PPX2 vessels replacing PPX1 vessels would be used. In other words, as PPX2 vessels are deployed (given the economic incentive of reducing unit costs), the number of PPX1 vessel calls would be reduced by 140 percent of the number of added PPX2 vessel calls.

5.5.4 Savannah Harbor Fleet Projections

Table 5-19 shows the final PPX vessel call forecast for the FE (Panama) ECUS route service. It depicts how at the 42-foot channel depth (the without project condition), the forecasted calls for PPX1 and PPX2 vessels are all PPX1 calls. Beyond 42 feet, the calls are divided between the two classes as indicated by MSI's unconstrained forecast of vessel calls. For this particular route, PPX2 deploy to their full allocation at 44 feet. The vessels could load a little deeper in a 45-foot channel and the Transportation Cost Savings Model picks that up and calculates a "deepening" benefit using the same number of trips but more Savannah cargo. Table 5-20 shows the vessel calls for the ECUS Med service, and Table 5-21 shows the projected vessel calls for the FE (Suez) ECUS service. Similar projections are made for each route.

Table 5-19: Projected FE (Panama) ECUS Vessel Calls: Garden City Terminal

Vessel Class – Project Depth	2017	2020	2025	2030
PPX1-42	153	349	410	587
PPX2-42	40	109	156	218
PPX1-44	97	196	192	282
PPX2-44	79	218	311	435
PPX1-45	97	196	192	282
PPX2-45	79	218	311	435
PPX1-46	97	196	192	282
PPX2-46	79	218	311	435
PPX1-47	97	196	192	282
PPX2-47	79	218	311	435
PPX1-48	97	196	192	282
PPX2-48	79	218	311	435

Table 5-20: Projected ECUS MED Vessel Calls: Garden City Terminal

Vessel Class – Project Depth	2017	2020	2025	2030
PPX1-42	13	19	21	27
PPX2-42	3	6	8	10
PPX1-44	8	11	10	13
PPX2-44	6	12	16	20
PPX1-45	8	11	10	13
PPX2-45	6	12	16	20
PPX1-46	8	11	10	13
PPX2-46	6	12	16	20
PPX1-47	8	11	10	13
PPX2-47	6	12	16	20
PPX1-48	8	11	10	13
PPX2-48	6	12	16	20

Table 5-21: Projected FE (Suez) ECUS Vessel Calls: Garden City Terminal

Vessel Class – Project Depth	2017	2020	2025	2030
PPX1-42	147	234	266	368
PPX2-42	36	73	101	137
PPX1-44	97	122	124	165
PPX2-44	72	137	200	255
PPX1-45	97	118	120	160
PPX2-45	72	132	192	246
PPX1-46	97	116	117	156
PPX2-46	72	129	188	241
PPX1-47	97	116	115	154
PPX2-47	72	129	188	238
PPX1-48	97	116	115	154
PPX2-48	72	129	188	238

Table 5-22 presents the total forecasted vessel calls by vessel size class, channel depth, and year. This vessel call projection is used in the Transportation Cost Saving Model and the Tide delay and Congestion model.

Table 5-22: Total Projected Vessel Calls: Garden City Terminal

42-Foot Depth	2017	2020	2025	2030
SPX	497	593	758	947
PX	1,196	778	1,122	1,196
PPX1	479	866	1,006	1,421
PPX2	120	271	382	527
Total	**2,292**	**2,509**	**3,267**	**4,092**

44-Foot Depth	2017	2020	2025	2030
SPX	497	593	758	947
PX	1,135	700	992	1,067
PPX1	312	478	471	672
PPX2	239	533	761	1,035
Total	**2,183**	**2,304**	**2,982**	**3,720**

45-Foot Depth	2017	2020	2025	2030
SPX	497	593	758	947
PX	1,109	671	952	1,007
PPX1	312	474	467	666
PPX2	239	527	753	1,027
Total	**2,157**	**2,265**	**2,930**	**3,647**

46-Foot Depth	2017	2020	2025	2030
SPX	497	593	758	947
PX	1,096	658	932	982
PPX1	312	471	465	662
PPX2	239	524	749	1,021
Total	**2,144**	**2,247**	**2,903**	**3,613**

47-Foot Depth	2017	2020	2025	2030
SPX	497	593	758	947
PX	1,092	649	924	975
PPX1	312	471	462	661
PPX2	239	524	749	1,018
Total	**2,140**	**2,238**	**2,892**	**3,601**

48-Foot Depth	2017	2020	2025	2030
SPX	497	593	758	947
PX	1,092	649	924	975
PPX1	312	471	462	661
PPX2	239	524	749	1,018
Total	**2,140**	**2,238**	**2,892**	**3,601**

5.6 Without-project Conditions: Socio-Economic Profile

Table 5-23 presents the projected population growth for the five Georgia counties and two South Carolina counties in the local area around Savannah Harbor. Population growth for the local area is projected to be somewhat higher than the national average (1.09% average annual local growth vs. 0.83 average annual national growth). The population estimates for the City of Savannah are included in the Chatham County values.

Projected employment figures for the Georgia Counties are presented in Table 5-24. In general, projections for the five Georgia counties are consistent with a trend identified for all Georgia coastal counties, which is lower future employment in construction and manufacturing and high future employment in retail and services (Georgia Institute of Technology, 2006). Employment projections for the South Carolina counties are included in the South Carolina Department of Commerce projections for the Low Country Workforce Development Area. These projections indicate an employment increase of 14.64% for the workforce development area from 2004 through 2014. The ten-year average annual employment growth rate for the workforce development area is 1.38%.

Table 5-23: Local Area Population Projections

	2005	2030	25 Year Increase	Average Annual Increase
Bryan County, GA	30,520	45,986	50.67%	1.65%
Bulloch County, GA	65,445	82,111	25.47%	0.91%
Chatham County, GA	248,084	307,472	23.94%	0.86%
Effingham County, GA	47,032	79,935	69.96%	2.14%
Liberty County, GA	70,237	89,163	26.95%	0.96%
Beaufort County, SC	137,814	209,680	52.15%	1.69%
Jasper County, SC	21,452	29,180	36.02%	1.24%
Total 7-County Area	461,318	604,667	31.07%	1.09%
City of Savannah[1]	140,598	174,256	23.94%	0.86%

[1] Chatham County, GA

Sources: Georgia Coast 2030: Population Projections for the 10-County Coastal Region, Georgia Institute of Technology, Sept. 2006 and South Carolina Department of Commerce

Table 5-24: Local Area Employment Projections

	2000	2030	30 Year Increase	Average Annual Increase
Bryan County	7,000	13,500	92.86%	2.21%
Bulloch County	27,600	43,000	55.80%	1.49%
Chatham County	156,000	202,000	29.49%	0.87%
Effingham County	10,100	15,000	48.51%	1.33%
Liberty County	33,400	46,300	38.62%	1.09%
Total 5-County Area	234,100	319,800	36.31%	1.05%

Source: Georgia Coast 2030: Population Projections for the 10-County Coastal Region, Georgia

Institute of Technology, Sept. 2006

The Georgia Ports Authority identifies south eastern, south central, and north central states as their primary hinterland (Table 5-25). Historically, more than half of Garden City Terminal trade includes these states. Population projections provided by the US Census Bureau indicate that south eastern and south central state populations are projected to grow faster than the national average. Although north central state populations are projected to grow more slowly than the national average, Savannah Harbor's primary hinterland is projected to grow faster than the national average.

Table 5-25: Savannah Harbor Market Area Population Projections (2005 – 2030)

	2005	2030	25 Year Increase	Average Annual Increase
Total US	295,507,134	363,584,435	23.04%	0.83%
North Central[1]	28,877,479	31,228,171	8.14%	0.31%
South Central[2]	36,359,249	48,213,920	32.60%	1.14%
South East[3]	52,785,522	73,427,202	39.10%	1.33%
SH Market Area	118,022,250	152,869,293	29.53%	1.04%

[1] North Central States = IL, IN, KY, and MO
[2] South Central States = AR, KS, LA, OK, and TX
[3] South East States = AL, FL, GA, MS, NC, SC, and TN
Source: US Census Bureau, Population Division, Interim State Population Projections, 2005

5.7 Without-project Conditions: Environmental Resources

Overall, future without-project environmental conditions in the study area are projected to be very similar to existing conditions. There are four major influencing factors which will largely determine future without-project environmental conditions in the study area. These three factors include:

- Population growth and associated development;
- Sea-level rise;
- Federal, state, and local regulation; and
- Environmental management.

The influence of each of these factors on future without-project environmental conditions is discussed below.

5.7.1 Population Growth and Associated Development

Although strong population growth is projected to continue for the southeastern states, growth for the Savannah Metropolitan Statistical Area is projected to continue at approximately 1% annually (Savannah Chamber of Commerce, 2007). Urban and tourism-related waterfront development along the Savannah River is replacing some former water dependent industrial uses. Further development of the study area's water-borne transportation infrastructure is projected for the near future, which is driven largely by growth in the Port's hinterland. Expansion of the Elba Island LNG

facility will increase LNG vessel traffic by as much as 80%. Planned port facility infrastructure improvements at the Garden City Terminal will increase TEU capacity to 6.5 million TEUs before 2020; although, the projected TEU volume will be less than half that amount in 2020. Under without-project conditions, vessel traffic at Garden City Terminals is expected to approximately double by 2024.

The residential and industrial development will convert more lands from natural areas to developed sites. Jasper County, South Carolina and the western portion of Chatham County and Effingham County, Georgia have experienced the most growth in recent years. Future population growth was presented in Table 5-23. One particular area that will likely develop is along the South Carolina boundary of the Savannah National Wildlife Refuge, in Jasper County. Topographic surveys have been prepared, and the land has been put on the market. Those lands currently serve as unofficial natural buffers to the Wildlife Refuge.

5.7.2 Sea-level rise

NOAA maintains a gage at Fort Pulaski that has collected data on sea level for over 70 years. Based on that data, the historic sea level change trend at Savannah is a rise of 2.98 mm/year (0.12 inches/year). That rate is a combination of the global sea-level rise and local vertical land movement. Numerous analyses have been conducted and reports prepared on the potential for larger changes in sea level and overall climate change in the future as a result of greenhouse gases and other variables. Most studies agree that the effects will differ by location, but the scientific opinions vary substantially on what those changes may be for a given location.

For this analysis, Savannah District believes that the most likely future condition at Savannah is a continuation of the historic trend (low rate) that has been measured at this location for over 70 years. If that rate continues for the 50-year period of analysis, the sea level would be ½ foot higher in Savannah in 2065 than it is at present. The Corps is required to consider other rates of sea-level rise in its evaluations (intermediate and high rates). Those rates would result in an increase in a sea level of up to 2.3 feet higher by 2065. As sea level rises in Savannah Harbor, the amount of tidal freshwater marsh is expected to decrease. The Cooperating Agencies believe the Corps should perform its basic evaluation of the proposed project using the present elevation of sea level. They also requested the Corps evaluate two other scenarios: a 25- and 50-cm (0.8- and 1.6-feet) rise by 2065. The EIS contains the information on the effects of the proposed alternatives under those three scenarios. The Cooperating Agencies also believe that the Corps should mitigate for wetland impacts expected to occur at the time of construction, instead of using an average condition expected to occur over the life of the project. In November 2011, the Office of the Assistant Secretary of the Army for Civil Works (OASA (CW)) concurred that this project should mitigate for wetland impacts expected to occur at the time of construction.

If the historic rate observed over the last 70+ years at Savannah has also occurred since the City was founded in 1733, the sea level would have been 2.8 feet lower when it was founded than it is at present. It would also have been roughly 1.5 feet lower than today during the 1860s when much of the present-day surrounding marsh was managed for rice production, which requires freshwater to flood the fields.

If the historic rate continues for the 50-year period of analysis for this project, the ½ foot higher sea level in Savannah in 2065 would have marginal impacts on marshes in the estuary. The Corps' analyses indicate that tidal freshwater marshes could be reduced by approximately 370 acres if the historic rate of sea-level rise continues to 2065. Higher amounts of sea-level rise could greatly alter marshes in the estuary. The tidal freshwater marsh would be the most affected, since it is generally bounded by bottomland hardwoods and cannot migrate upriver. If a higher rate occurs, the Savannah estuary could experience a significant loss of the remaining tidal freshwater marsh.

Sea-level rise would also affect other natural resources in the estuary, since it would change salinity levels. Fish species such as the endangered Shortnose sturgeon may lose some of their existing habitats if salinity levels increase too much. Chloride levels at the City of Savannah's water intake would also be expected to rise as saline ocean waters move further up the estuary. At some point, the City could find the river water unacceptable for the industries that it serves that desire low chloride levels in their makeup water. At that point, either the City or the industries would have to treat the makeup water or the industries would experience higher maintenance costs for their boilers.

Section 7.5.2.2 of the Engineering Appendix describes the results of the detailed analyses that the Corps performed concerning various sea-level rise scenarios. Section 12 of this document also addresses the effects of possible changes in sea level.

5.7.3 Environmental Regulations

Occurring concurrently with increases in population, urban development, and waterborne commerce will be a continuation of current environmental regulations, restoration efforts, and management which will bring about improvements in some aspects of future environmental conditions. Federal and state environmental regulations are expected to continue the pursuit of improved air and water quality. The study area is projected to remain an "Attainment Area" based on existing emission levels and low projected growth, even though regulations are expected to become more stringent. Future water quality in the Savannah River is expected to improve due to new dissolved oxygen Total Maximum Daily Load (TMDL) regulations, which are currently under development. The National Marine Fisheries Service is expected to continue developing marine traffic regulations that would improve the safety of marine mammals and sea turtles. Other than the new TMDL regulations, there are no major planned or foreseen regulatory changes which will significantly alter existing environmental conditions.

5.7.4 Environmental Management

Current environmental restoration and management efforts also are expected to continue under without-project conditions. The Savannah Harbor LTMS (1996) identifies numerous structural and operational management measures, which are being implemented to maintain environmental quality in the system. The LTMS also identifies restoration measures which have been constructed and are currently maintained (Section 2 Prior Studies, Reports, and Projects). In addition to the LTMS, the Savannah Harbor DMMP identifies future without-project dredging volumes and schedules, dredging methods, beneficial uses, and dredged material placement plans. All of the environmental management and restoration actions prescribed in the LTMS and DMMP are expected to continue under without-project conditions.

Environmental management and restoration measures identified in the LTMS and DMMP, which are expected to continue under without-project conditions, include the following.

- Rotational use of confined disposal areas to improve migratory bird and shorebird habitat;
- Nesting island construction and maintenance to improve bird habitat;
- Maintenance of preferred habitat characteristics, such as non-vegetated island areas;
- Wetland restoration and creation;
- Operation of water control structures within the Savannah National Wildlife Refuge in order to maintain and improve migratory waterfowl habitat; and
- Beneficial use of dredged materials for indirect beach nourishment.

In addition, maintenance of sediment traps and advance maintenance dredging of navigation channels is expected to continue.

Continued improvement is expected in the Striped bass population in the Savannah River estuary. The states of Georgia and South Carolina recently reopened this recreational fishery. Analyses indicate that this species has resumed limited natural spawning in the estuary. The population of Shortnose sturgeon within the estuary is expected to remain stable at low numbers of individuals.

5.8 Without-Project Conditions: Study Area Cultural Resources

No significant changes to the Savannah National Historic Landmark District or to Old Fort Jackson are projected under without-project conditions. Shoreline erosion at Fort Pulaski National Monument is projected to continue at observed rates, as identified in Section 4.9.2. Under future without-project conditions, the wreck of CSS *Georgia*

will remain on the northern bank of the navigation channel. Maintenance of the channel width would continue to be restricted in that location to avoid impacting the wreck.

6 Formulation of Alternative Plans

Plan formulation is the process of building plans that meet planning objectives and avoid planning constraints. Once the study's objectives and constraints have been identified, many professional disciplines are required to use their knowledge, experience, and judgment to define the combination of management measures that comprise different alternative plans. These plans are then developed in sufficient detail so that a realistic evaluation and comparison of the plan's contributions to the planning objectives and other effects can be identified, measured, and considered.

Plan formulation has been conducted for this study with a focus on contributing to NED with consideration of all effects, beneficial or adverse, to each of the four evaluation accounts identified in the Principles and Guidelines (1983), which are National Economic Development, Environmental Quality, Regional Economic Development, and Other Social Effects. This chapter walks the reader through the development of alternative plans for the Savannah Harbor Expansion Study.

6.1 Planning Goals

Goals are the broad, over-arching purposes for a study. They may be developed from a variety of sources, and given to a study team prior to beginning their tasks. They may be defined by the non-Federal partner or any other stakeholder, and will be unique to each study. The P&G, described in Chapter 1, presents the Federal objective as "...to contribute to national economic development consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements." Generally, the planning goals are the objectives of some organization higher up in the hierarchy. Likewise, the Federal objective is also known as the NED goal to its water resource agencies like the Corps. Therefore, the primary planning goal for this study is to recommend a navigation plan for the Savannah River channel that contributes to the national economic development consistent with protecting the nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements."

The cooperating agencies (USEPA, USFWS, and NMFS) also collaborated on the development of a set of goals related to the planning process and project-related outcomes. These goals are consistent with the Cooperating Agency Vision Statement (see Plan Formulation Appendix), and are listed below.

Cooperating Agency Process Related Goals:

- Determine the specific and differential incremental effects of each channel improvement alternative;

- Identify and evaluate impacts on the human environment, including impacts on natural resources, economics, and societal considerations (jobs);
- Ensure studies are conducted in a manner that leads to their technical acceptance by the scientific community;
- Clearly identify all benefits and costs for the decision-makers;
- Recognize that mitigation may be necessary for any or all of the identified impacts;
- If needed, recommend specific actions that should be taken outside the context of the expansion Project to improve the local environment and/or compensate for past harbor improvement projects. The report would identify the process and participants to accomplish those specific needed actions;
- Document all findings in a report that leads decision-makers to clear decisions on the project.

Cooperating Agency Outcome Related Goals:

- Produce positive economic benefits for the port community and have beneficial environmental effects;
- Include a mitigation plan that addresses unavoidable impacts to critical natural resources;
- Include post-project monitoring to ensure that the expected levels of adverse impacts are not exceeded; and
- Be supported by most stakeholders.

6.2 Project Objectives

After the problems and opportunities were defined (see Chapter 3), the planning objectives and constraints were developed to guide the team's efforts in solving those problems. This section describes the planning objectives for this study.

Planning objectives are statements that describe the desired results of the planning process by solving the problems and taking advantage of the opportunities identified in Chapter 3. The guidelines for the study team in developing planning objectives were that they:

1) Must be directly related to the problems and opportunities identified for the study and will be used for the formulation and evaluation of plans; and
2) Must be clearly defined and provide information on the effect desired (quantified, if possible), the subject of the objective (what will be changed by accomplishing the objective), the location where the expected result will occur, the timing of the effect (when would the effect occur) and the duration of the effect.

The study team worked with many stakeholders to develop objectives for this project. All were helpful insights into their desired outcomes. However, to meet the planning guidelines mentioned above, they were summarized into the following objective:

Reduce navigation transportation costs to and from the Savannah Harbor to the extent possible over the next 50 years.

Plans should integrate and/or complement other state and agency related programs (including dredged material management and environmental programs) to the extent possible over the next 50 years.

6.3 Planning Constraints

Planning constraints restrict the set of alternative plans developed and also influence the technical investigations conducted during the analysis. The desire to avoid or minimize impacts to natural resources resulted in technical investigations being conducted for dissolved oxygen, salinity, marsh succession, chloride effects at Savannah's industrial water intake, dredged material physical and chemical characteristics, and an investigation of the Upper Floridan aquifer.

The following set of constraints was used to guide the formulation of alternative plans:

- Do not violate maritime safety requirements;
- Do not violate environmental restrictions on dredging;
- Do not significantly impact the Upper Floridan aquifer;
- Do not significantly impact cultural resources;
- Do not adversely impact the landside infrastructure of the Savannah Harbor;
- Do not significantly impact Striped bass recovery;
- Do not significantly impact Shortnose sturgeon; and
- Do not significantly affect dissolved oxygen.

Additionally, the collaborating agencies requested the following be included into the planning process for this study:

- Acknowledge proximity of navigation channel to the Savannah National Wildlife Refuge (sensitivity of the freshwater refuge to potential impacts from future harbor improvements); and
- Refine hydrodynamic and salinity models and conduct additional field studies (as necessary for mitigation of alternative plans).

6.4 Plan Formulation Criteria

Management measures and alternative plans were developed to address the problems identified in Chapter 3: Problems and Opportunities. Each alternative plan is formulated in consideration of four general criteria, as identified in the Principles and Guidelines (1983): completeness, efficiency, effectiveness, and acceptability.

Completeness is the extent to which the alternative plans provide and account for all investments, or other actions, necessary to ensure the realization of the planning objectives, including actions by other Federal and non-Federal entities. **Efficiency** is the extent to which an alternative plan is the most reasonable, least cost means of achieving the objectives. **Effectiveness** is the extent to which the alternatives plans contribute to achieving the planning objectives. **Acceptability** is the extent to which the alternative plans are acceptable in terms of applicable laws, regulations, and public

policies. Appropriate mitigation of any unavoidable adverse effects shall be an integral component of each alternative plan.

Identification of project-specific planning criteria used in USACE project planning is guided by the Principles and Guidelines (1983), the Planning Guidance Notebook, ER 1105-2-100 (22 Apr 2000), and The National Environmental Policy Act (NEPA) of 1969, and Procedures for Implementing NEPA, 33 CFR Part 230. The following technical, economic, institutional, environmental, and social formulation and evaluation criteria have been identified for this study:

Technical Criteria

- The selected plan should be consistent with local, regional, and state goals for water resources development;
- Plans must be realistic and reflect state-of-the-art measures and analysis techniques;
- The optimal scale of project development should be identified by analyzing NED and engineering feasibility;
- The plan should accommodate vessels projected to call at Savannah Harbor during the planning period, based on observed industry operations and reasonable forecasts;
- The plan should maintain existing vessel operability under various weather conditions; and
- The plan should be a product of proven elements and practices which will withstand projected weather and sea conditions, such as storms, floods, and waves.

Economic Criteria

- Each separable unit of improvement should be optimized to provide the maximum net benefits;
- The scope of the proposed development must be scaled to provide maximum net NED benefits. However, departure from the economically optimal (i.e., NED) project is possible in cases where the departure is justifiable and substantiated and an exception is granted from the Assistant Secretary of the Army (Civil Works); and
- There must be no more economical means, evaluated on a comparable basis, of accomplishing the same purpose that would be precluded from development if the Federal plan were undertaken. This limitation applies only to those alternative possibilities that would be physically displaced or economically precluded from development by the project.

Institutional Criteria

- Plans must be consistent with existing Federal, state, and local laws;
- Plans must be locally supported to the extent that non-Federal partner provides a letter of intent stating that it understands its responsibilities and obligations as set forth in the WRDA of 1986, as amended, and related policy;
- Prior to the Preconstruction Engineering and Design (PED) Phase, the non-Federal partner would enter into a written Design Agreement to cost share 25 percent of the costs of the Design Phase upfront. Ultimate cost sharing of design is the same percentage as for construction. Settlement is made at the time of construction, subsequent to execution of the Project Partnership Agreement (PPA);
- Prior to the Construction Phase, the non-Federal partner would enter into a written PPA to provide all items of local cooperation satisfactory to the Secretary of the Army, as mandated by Section 22 of Public Law 91-611, as amended; and
- The GRR and EIS must be approved by the Secretary of the Interior, Secretary of Commerce, the Administrator of the Environmental Protection Agency, and the Secretary of the Army to fulfill the conditions of the project's authorization.

Environmental Criteria

- The plan should minimize the commitment of natural resources, whether they are marine bottom-lands, wetlands, other coastal zones, inland environments, or wildlife in these areas;
- The plan should avoid or minimize environmental impacts and maximize environmental quality in the project area to the extent practicable considering environmental, economic, and engineering criteria;
- A mitigation plan will be developed to fully mitigate any remaining unavoidable adverse consequences which may result from the Recommended Plan;
- The available sources of expertise should be used to identify environmental resources that might be endangered, damaged, or destroyed by plan implementation. These would include the USFWS, USEPA, NMFS, and appropriate state agencies, such as the Georgia Department of Natural Resources and the South Carolina Department of Natural Resources; and
- Measures should be incorporated into the Recommended Plan to protect, preserve, restore, or enhance environmental quality in the project area.

Social Criteria

- The plan should be capable of being integrated into local or regional planning for water and air pollution abatement, transportation, recreation, and land use;
- As much as possible, the plan should minimize noise, dust, odor, unsightliness, and potential health risks;
- The plan should meet existing public health and environmental control standards;
- The plan should not displace, devalue, or destroy important historical and cultural landmarks or sites; and
- Adverse impacts on area recreation resources should be avoided or minimized.

6.5 Management Measures

Management measures are the general categories of actions which are the basis for alternative plan development. The management measures used in this feasibility study were developed through discussions and interviews with GPA, Garden City Terminal operations and management personnel, Savannah Harbor Pilots Association members, and public input. Management measures identified to address the navigation-related problems at Savannah Harbor include operational (i.e., non-structural) measures, locally implemented structural measures, structural measures implemented at other ports, and structural modification of the Federally-authorized channel.

The management measures presented below were assessed for their potential as building blocks of the alternative plans for potential navigation improvements at Savannah Harbor. Equal consideration must be given to structural and non-structural measures during the planning process. Management measures are listed below according to the planning objective they are designed to address and according to whether the measure is structural or non-structural.

1. Management Measure Objective: Reduce tidal delays

   Non-Structural Measures

   - Timing/schedule (dealing with a single vessel only)
   - Reduce under keel clearance requirement
   - Increase efficiency of landside operations to decrease turn-around time
   - Specialization/optimization of facilities
   - Modification of Garden City Terminal
   - Improved traffic management practices (dealing with coordination of multiple vessel movements)

   Structural Measures

   - Regional Port (hub and spoke concept)

- Deeper channel
- Alternate terminal locations
    - Offshore transshipment facility
    - Onshore terminal
- Straighter channel alignment
- Meeting Areas
- Increased/Improved landside infrastructure

2. Management Measure Objective: Improve vessel maneuverability

Non-Structural Measures

- Improved equipment
- Vessel design modifications
    - Thrusters
    - Power
- Tug assistance
- Pilot training
- Aids to navigation
    - Portable GPS navigation system
    - Harbor based vessel control system
    - Range lights/radar reflectors
    - Fixed radar reflectors along channel
- Real time environmental data
    - Real time tide data vs. predicted tide
    - Wind speed and direction
    - Current speed and direction

Structural Measures

- Bend wideners
- Turning basins
- Meeting Areas
- Straighten river/longer ranges

3. Management Measure Objective: Reduce the need to light load caused by channel depth constraints

Non-Structural Measures

- Timing/schedule (dealing with a single vessel only)

- Reduce underkeel clearance requirement
- Increase efficiency of landside operations to decrease turn-around time

- Specialization / optimization of facilities
  - Modification of Garden City Terminal
    - Increase efficiency of landside operations to decrease turnaround time
    - Specialization / optimization of facilities
- Improved traffic management practices (dealing with coordination of multiple vessel movements)

Structural Measures

- Regional Port (hub and spoke concept)
- Deeper channel
- Alternate terminal locations
  - Georgia
    - East Coast Terminal
    - Ocean Terminal
    - Elba Island
    - Brunswick
    - Other
  - South Carolina
    - Disposal Area 12A proposed terminal
    - Disposal Areas 14A/14B proposed terminal location
    - Tybee Island National Wildlife Refuge
    - Other locations
- Offshore transshipment facility
- Onshore terminal
- Straighter channel alignment
- Meeting Areas
- Increased/Improved landside infrastructure

4. Management Measure Objective: Reduce the need to light load caused by operational constraints

Non-Structural

- Timing/schedule (dealing with a single vessel only)
- Reduce under keel clearance requirement
- Increase efficiency of landside operations to decrease turn-around time
- Specialization/optimization of facilities
- Improved traffic management practices (dealing with coordination of multiple vessel movements)

Structural

- Deeper channel
- Alternate terminal locations
    - Offshore transshipment facility
    - Onshore terminal
- Regional Port (hub and spoke concept)
- Straighter channel alignment
- Meeting Areas
- Increased/Improved landside infrastructure
- Create breakwaters

6.5.1 Preliminary Screening of Management Measures

The list of nonstructural measures presented above was assessed on their potential to address navigation problems and opportunities in Savannah Harbor. Most of these measures were screened out due to their ineffectiveness in addressing navigation problems at Savannah Harbor. Additional navigation aid improvements such as buoys and/or navigation markers would not be helpful given the present condition of the harbor and the current configuration of existing navigation aids.

The traffic management system currently employed by the Savannah Bar Pilots includes ship to ship and ship to dispatch communication via radio/telephone as ships traverse the harbor. Each Pilot is in contact with the dispatcher and the other shipboard Pilots as they pilot the ships into and out of the harbor. Ships approaching the Port of Savannah are queued based on the following factors in order of importance (1) draft restrictions, (2) tide jobs/labor costs, and (3) Canal appointments. As each Pilot takes control of a ship he is in contact with the dispatcher and the other shipboard

Pilots as they pilot the ships into and out of the harbor. The Pilots consider this the best traffic management system for the Port of Savannah at this point in time.

The Pilots have looked at a system managed by the US Coast Guard called the Vehicle Traffic Service (VTS). The purpose of a VTS is to provide active monitoring and navigation advice for vessels in particularly confined and busy waterways such as the Houston Ship Channel and Baltimore Harbor. VTS is used to prevent vessel collisions, ramming, and grounding in the harbor and approaches. It is also designed to expedite ship movements, increase transportation system efficiency, and improve all-weather operating capability.

There are two general types of VTS: surveilled and non-surveilled. Surveilled systems consist of one or more land-based sensors (e.g., radar, AIS, closed circuit television) which output their signals to a central location where operators monitor and manage vessel traffic movement. Non-surveilled systems consist of one or more reporting points at which ships are required to report their identity, course, speed, and other data to the monitoring authority.

The Savannah Bar Pilots feel that neither type of VTS would provide a better management system than the system already in place. This does not mean to say the Savannah Bar Pilots are not interested in system improvements. The Savannah Bar Pilots will continue to investigate system improvements as technology improves and congestion increases.

However, two nonstructural measures were carried forward for more detailed evaluation in this investigation (1) reduce underkeel clearance requirements and (2) increase efficiency of landside operations to decrease turn-around time. Both of these measures could potentially reduce lightloading and/or tidal delay costs to vessels that are constrained by existing channel dimensions in Savannah Harbor and are carried forward for more detailed consideration.

The structural measures presented in the previous chapter were also assessed on their potential to address navigation problems and opportunities in Savannah Harbor. The initial screening process of these structural measures was accomplished in the report: "Savannah Harbor Expansion Project Formulation of Alternatives (March 2004)", which serves as an addendum to the Plan Formulation Appendix (Appendix D). A number of structural alternatives were carried forward for further consideration including:

- Alternative terminal locations
    - Georgia
        - East Coast Terminal
        - Ocean Terminal
        - Elba Island
        - Brunswick

        - Other
    - South Carolina
        - Other than Disposal Areas *14A/14B* proposed terminal
        - Disposal Areas *14A/14B* proposed terminal location
        - Tybee Island National Wildlife Refuge
        - Other locations
- Regional Port
- Offshore transshipment facility
- Deepening existing 42 MLLW navigation channel (to Station 103)
    - Alternative 44 (44' Deepening)
    - Alternative 46 (46' Deepening)
    - Alternative 48 (48' Deepening)
- Improve existing 42 MLLW navigation channel
    - Meeting Areas
    - Bend Wideners
    - Aids to navigation
    - Coordination of multiple vessel movements
    - Straighten river / Longer ranges

6.6 Evaluation of Alternative Non-structural Measures

6.6.1 Reduce Underkeel Clearance Requirement

In 1996, a Port Users Workgroup was assembled to coordinate commercial navigation operations in Savannah Harbor. This Port Users Workgroup developed the underkeel clearance requirements currently in effect. The Port Users Workgroup consisted of representatives of the SPA, GPA, shippers, terminal operators, towing companies, and other maritime industry professionals. Also included were the Corps, USCG, and other Federal agencies responsible for safe and efficient navigation on these waterways. The intent of this cooperative partnership between Savannah's port, maritime industry, and government agencies was to proactively implement proven guidelines and operating controls to promote marine safety and to prevent economic and environmental loss. The Port Users Workgroup was cautious not to impose overly restrictive government regulation and controls. As a result of this coordination, the Workgroup developed *Port of Savannah Minimal Underkeel Clearance Guidelines for Minimum Underkeel Clearances*. The guidelines were adopted by parties to the Workgroup as minimum operational standards for vessels transiting Savannah Harbor. These guidelines may be modified in the future by a similar representative body of Savannah's port users.

The underkeel guidelines for commercial vessels are as follows. They are applicable to all vessels in excess of 1600 gross tons.

"The following minimum underkeel guidelines apply in all conditions of tide and weather.

(a) 4 feet for transits in the navigation channel between the sea buoy, across the Savannah Bar, through Jones Island range, ACOE Station –14, where the project depth of the channel increases 2 feet.

(b) 2 feet for transits between Jones Island range and the point in the navigation channel which is adjacent to the facility of destination.

(c) When operating on waters outside the established navigation channel, and while moored at a facility pier, 1 foot for single-skin tank vessels greater than 5,000 gross tons and 6 inches for all other deep draft vessels. These guidelines are also applicable for vessels maneuvering outside the boundaries of the navigation channel."

The Savannah Harbor underkeel guidelines are consistent with other deep-water ports in the United States. Specifically, the ports of New York – New Jersey, Delaware River, Norfolk – Hampton Roads, and Los Angeles – Long Beach require a minimum of three feet underkeel in their harbors.

It is the pilot's decision whether conditions are adequate for a vessel to transit the river at a given time. The Savannah Harbor underkeel guidelines are minimum standards and are not intended to be limiting for pilots, operators, or owners that choose to require a higher degree of safety for their operations. It is also the owners/operators discretion to require that their vessels transit with underkeel clearance in excess of the minimum requirements established by the guidelines. For example, some carriers consider 10% of the vessels' design draft to be a standard rule of thumb for underkeel clearance, which is more than four feet for the largest container ships calling at Savannah Harbor. If a vessel has poor maneuverability, the pilots may require as much as five or six feet of underkeel clearance.

By riding the high tide up or down the river, vessels that are depth-constrained by channel dimensions of Savannah Harbor can achieve additional underkeel clearance, allowing deeper loading or use of a larger vessel. The pilots currently have real-time information about channel depths from National Oceanic and Atmospheric Administration (NOAA) tide gauges, which can be accessed by cell phone. The USACE and port facilities provide the pilots and vessel masters with up-to-date information on channel depths and berth depths, respectively. The pilots are also aware of areas subject to shoaling and the type of material accreted. Much of the substrate of the Savannah Harbor Federal channel is either hard sand or soft mud. Although alternative water level information tools have been implemented in other ports, the pilots are satisfied that NOAA's existing real-time river stage and tide information system provides sufficient information.

The underkeel clearance requirement has officially been in effect since 1996 and was developed by a committee of Port users with competing economic interests, but who all recognize the primacy of safe vessel operations. Extensive discussions with the pilots and the Port community indicate that no additional navigation information or other operational changes would be sufficient to allow systematic reduction of the underkeel clearance requirement. Therefore, this alternative was not considered further.

6.6.2 Modification of Garden City Terminal

As a nonstructural measure, modifications to Garden City Terminal would entail improvements to the container throughput capacity of the terminal beyond those currently projected under without-project conditions. The rationale for this particular nonstructural alternative is that increasing the efficiency of the terminal could potentially decrease the turn-around time for vessels calling at the terminal. Given the growth forecasts for containers moving through Savannah Harbor during the period of analysis, the decreased turn-around time could potentially reduce berth and channel congestion and increase the total number of containers handled at the Port without structurally altering channel dimensions.

Ocean Terminal could not be used to support container operations at Garden City Terminal without its conversion to a dedicated container terminal. The terminals are separated by approximately four miles of city streets, primarily Bay Street which is already very congested. It would not be practical to use Ocean Terminal to provide storage for Garden City Terminal container operations. The conversion of Ocean Terminal to a dedicated container terminal is addressed in Chapter 6.8: Alternative Terminal Locations.

The evaluation of this nonstructural measure is based on its ability to address navigation problems and opportunities in Savannah Harbor. Specifically, it must be determined to what extent this nonstructural measure could address problems associated with channel dimensions which are insufficient to efficiently accommodate the fleet of container ships currently calling on and projected to call on Garden City Terminal in the future.

The viability of modifications to Garden City Terminal as an effective nonstructural measure depends in part on the level of current and future berth congestion. Again, the premise of this measure is that if turn-around time for vessels could be decreased, there might be less berth congestion, allowing depth-constrained vessels greater opportunities to take advantage of the tides and transit the system more rapidly. GPA's Garden City managers indicate that this terminal currently has a berth utilization of approximately 42 percent (based on a 24-hour operation, 365 days/year). Based on industry standards which typically describe 50 percent as full practical berth utilization, this level of berth utilization is approaching full utilization. GPA's build-out plans increase Garden City's TEU handling capacity to 6.5 million TEUs by 2020.

At build-out in 2020, according to the current master plan, the GCT will have 9,700 feet of berth and 560 net acres of container storage area so that facility productivities are projected to be:

- 700 TEU's per berth foot per year in 2020, (formerly 278 TEU's per foot of berth per year in 2006); and
- 11,607 TEU's per net container storage acre per year in 2020 (formerly 5,650 TEU's per net container storage acre per year in 2006).

Berth utilization is expected to be 58% upon completion of Master Plan build-out in 2020.

Additionally, GPA is pursuing an aggressive upgrade of its container handling equipment, which includes a transition to Rubber Tired Gantry cranes (RTGs), which allows a greater concentration of containers per acre. Garden City Terminal currently has 71 RTGs in operation and has a purchasing plan in place to increase to 169 RTGs in operation by 2020. The flow of containers through GCT will be further enhanced by the addition of a new eight lane gate in 2015 and the expansion of existing Gate 4 from 15 to 24 lanes in 2014.

GPA has implemented some portions of the master plan, as the berth length has been already been increased from 8,300 to 9,700 feet. Based on the current levels of facility upgrades and expansion and the projected fulfillment of the Master Plan build-out, there are few if any navigation benefits which would result from additional improvements to Garden City Terminal. It is unlikely that additional improvements to Garden City Terminal would further increase vessel turn-around time to the extent that depth-constrained vessels would have greater opportunities to take advantage of the tides and transit the system more rapidly. Therefore, this non-structural alternative did not receive further consideration.

6.7 Evaluation of Alternative Structural Measures

Structural measures considered for preliminary evaluation include:

- Channel modifications from the sea to Garden City Terminal;
  - Deepening,
  - Widening,
  - Meeting Areas,
  - Expand turning basins,
- Alternative container ship terminal development;
  - East Coast Terminal, GA,
  - Ocean Terminal, GA,
  - Elba Island, GA,

- Brunswick, GA,
- Other locations, GA,
- Disposal Site 12A, SC,
- Disposal Sites 14A/14B, SC,
- Tybee Island National Wildlife Refuge (NWR), SC,
- Other locations, SC,
- Development of an Offshore Transshipment Terminal, and

- Development of a Regional Port.

Under alternative container ship terminal development measures, channel modifications would be implemented from the sea to an alternative terminal downstream of Garden City but not beyond. As a result of these improvements, Savannah Harbor would have (1) channel dimensions sufficient to more efficiently accommodate Post-Panamax container ships and (2) throughput capacity sufficient to accommodate the anticipated growth in the volume of containers during the period of analysis. The potential appeal of alternative terminal locations is that by being located downstream from Garden City Terminal, dredging costs and possibly environmental impacts associated with saltwater intrusion into freshwater wetlands would be reduced. Construction of a new container terminal in Savannah Harbor (in addition to the existing Garden City Terminal) would be a very expensive undertaking, but it may be possible that cost savings from avoided dredging costs and environmental impacts would out-weigh the additional construction costs.

The alternative terminal locations considered in this investigation (listed above) are illustrated in Figure 6-1, with the exception of the Colonel's Island terminal in Brunswick, Georgia. Port Royal, South Carolina was also identified as a potential alternative terminal location. Port Royal is located approximately 10 miles north of Hilton Head Island along the Beaufort River. This site was eliminated from detailed investigation in this analysis due to geotechnical considerations. Savannah District's Engineering Division discovered that a freshwater aquifer lies close to the surface at Port Royal. This site was not carried forward for detailed investigation due to concerns that deepening the Beaufort River could result in saltwater intrusion into this important source of water supply.

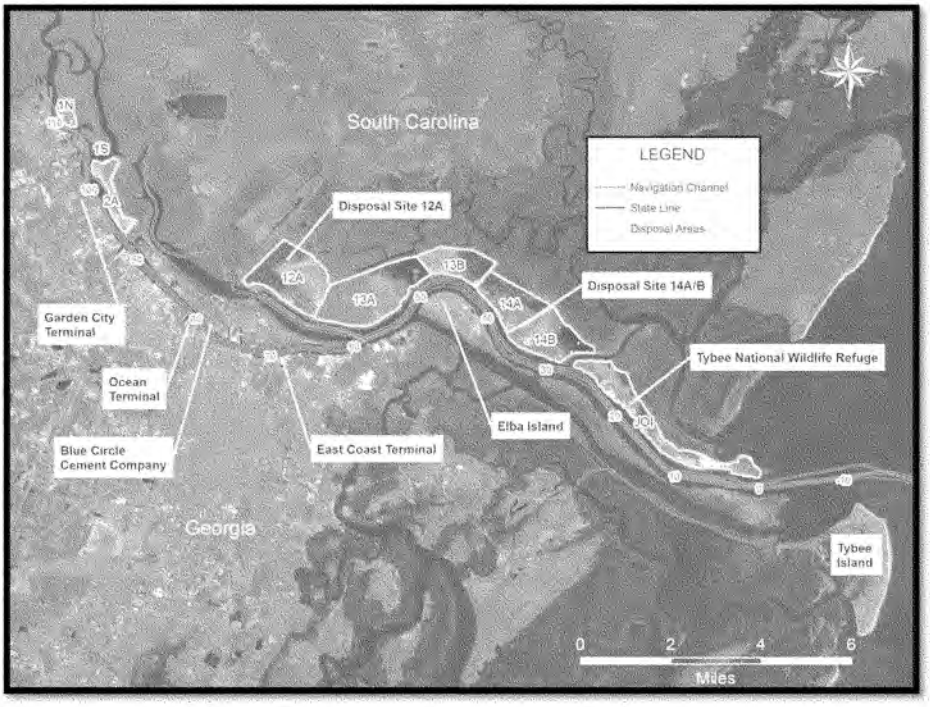


Figure 6-1: Alternative Terminal Locations

To address the navigation problems and opportunities in Savannah Harbor, an alternative terminal would need sufficient capacity to handle the volume of containers anticipated to be carried on depth-constrained container ships. These ships are typically Post-Panamax-class vessels that are consistent with the study Design Vessel (the *Susan Maersk*, an 8,200 TEU Post-Panamax class container ship launched in 1997 (beam: 140 feet, length overall 1,138 feet; design draft: 47.6 feet). It is assumed in this analysis that a new terminal would not eliminate the need for the continued operation of the Garden City Terminal. Instead, the new facility would supplement container handling capacity to help meet the growth in future demand. For this analysis, it was assumed that the new terminal(s) would handle depth-constrained container vessels, and Garden City Terminal would handle container ships that are not depth-constrained by the existing 42-foot channel. It is also assumed that the new terminal would not result in underutilization of Garden City facilities and that costs of such inefficiencies would not be incurred.

It was concluded that a new container terminal would need to be significantly large to achieve economies of scale in facility development, equipment purchase, and terminal operations. To achieve economies of scale, the following mix of facilities and equipment would represent the minimum features for a new state-of-the-art container facility to be an effective and efficient terminal. This mix of facilities and equipment, which are consistent with industry standards, would provide approximately 1.5 million TEU throughput capacity:

- Two berths with an assumed length of 1,250 feet per berth;
- Each will need a minimum of three Super Post-Panamax cranes (with a 72-95 long ton rated capacity);
- Other handling equipment to include: seven Rubber Tired gantries, 10 Five-high loaded Top lifts (87,000 lbs.), and two Seven-high empty stackers (15,000 lbs.);
- 300 acres total, including: 90 acres for container storage, 15 acres of parking space for vehicle storage, 10 acres for service drives and buffer, and 35 acres for container handling marshaling yard for rail loading;
- Annual throughput capacity commensurate with these facilities would be approximately 1.5 million TEUs;
- Dedicated rail access with intermodal rail connection within 10 miles;
- Sufficient landside area for potential future expansion; and
- For existing terminals that would be modified to handle containers or more containers (e.g., Garden City Terminal, Ocean Terminal, East Coast Terminal, Brunswick's Colonel's Island Terminal), 90 acres of container parking would be needed per berth. For these terminals, no additional area would be needed for vehicle storage, service drives, or rail container marshaling.

6.8 Alternative Terminal Locations

The evaluation of alternative downstream terminal locations is largely based on differences in construction costs; although other criteria such as differences in container transportation costs and differences in potential environmental impacts (apart from their associated mitigation costs) are also assessed. All environmental mitigation costs are included in the construction cost estimates. All cost estimates are preliminary level estimates appropriate for screening of potential measures. More detailed cost estimates are developed for measures selected for more intensive investigation and development into alternative plans. Negligible or very marginal differences among the alternative terminal locations were estimated for maintenance dredging costs, terminal operation costs, and potential impact to project benefits. Other differences such as transportation costs and cargo distribution costs are discussed at a cursory level.

6.8.1 Alternative Terminal Locations: Transportation Cost Differences

The location of alternative terminals downstream of Garden City Terminal would result in reduced distances Post-Panamax container ships would need to travel up-river and reduced transit time. These reductions in distance and sailing time would produce lower waterborne transportation costs for vessel using the downstream terminal. These waterborne transportation cost savings would be offset by increased landside transportation costs due to longer over-the-road distances to major cargo distribution points. Containers would have to be transported this additional (compensatory) landside distance using either truck or rail.

Table 6-1 compares waterborne cost savings to additional truck or rail costs. For the purpose of a preliminary screening, the values in the table are based on the simple assumption that the landside transportation distance is equivalent to the reduced river mileage. Each terminal is evaluated for 1.5 million annual TEUs. Waterborne transportation costs per mile are based on a fully loaded 4,000 TEU vessel. Rail and truck costs (per mile) were developed by the Intermodal Association of America, based on the Savannah to Atlanta route. The cost differential may be significantly greater than expressed by these estimates, since per mile truck and rail costs for the Atlanta route (approximately 250 miles by Interstate) are significantly less than costs of relatively slow movements to/from an alternative terminal in the vicinity of the port. All cost estimates are in 2003 dollars.

Table 6-1: Annual Waterborne Transportation Cost Savings and Landside Transportation Cost Increases (2003)

	Reduced Mileage (each way)	Annual Savings in Waterborne Transportation Costs	Minimum Annual Costs Of Compensatory Move by Landside Mode	
			Truck	Rail
Ocean Terminal	3.6	$320,025	$3,898,359	$4,895,613
Blue Circle Site	4.2	$370,555	$4,513,889	$5,668,605
Disposal Site 12A	5.7	$505,302	$6,155,303	$7,729,915
East Coast Terminal	7.2	$640,050	$7,796,717	$9,791,226
Elba Island	11.0	$976,918	$11,900,253	$14,944,503
Disposal Sites 14A/B	11.4	$1,010,605	$12,310,606	$15,459,831
Tybee NWR	15.2	$1,347,473	$16,414,141	$20,613,108

6.8.2 Alternative Terminal Locations: Criteria Evaluation

Each of the alternative terminal locations was assessed for the four criteria - completeness, effectiveness, efficiency, and acceptability - contained in the Principles and Guidelines (1983) and defined below. A "Yes" answer indicated that the terminal met the requirement of the criteria, a "No" answer indicated the terminal did not meet the requirement of the criteria, while a "Marginal" answer indicated that the terminal minimally met the criteria:

- **Completeness** – The extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects. This may require relating the plans to other types of public and private plans if the other plans are crucial to realization of the contributions to the objective.
- **Effectiveness** – The extent to which an alternative plan alleviates the specific problems and achieves the specified opportunities.
- **Efficiency** – The extent to which an alternative plan is the most cost effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the Nation's environment.
- **Acceptability** – The workability and viability of the alternative plan with respect to acceptance by State and local entities and the public and compatibility with existing laws, regulations, and public policies.

Garden City Terminal:

- Completeness – Yes;
- Effectiveness – Yes;
- Efficiency – Yes, although there may be some questions with regard to environmental effects;

- Acceptability – Yes; GPA is already in the process of doing things that will allow the port to meet the requirements for future traffic without having to deepen.

Ocean Terminal:

- Completeness – Yes;
- Effectiveness - Yes, while it is not 300 acres, it could be designed to handle the 1,500,000 TEUs as required;
- Efficiency - No, because of the increased traffic and the cost of additional land to make the site adequate. Renovation costs for this site are rather high;
- Acceptability – Marginal, it is questionable as to whether the public will accept the additional traffic created by the movement of additional trucks through that part of the City.

Blue Circle:

- Completeness – Marginal, because of the size of the site and the surrounding land use. Would need to purchase land for the terminal from the Golf Club;
- Effectiveness - Yes, because a terminal with a capacity of 1,500,000 TEUs could be established at the site;
- Efficiency - No, because of the high cost of renovating the site (tear down old facilities) in order to establish a container facility;
- Acceptability - No, because of land issues, the acceptability of having a container terminal on a golf course or in the area of an exclusive development.

Disposal Site 12A:

- Completeness – Yes;
- Effectiveness - Yes, the area can accept a new terminal and move the required number of TEUs;
- Efficiency - No, because of the cost to build a terminal at the site and to bring in the necessary transportation requirements. An impact to the environment could occur if a replacement disposal site is constructed in the surrounding marsh. Those impacts may be avoided if the sediments are used beneficially or deposited in the ODMDS;
- Acceptability - No, because of likely environment impacts and high transportation costs (utility, road and rail access to the site).

East Coast:

- Completeness – Marginal, based the acreage available to the terminal.
- Effectiveness – Marginal, because the area is too small to handle the required container traffic;
- Efficiency - No, because of the additional land costs to bring up the area to minimal acceptance and the cost of turning the facility into a container port;
- Acceptability - No, because traffic to and from the terminal, both rail and truck, would have to pass through the City to get to inland areas served by the port.

Elba Island:

- Completeness - No, the terminal berths would be on a dangerous bend in the River which would affect navigation. Lack of affordable road and rail access;
- Effectiveness - No, because of its location with respect to the channel and safety questions with regard to its co-location with the LNG Terminal;
- Efficiency - No, because of transportation costs;
- Acceptability - No, because of the increased transportation costs, the location of the berths with respect to the channel, and the fact that the terminal would be in the blast zone for the LNG Terminal, a navigation safety problem.

Disposal Area 14A&14B:

- Completeness - Yes;
- Effectiveness – Yes; the area can accept a new terminal and move the required number of TEUs;
- Efficiency - No, because of the cost to build a terminal at the site and to bring in the necessary transportation requirements. An impact to the environment could occur if a replacement disposal site is constructed in the surrounding marsh. Those impacts may be avoided if the sediments are used beneficially or deposited in the ODMDS;
- Acceptability - No, because of likely environment impacts and high transportation costs (utility, road and rail access to the site).

Tybee NWR:

- Completeness - Yes, same as Disposal Area 12A;
- Effectiveness - Yes, same as Disposal Area 12A;
- Efficiency - No, because of the cost to build a terminal at the site and to bring in the necessary transportation requirements. Environmental effects because of the requirement to obtain a replacement disposal area when all of the surrounding area is marsh. Those impacts may be avoided if the sediments are used beneficially or deposited in the ODMDS;
- Acceptability - No, not acceptable from the point of view of the environment and the transportation costs. The site is a National Wildlife Refuge.

Colonel's Island:

- Completeness – Yes;
- Effectiveness – Marginal, because of the distances involved with respect to the port and the inland customers it serves;
- Efficiency - No, because the entire property is wetlands; and the cost of dredging, unknown at this time, may be prohibitive, and transportation costs;
- Acceptability - No, it is unacceptable to Ga. DNR because of the wetlands involved.

Offshore Transhipment Facility:

- Completeness - No, because the size of the structure required to handle the proposed 1,500,000 TEUs, and its establishment in an open ocean environment is not practicable. While there is one such facility in a closed harbor (Hong Kong), and oil rigs exist in the Gulf of Mexico (too small), this is too experimental for this project;
- Effectiveness - No, while it would alleviate some problems it would cause more than solve. The environmental variables, i.e., the minimal wave environment, under which such a facility could operate is on the low end; therefore most of the time the facility would be unable to operate;
- Efficiency - No, the costs for a facility to handle the required TEU's would be very high.
- Acceptability - No, because the cost to build and the operating conditions under which the facility could operate would make it unacceptable to the public.

Table 6-2 contains a summary of the extent to which the Alternative Terminal Sites meet the criteria for alternative plans.

Table 6-2: Evaluation of Alternative Terminal Sites

Site	Completeness	Effectiveness	Efficiency	Acceptability
Garden City	Yes	Yes	Yes	Yes
Ocean Terminal	Yes	Yes	No	Marginal
Blue Circle	Marginal	Yes	No	No
DA 12A	Yes	Yes	No	No
East Coast	Marginal	Marginal	No	No
Elba Island	No	No	No	No
DA 14A/l4B	Yes	Yes	No	No
Tybee NWR	Yes	Yes	No	No
Colonel's Island	Yes	Marginal	No	No
Offshore	No	No	No	No

6.8.3 Alternative Terminal Locations: Cost Evaluation

The alternative terminals are discussed below, moving from upstream to downstream. Discussions include costs anticipated with modification or development of the alternative marine terminals and with channel deepening to -48 feet MLLW from the sea to the terminals. Analyses include quantitative and qualitative considerations of the assets and liabilities of each site. Following evaluations of the alternative terminals, an assessment of the potential for an offshore container transshipment facility and a Regional Port will be presented. The facility costs, dredging costs, and total costs of the alternative terminals along the Savannah River are presented in Table 6-3.

Table 6-3: Facility Costs, Dredging & Mitigation Costs, and Total Costs for Alternative Terminals (2003)

Alternative Terminals	Facility	Dredging & Mitigation	Total Costs
Garden City Terminal	$0	$332,348,000	$332,348,000
Ocean Terminal	$249,907,000	$305,004,000	$554,911,000
Blue Circle Site	$365,301,000	$291,495,000	$656,796,000
Disposal Area 12A	$339,423,000	$192,241,000	$531,664,000
East Coast Terminal	$374,271,000	$203,011,000	$577,282,000
Elba Island	$287,379,000	$138,290,000	$425,669,000
Disposal Sites 14A/B	$358,275,000	$127,089,000	$485,364,000
Tybee NWR	$391,835,000	$79,678,000	$471,513,000
Colonel's Island, Brunswick	$303,876,000	$137,527,000	$441,403,000

NOTE: After conducting more detailed analyses than the Corps performed, the Joint Project Office stated in 2011 that development of a new container terminal in Jasper County would likely cost over $4 billion, due in part to the high cost of transportation corridors. This facility is currently proposed to be constructed at DMCAs 14A and 14B site used in this analysis.

The total costs are carried forward to the summary assessment of the alternative terminals contained in Table 6-4. This table contains facility development costs, dredging costs, mitigation costs, positive and negative aspects of each site, and a summary assessment. All of the alternative facilities are expected to have costs significantly in excess of those which would result from deepening to the Garden City Terminal. For this reason, none of the alternatives to Garden City Terminal were given a "high" assessment in the final column. "Low" assessments were based on negative aspects of the sites outweighing positive aspects. "Medium" assessments were based on positive aspects of the sites outweighing negative aspects.

As indicated in Table 6-4, two sites were assigned a "medium" assessment: Disposal Sites 14A/14B and Disposal Area 12A. Although these sites have significant uncertainties, particularly with respect to environmental effects of landside transportation (rail and road), they have significant positive features as well, even if the total costs for use of these sites do not appear favorable based on this preliminary assessment.

6.8.4 Alternative Terminal Locations: Summary Assessment

Based on the factors described in the analysis and highlighted in Table 6-4, the overall rating of the sites was ranked as a potential deep draft container terminal. The Garden City Terminal was the only one that received a ranking of HIGH. The team gave three sites a MEDIUM ranking, while six sites were judged as having a LOW potential. The extent to which the sites could meet the criteria for an alternative plan was heavily considered in this assessment.

Table 6-4: Summary Assessment of Alternative Terminals

	Total Costs*	Positive Features	Negative Features	Overall Potential
Garden City Terminal	$332,348,000	- Ongoing Container Operation - Access to Rail and Highway - Sufficient area	- Potential environmental impacts	High
Ocean Terminal	$554,911,000	- Close to Garden City - Access to Rail and Highway	- Area may not be adequate for container facility - Associated truck traffic may exacerbate congested streets	Low
Blue Circle Site	$656,796,000	- Highway access	- Area may not be adequate for new container facility - Uncertain rail connection - Could potentially need to relocate existing operation	Low
Disposal Area 12A	$531,664,000	- Sufficient area - Highway access	- Environmental effects: access & replacement disposal capacity - Reduced efficiency of Back River sediment basin	Medium
East Coast Terminal	$577,282,000	- Rail access	- Area may not be adequate for container facility - East-west landside transport - Could potentially need to relocate existing operation	Low
Elba Island	$425,669,000	- Sufficient area - Downstream location	- Safety issues: adjacent to LNG facility - Safety issues: LNG navigation and navigation near LNG terminal - East-west landside transport	Low
Disposal Sites 14A/B	$4,000,000,000	- Sufficient area - Downstream location	- Loss of disposal capacity - Environmental effects: access & replacement disposal capacity	Medium
Tybee NWR	$471,513,000	- Sufficient area - Downstream location	- Environmental effects: site, access, replacement disposal capacity - Potential Intracoastal waterway impacts	Medium
Colonel's Island, Brunswick	$441,403,000	- Sufficient area	- Distance from inland markets - Environmental effects: wetlands disturbance	Low
Offshore Terminal	Unknown	- Potential for regional service - No channel deepening	- Unknown costs of facility - Environmental effects - High costs of double handling - Delays due to weather	Low

NOTE: * These costs were reported in Savannah District's 2005 Formulation of Alternatives Report. In 2011, the Joint Project Office estimated that the cost to develop a new container terminal in Jasper County would be $4 billion, including the land transportation corridors, but not including deepening the shipping channel.

The four sites that were judged as having either a MEDIUM or HIGH potential as a terminal were then compared just on their economics. Table 6-5 shows that comparison. The cost of the next most economically efficient alternative was 42 percent more than the lowest cost site. Therefore, only the lowest cost site (Garden City Terminal) will be considered in the detailed evaluations.

Table 6-5: Evaluation of Higher Ranked Alternative Terminal Sites (2003)

Site	Terminal Construction Cost	Dredging & Mitigation Cost	Total Cost	Incremental Cost (percentage)
Garden City	$0	$332,348,000	$332,348,000	
Tybee NWR	$391,835,000	$79,678,000	$471,513,000	41.8%
DA 14A/14B	$358,275,000	$127,089,000	$485,364,000	46.0%
DA 12A	$339,423,000	$192,241,000	$531,664,000	60.0%

6.9 Development of a Regional Southeastern US Container Port

One alternative considered as a potential solution to the problems outlined in Chapter 3: Problems and Opportunities is the development of a single southeastern US regional container port, which would act as a hub for all other container ports in the southeastern US. A regional southeastern container port would be the port-of-call for the largest container ships, which would arrive from and depart for the largest ports of major trading partners throughout the world. Conceivably, in-bound containerized cargo would be transshipped at the southeast US regional container port from larger Post-Panamax vessels onto smaller container ships which would call at multiple ports along the southeastern US coast. Out-bound containerized cargo would arrive at the Regional Port on Panamax size, or smaller, feeder vessels and be transshipped onto Post-Panamax size vessels for the ocean voyage to the ports of foreign trading partners. This concept is sometimes referred to as a hub-and-spoke operation. The Regional Port is the hub, which would be the jumping off point to the ports of international trading partners. Feeder vessels are the spokes, which ferry cargo back and forth from the hub to local southeastern US ports.

The apparent advantage of a regional southeastern US container port hub is that the economic and environmental costs of deepening channels and developing landside infrastructure would only need to be incurred for a single port, the regional hub, leaving the smaller ports to operate with shallower channels and less intensive infrastructure development because they would be serviced by smaller feeder vessels. Conceivably, many of the southeastern US ports, which would be serviced by feeder vessels under a hub-and-spoke operation, currently have sufficient channel dimensions and landside infrastructure to support the role of a local port in a hub-and-spoke operation.

Although a hub-and-spoke operation may be intuitively pleasing, there are a number of factors which make such an operation, and the development of a southeastern US regional container port, infeasible. These factors include:

- The projected future volume of TEUs which would be handled at southeastern US ports is extremely large and exceeds the total capacity of any of the major US east coast ports;
- USACE participation in planning and constructing a Regional Port would require Congressional authorization and a non-Federal sponsor;
- The lack of a centralized planning jurisdiction which would encourage development of a Regional Port and discourage competitive development of local ports; and
- Local port planning and development is already underway which would make a Regional Port redundant.

In 2006, the major southeastern US container ports handled 6.9 million TEUs. In ten years time, at an assumed annual growth rate of 6%, that volume will nearly double to 17 million TEUs. Using the 2006 Savannah Harbor market share analysis conducted by GPA as a guide, approximately 60% of all TEUs in the ports range are on liner services which would benefit from a deeper channel. In order for this additional volume to be handled by a Regional Port, that port would need to have a throughput capacity of approximately 5 million TEUs in 2016, which is twice the size of Savannah Harbor's current TEU throughput and one million TEUs greater than the current throughput of the nation's third largest container port (New York/New Jersey). In 20 years time, a US regional southeastern Regional Port would need sufficient capacity for 12 million TEUs, which is approximately the 2006 total TEU volume of the nation's two largest container ports (Long Beach and Los Angeles). There is currently no precedent for the construction of a new port of that size, which would necessarily also include extensive landside transportation infrastructure to transship the TEU volumes. In 50 year's time, even more container throughput capacity would be required.

A recent analysis (Economic Appendix, Attachment I: Regional Port Analysis, 2007) assessed the expansion potential of existing southeastern US container ports to see if any single port could reasonably expand to the capacity necessary for a southeastern US Regional Port. The analysis concluded that there was no existing port that could expand container throughput capacity sufficiently to handle the future TEU volume growth projected for the major southeast US container ports. In addition, there are no prospective future port locations which have been identified or proposed which would have the TEU capacity required of a southeastern US Regional Port.

The likelihood of a regional southeastern US hub container port is further reduced by historic and existing port and container terminal development protocols used in the United States. There is no central planning entity which has the jurisdiction to encourage the development of a container port in one location and discourage development of a competitive port in another location.

Container port and terminal development are typically based on perceived local needs and some combination of local public and private funding. Federal involvement is limited to the improvement of publicly available general navigation features (GNF), such as channels and turning basins. While significant, the cost of GNF represents only a minor portion of total port development costs. The extent of the general navigation feature improvement is largely dependent on locally or privately funded port and terminal development and on the commitment of a non-Federal partner to share the costs of the proposed general navigation feature improvement. Port and terminal development is not initiated by the Federal Government. Under existing guidelines and regulations, the Federal Government may only be a partner in the improvement of general navigation features. Local agencies fund port and terminal development.

A third deterrent to the development of a regional southeastern US container port is that local port development initiatives are already underway to address projected future growth in southeastern TEU volumes. The implementation of planned port development projects in the southeastern US would make much of the capacity of a proposed Regional Port redundant, at least for the foreseeable future. Ongoing container port and terminal development in Savannah, Charleston, Norfolk (two terminals), Jacksonville (two terminals), and Wilmington, North Carolina will increase the region's TEU handling capacity by more than 12 million TEUs over the next ten years. Additional container terminals are also being considered which haven't yet progressed beyond conceptual planning and are not included in the ports mentioned above, such as container terminal development at Jasper County on the Savannah River.

Overall, a southeastern US regional hub port has a very low potential for future development because of the large TEU capacity it would require in order to be an effective Regional Port. The large TEU handling capacity would incur large capital outlays and local resource impacts, which would likely be unacceptable. Institutional conditions favor localized port development over regional development, which further decreases the potential for development of a Regional Port. This structural alternative was not carried forward for more detailed analysis.

6.10 Other Channel Modifications (Structural Alternatives)

6.10.1 Meeting Areas

The need for meeting areas was expressed by the Savannah Harbor Pilots subsequent to the preliminary channel design. Meeting areas provide areas for the design vessels to be able to meet in transit to avoid delays that would otherwise be incurred if a vessel had to either wait in the entrance channel or at a dock until a design vessel had exited the channel. For Savannah Harbor, all "passing" lanes are defined as meeting areas. "Passing" is typically defined as ships overtaking each other. "Passing" in this sense is not practiced in Savannah Harbor; therefore, any subsequent reference to

"passing" shall be understood as meeting.

The current design of the Savannah Harbor navigation channel (500-foot minimum width) does not provide sufficient width to accommodate two-way traffic of post-Panamax vessels at any time in the tidal cycle. According to the Harbor Pilots, it is necessary to have fifty feet of clearance between the edge of the navigation channel and the container vessel and one hundred and fifty feet of clearance (the width of another post Panamax vessel) between passing vessels. Adding the width of the vessels and the required clearance shows a minimum required channel width of 514 feet (50+ 132+ 150+ 132+50). If the channel were to be deepened on existing side slopes, as has been proposed, then the minimum width of the channel at its deepest point would be 464 feet with a 48-foot channel, and slightly narrower with each shallower depth alternative.

The addition of an appropriately sized meeting area (a widening of the navigation channel to 600 feet for approximately 6,000 feet) would allow two post-Panamax vessels to meet, as well as the meeting of a post-Panamax and Panamax vessel. The addition of a smaller meeting area could allow meeting of a post-Panamax and Panamax vessel, but would not facilitate the meeting of two post-Panamax vessels in the harbor.

Design trends for the World fleet show a continued growth in the size of individual container vessels over time. The increase in the proportion of these larger vessels in the world fleet and the probability of some of these larger vessels calling on the harbor in the future suggests the need to examine a mid-harbor meeting area. Effective channel design must support the projected fleet, which includes regularly scheduled Post-Panamax vessel calls.

During the beginning stages of the SHEP navigation study, the Pilots initially suggested the Long Island Range (Station 16+500 to 19+500) as a long straight reach that would be appropriate. During the simulation runs, the pilots typically met in the Fort Jackson range using a widened potion of the design channel as a meeting area. As a result, Pilots requested, and the navigation study recommended that the Oglethorpe Range (Station 55+000 to 58+000) be considered as a meeting area being centrally located on a long straight reach.

In a subsequent meeting with the pilots, a need was expressed for a meeting area across from the CITGO dock as pilots experienced delays when vessels are anchored at the CITGO dock. Initial design was a meeting area that ran through Marsh Island Turning Basin (Station 89+134 to 92.000). This area was eventually removed from consideration as attempts to provide more adequate length for a meeting area produced considerable upland taking of real estate.

An incremental analysis of these potential meeting areas is presented in Chapter 11.1: Net Benefits of Alternative Plans.

6.10.2 Bend Wideners

Ship Simulation studies were performed using the Design Vessel, *Susan Maersk*. This vessel is an 8,200 TEU, post-Panamax class container ship launched in 1997. It has a beam of 140 feet, a length overall 1,138 feet, and a design draft: 47.6 feet. The Ship Simulation Report identified ten areas where potential bend wideners could be included in channel design (Table 6-6). Three bend wideners were identified in the ship simulation modeling as being needed to allow safe transit of the Design Vessel. Therefore, the three bend wideners are included in the final channel designs advanced to detailed analyses. Note that widening at the Fort Jackson range occurs on the north side and the south side of the channel.

Table 6-6: Ship Simulation Results: Bend Widening

Range Number	Range/Reach Name	Approximate Station	Simulation Results
0A	Tybee/Bloody Pt.	-41+000 to -38+000	No widening
1A, 2, 2A	Jones Island	-23+000 to -14+000	Widen to the north
6	New Channel/Long Island Crossing	9+500 to 11+500	No widening
9	Lower flats	27+500 to 31+500	Widen to the north
10 to 19	Upper Flats/Bight	31+000 to 49+500	No widening
20	Ft. Jackson	49+500 to 52+500	Widen to the south
20 & 21	Ft. Jackson & Transition	52+500 to 55+000	Widen to the north
24 & 25	Wrecks Channel	65+000 to 66+500	No widening
25,26,27	Wrecks Channel/City Front	69+000 to 71+500	No widening
31	City Front/Marsh Island	76+000 to 78+000	No widening
34 & 35	Marsh Island Turning Basin	87+500 to 90+000	No widening

6.10.3 Straightening of the River

The Harbor Pilots did not identify any portion of the channel where straightening would markedly increase the efficiency of transit. Additionally, Savannah District design staff did not identify a specific area that imposes an undue degree of difficulty in vessel handling necessitating a major straightening of the river. Therefore, this minor modification was not included as a component of alternative channel designs.

6.10.4 Turning Basin Expansion

King's Island Turning Basin adjacent to Garden City Terminal was designed for a 4,000 TEU capacity container ship with a 960-foot length overall. The Design Vessel, the *Susan Maersk*, is an 8,200 TEU vessel with a 1,138-foot length overall. All container ships calling at Garden City Terminal use the King's Island Turning Basin; therefore, turning basin expansion will be included as a component of alternative plans.

6.11 Development of Alternative Plans

An assessment was conducted of non-structural measures (underkeel clearance and modifications to the Garden City Terminal), and structural measures (alternative terminal locations, offshore transshipment facility, passing areas, bend wideners, and straightening of the river). Although the conclusions for those evaluations were included at the end of each separate section, they are summarized here to aid the reader in understanding the rationale for the decisions that the team reached.

Modification to the underkeel clearances used in the harbor was not be pursued in detail as a means of increasing vessel transit efficiency, because the Harbor Pilots do not believe they could operate safely with less clearance. The guidelines used by the Pilots comply with channel design and safety criteria, so there was no need to pursue this feature further.

GPA regularly improves the facilities at the Garden City Terminal, increasing its container throughput capacity. The Ports Authority has several improvements in various stages of planning and indicates it will continue to add to the capacity of that facility as the traffic levels increase. Based on the schedule of improvements already identified and actions the Ports Authority has taken to allow it to expand the capacity of the site even further in the future, additional improvements at Garden City Terminal beyond what will occur under the without project condition are not warranted as part of this project.

Based on the assessment of the alternate terminal locations, the Garden City Terminal is the most economically feasible location to which a channel deepening should be considered. Although dredging costs would be lower to most of the other sites considered, the total costs, including dredging, site development, and transportation corridor costs, would be higher. All the other locations would be more costly methods of serving the expected growth in container volumes. In addition, the expected reduction in environmental impacts with the alternate locations would be lower, when all the effects of developing the alternate site are included. In addition, an effective Regional Port would not be technically or institutionally feasible. There are no existing or planned US east coast ports which could handle the large volume of TEUs which would be handled at a Regional Port, and there is no governing authority which would support development of a Regional Port.

Passing (meeting) areas was included in the alternative plans and was assessed as a component of the incremental cost analysis. This feature is needed to address the effects that the design vessel will have on traffic movements in the interior portion of Savannah Harbor. Under future conditions, Post-Panamax vessels are projected to call regularly at Savannah Harbor. They will likely have an adverse effect on the movement of other vessels transiting the harbor. That effect will be more pronounced for plans which deepen the channel on the existing side slopes. The Harbor Pilots identified the potential locations of two passing areas in the interior portion of the harbor.

Channel design criteria indicate the need to include bend wideners to accommodate the larger design vessel. This need was supported by the Ship Simulation Study. Therefore, the three bend wideners identified as being needed for safe transit of the Design Vessel will be included as features of the alternative channel designs.

No new navigation aids were deemed to be needed to enhance the efficiency of vessel transits through the inner harbor. However, the detailed design of the deeper channel will include an analysis of whether additional buoys or range markers will be needed to mark the deeper channel, and whether the existing aids need to be moved to accommodate the new channel. There will be additional buoys placed on the Entrance Channel extension from Station -60+000 to -98+600B.

Neither vessel traffic coordination nor major straightening of the river was found to be needed, so they were not be included in the final channel design.

No channel modifications features were identified as being needed at this time to enhance Homeland Security. Inbound vessels are presently required to provide 96-hour advance notice, including a manifest of the cargo and crew. The Harbor Pilots already board the vessels offshore, before the vessels reach the coastline. Therefore, a separate boarding area is not considered needed. The final channel design will not contain any features to enhance Homeland Security.

All vessels calling at the Garden City Terminal presently use the Kings Island Turning Basin. It is the largest turning basin in the harbor and is located at the upstream end of the Garden City Terminal. The Hydraulic Design Manual of Deep-Draft Navigation Projects (EM 1110-2-1613) and the project design vessel, the *Susan Maersk*, were used to determine the size to which the Kings Island Turning Basin (KITB) had to be enlarged to accommodate PPX2 vessels. This evaluation indicated that the KITB would need to be enlarged to 1,600 feet long by 1,600 feet wide. The KITB was the only turning basin considered as part of the SHEP. It is the only turning basin within close proximity to GPA's Garden City Terminal where the vast majority of the containerships go. This expansion will be included in the alternative channel designs.

The Sediment Basin is a component of the Sediment Control Works of Savannah Harbor. The Basin is a quiescent area that collects sediments at a relatively high rate. The location of the Basin adjacent to large confined dredged sediment placement facilities allows for sediments to be removed from that location at a lower cost than elsewhere in the harbor. Although originally designed to be at a depth equal to the navigation channel, the Basin was not deepened as part of the 1993/1994 harbor deepening, and it is now 4 feet shallower than the authorized navigation channel. Because of that difference in depth, there was a question as to whether or not the difference in depth between the Sediment Basin (38 feet) and the existing channel (42 ft) was responsible for the decrease in efficiency of the Sediment Basin (approximately 60%).

Further investigations found that the sediment shoaling material in the Sediment Basin was suspended sediment and that the depth difference between the channel and the Basin was not the major controlling factor for Sediment Basin shoaling. The change in shoaling conditions between the periods 1981 – 1985 to 1997 – 2004 was mainly due to an increase in ebb flow velocities which control the depth to which the basin shoals.

After conducting a conceptual level assessment of the effects of further channel deepening, the team agreed to leave the Sediment Basin at its present depth and not deepen that facility as part of this project. Later studies indicated the need to construct a berm near the throat of the Sediment Basin as part of the project's mitigation plan. This would allow the Sediment Basin to gradually fill in with sediment and restrict the flow of more saline water from Front River into Back River. While this would help reduce salinity levels in Back River, it would effectively remove the benefits of the Sediment Basin with respect to sediment trapping and removal. Consequently, any expected increases in yearly channel maintenance costs will be included in the economic analysis of the proposed alternatives.

6.12 Description of Alternative Plans

6.12.1 Plan A – No Action

In this plan, no improvements would be made to the existing Savannah Harbor Federal Navigation Project. This is equivalent to the without-project condition. The navigation channel would remain at its presently authorized 42-foot depth in the inner harbor and 44- foot depth in the entrance channel. This plan will serve as the basis for comparison of the expected project impacts. It will comprise the environmental and economic conditions that are expected to occur over the 50-year period of analysis. The analysis will include an identification of the type and volume of commodities that are expected to pass through Savannah Harbor if no harbor improvements are implemented. The size and number of vessels that will transport those commodities through the harbor will be identified. Expected changes in the environmental setting will also be identified.

6.12.2 Plan B – Channel Deepening Alternatives

This plan will include several levels of harbor deepening so that an incremental analysis can be performed, as well as an overall determination of the justification of this proposed action. The plan will include several scales, ranging from a 44-foot to a 48-foot channel depth.

- Plan B-44: a 2-foot channel deepening
- Plan B-45: a 3-foot deepening
- Plan B-46: a 4-foot channel deepening
- Plan B-47: a 5-foot deepening
- Plan B-48: a 6-foot channel deepening

The above deepening plans were evaluated with respect to the following channel components:

- **Length of Inner Harbor Channel Deepening:** All alternatives considered would involve deepening the inner harbor channel from the ocean (Station 0+000) to Station 103+000, plus an upstream transition;
- **Channel Width:** Maintain existing side slopes. The existing inner harbor channel is 500 feet wide. The bottom width for the deepened inner harbor would range from 488 feet for the 44-foot project to 464 feet for the 48-foot project. The existing entrance channel width is 600 feet. The bottom width of the deepened entrance channel would range from 588 feet for the 44-foot project to 564 feet for the 48-foot project.
- **Entrance Channel Extension:** The length of the entrance channel extension varies with each project depth and ranges from a 35,682 foot extension for the 44-foot project to 38,600 for the 48-foot project.
- **Turning Basins:** Deepen and enlarge Kings Island Turning Basin to 1,600 feet x 1,600 feet;
- **Bend Wideners**: Use the three bend wideners identified as necessary by the Ship Simulation Study; and
- **Meeting Areas:** Use the three alternative meeting area alternatives incrementally evaluated in the Ship Simulation Study:
    - Long Island meeting area – 8,000 foot meeting area located from approximately Station 14+000 to Station 22+000;
    - Oglethorpe meeting area – 4,000 foot meeting area located from approximately Station 55+000 to Station 59+000;
    - Combination of both Long Island and Oglethorpe meeting areas.

Savannah District used the hydrodynamic and water quality models to identify many of the impacts to natural resources from the proposed project alternatives. These included impacts to salinity, water quality, wetlands, and fisheries. Impacts to other resources were evaluated using separate analyses. Those evaluations included potential impacts to the drinking water aquifer, the City of Savannah's raw water intake at Abercorn Creek, adjacent ocean beaches, riverine shorelines, and air quality.

After the expected impacts to these resources were identified, the Savannah District used the hydrodynamic and water quality models and other assessment tools to evaluate ways to reduce those impacts. A flow re-rerouting plan was developed for each depth alternative that minimized impacts to freshwater tidal wetlands, the resource which the agencies identified as being most at risk from this project, as well as fisheries habitat. The study team decided to adopt the findings of a separate study which identified injection of oxygen as being the best method to remove the incremental effects of the SHEP on dissolved oxygen levels in the harbor.

Using the selected flow-re-routing plans, the water quality model was rerun to determine whether changes would be required to the preliminary design of the oxygen injection systems. Changes were found to be needed, and those changes were included when the models were rerun to identify the remaining impacts to fishery resources.

This iterative modeling revealed that the proposed mitigation features (flow-altering plans and oxygen injection systems) would substantially reduce project impacts to freshwater wetlands, the dissolved oxygen regime, and fisheries habitat. Chapter 8: Alternative Plan Evaluation: Environmental Impacts identifies and discusses the impacts of the depth alternatives after avoiding and reducing project impacts. Substantial adverse impacts would remain to freshwater wetlands, Shortnose sturgeon habitat, and Striped bass habitat even with the flow rerouting plan and the injection of oxygen. Because of those remaining impacts, additional mitigation is appropriate. Those actions are the third step in the mitigation planning process, which are described in detail in Chapter 9: Alternative Plan Evaluation: Mitigation Planning.

7 Alternative Plan Evaluation: Benefits

The NED Procedures Manual Deep Draft Navigation (IWR Report 10-R-4) presents three general examples of NED navigation project benefits, which are based on the conceptual basis for navigation benefits identified in the Principles and Guidelines (1983). The NED Procedures Manual states as examples of navigation benefits (page 11):

"Reduced cost of transportation through use of vessels (modal shift), through safer or more efficient operation of vessels and/or use of larger more efficient vessels (channel enlargement), and through use of new or alternative vessel routes (new channels or port shift)."

The with-project condition transportation cost savings calculated in this analysis are in concurrence with this example presented in the NED Procedures Manual. With-project condition container ship transportation cost savings are based on safer and more efficient operation of container ships resulting from channel enlargement (widening and deepening). The Principle and Guidelines (1983) require that cargo transportation costs include the full origin to destination costs (sec. 2.7.4 (f) Deep-Draft Navigation Evaluation Procedure). The Principles and Guidelines further explain that factors to be considered in the analysis of transportation costs include "available service and schedules, carrier connections, and institutional conditions".

The benefits evaluation includes benefits from channel deepening alternatives based on transportation cost efficiencies and reduced tide-delays. Benefits are also evaluated for construction of meeting areas, which are based on reduced channel congestion delays. Alternative deepening plans are evaluated for one-foot increments of depth from -44 feet MLLW to -48 feet MLLW. Alternative meeting areas, including Long Island and Oglethorpe, are evaluated at the same one-foot depth increments.

7.1 Transportation Cost Savings Model Benefits

NED benefits were estimated by calculating the reduction in transportation cost for each project depth. Channel deepening reduces transportation cost by allowing a more efficient future fleet mix. As the Savannah Harbor channel is deepened, the reliability of the channel depth increases. The increased reliability is expected to encourage carriers to assign more of their large vessels to Savannah route services.

There are three primary impacts from channel deepening that cause changes in the future fleet at Savannah. The first is increases in a vessel's maximum practicable loading capacity[13]. Channel restrictions limit a vessels capacity by limiting its draft. Deepening the channel reduces this constraint, and the vessel's maximum practicable capacity increases towards its design capacity. This increase in vessel capacity results in fewer vessel trips being required to transport the forecasted cargo. The second impact of increased channel depth is the increased reliability of water depth, which encourages the deployment of larger vessels to Savannah. The third impact is a consequence of the second. The increase in Post-Panamax vessels displaces the less economically efficient Panamax class vessels.

Forecasted commodities were allocated to the future fleet in the following manner. First, a share of future tonnage was allocated to the sub-Panamax vessel class. As this fleet was not constrained by the existing depth (the maximum design draft was less than 35 feet), additional project depth would not affect the future fleet for this class of vessels and market. The allocation of future traffic to this vessel class was based on its historical share at Savannah and with an expected drop in sub-Panamax vessel class capacity of approximately 33 percent between now and 2015. The allocation varies by route and overall accounts for a small percentage of the forecasted traffic.

The second allocation was to the forecasted Post-Panamax container fleet. The transportation cost saving model does not explicitly account for vessel sailing drafts. Rather, based on historical data, the share of a vessel's capacity that is used to load and off load cargo at Savannah was calculated for the existing Panamax class fleet for each trade route. This historical share of vessel capacity was applied to the maximum practicable vessel capacity of the forecasted Post-Panamax vessels to estimate tonnage carried per call for the Post-Panamax fleet by project depth. These average tonnages per trip were then multiplied by the forecasted number of trips for each Post-Panamax vessel fleet in order to calculate the share of the forecasted tonnages carried by this vessel class. The remaining, unallocated forecasted cargo was then assigned to the Panamax class fleet.

The basic transportation cost model computes the costs per thousand miles for the forecasted vessel calls for the without and with project condition. The savings in costs between the without and with project condition make up the transportation cost savings benefits per thousand miles. The total trade route distance is then determined based on the weighted average origin-to-destination distances. It should be noted that

[13] The practicable loading capacity is more fully explained in the "Load Factor Analysis" section.

improvements at Savannah Harbor which result in fewer container vessel trips to the port does not necessarily translate into similar reductions in vessel trips for the entire trades routes that service Savannah Harbor. Port rotations are constantly changing. Therefore, to estimate actual transportation cost savings attributable to changes at Savannah Harbor, the amount of total round trip vessel cost savings is multiplied by the share of vessels calling at Savannah. In essence, the voyage cost is "allocated" based on Savannah's share of all vessels calling at Savannah.

To determine how much "weight" or vessel cost "allocation" to attribute to Savannah Harbor improvements, the study team first examined Savannah's historical share of cargo for each trade route, specifically the 2005/2007 cargo plus weight of all laden and empty boxes. The historical data for vessel calls at Savannah provided information as to number of TEUs and cargo weight, expressed in tons, of laden TEUs off loaded (Inbound/Import) and on loaded (Outbound/Export) at Savannah, but it unfortunately did not include total number of TEUs or weight (tons) carried on the vessels when they sailed in and out of Savannah. In addition, the historical data did not include total TEUs or weight of cargo on the entire trade route. Therefore, to estimate Savannah's share of trade route cargo, the study team needed to use proxies derived from the Load Factor Analysis (LFA) and the analysis of sailing draft relative to design draft. The total tonnage is imputed by using the total carriage weight from the LFA for each vessel by sailing draft relative to design draft from the historical calls.

Table 7-1 shows the weighted average estimated Savannah share of trade route cargo carried by Panamax ships on each trade route:

Table 7-1: Savannah Share of Voyage Cost

Service Route	Cargo Share	Route Service Distance	Savannah Proportion
FE (Panama) ECUS	24.48%	22,653	5,572
FE (Suez) ECUS	32.45%	24,196	7,852
FE ECUS EU	20.21%	31,356	6,337
FE ECUS MED	20.38%	34,321	6,994
AU ECUS EU	16.00%	28,526	4,564
ECUS AU PEN	15.99%	21,614	3,456
ECUS EU GULF PEN	9.40%	12,612	1,185
ECUS MED	15.31%	10,568	1,618
ECUS WCSA-ECSA	11.49%	11,701	1,344
RTW	11.86%	25,753	3,054

The total transportation cost savings benefits were estimated for a 50-year period of analysis for the years 2017 through 2066. Transportation cost savings were estimated using the TCSM for the years 2017, 2020, 2025 and 2030. Since Garden City terminal capacity of 6.5 million TEUs is expected to be reached by 2030, the transportation

cost savings were held constant beyond 2030. The present value was estimated by interpolating between the aforementioned dates and discounting at the current FY 2011 Federal Discount rate of 4.125 percent. Estimates were determined for each alternative project depth.

Benefits of channel deepening are defined as the reductions in transportation cost by project depth. Table 7-2 shows the average annual equivalent transportation cost savings by project depth by route service. The FE (Panama) ECUS, the FE ECUS EU PEN, and the FE ECUS MED PEN are all services that transit the Panama Canal. Combined with the FE (Suez) ECUS service, which transits the Suez Canal, these four trade route services comprise more than ninety percent of the total transportation cost savings. For the FE (Panama) ECUS world region service, the savings do not increase beyond a 45-foot project as the vessels on this route are generally expected to "cube" out by that depth due to relatively light cargo. On the FE ECUS EU PEN, savings do not increase beyond a 46-foot project depth. The FE (Suez) ECUS service, with its large make-up of heavier imports as well as a large forecasted contingent of Post-Panamax vessels, will continue to reap cost savings as the channel is deepened to 47 feet. For five services, transportation savings continue to accrue with a 47-project depth due to the fact that vessels are expected draft deeper and, at times, attain full design draft.

Table 7-3 shows the incremental average annual equivalent transportation cost savings by project and route service. The savings increase at a decreasing rate for each incremental project depth. There were small additional savings at 47 feet but no incremental savings beyond that depth.

Table 7-2: Average Annual Equivalent Transportation Cost Savings by Project Depth

Service Route	44 feet	45 feet	46 feet	47 feet	48 feet
FE (Panama) ECUS	$ 37,020,000	$46,520,000	$ 46,520,000	$46,520,000	$46,520,000
FE (Suez) ECUS	$ 31,670,000	$ 44,230,000	$53,560,000	$54,500,000	$54,500,000
FE ECUS EU PEN	$ 14,740,000	$19,900,000	$22,330,000	$ 22,330,000	$ 22,330,000
FE ECUS MED PEN	$ 10,720,000	$16,340,000	$ 20,210,000	$ 22,700,000	$ 22,700,000
AU ECUS EU PEN	$0	$0	$0	$0	$0
ECUS AU PEN	$0	$0	$0	$0	$0
ECUS EU GULF PEN	$ 600,000	$ 910,000	$1,150,000	$ 1,330,000	$ 1,330,000
ECUS MED	$ 550,000	$ 830,000	$1,050,000	$ 1,220,000	$ 1,220,000
ECUS WCSA-ECSA	$0	$0	$0	$0	$0
RTW	$ 2,910,000	$4,420,000	$5,560,000	$ 6,450,000	$ 6,450,000
Total AAE* Benefits	$ 98,210,000	$133,150,000	$150,370,000	$155,050,000	$155,050,000

*Average Annual Equivalent

Note: Transportation benefits are updated to 2012 values in Section 14 Selected Plan

Table 7-3: Incremental Transportation Cost Savings by Project Depth

Service Route	44 feet	45 feet	46 feet	47 feet	48 feet
FE (Panama) ECUS	$ 37,020,000	$9,500,000	$0	$0	$0
FE (Suez) ECUS	$31,670,000	$12,560,000	$ 9,330,000	$ 950,000	$0
FE ECUS EU PEN	$14,740,000	$ 5,170,000	$2,430,000	$0	$0
FE ECUS MED PEN	$10,720,000	$5,620,000	$3,870,000	$2,490,000	$0
AU ECUS EU PEN	$0	$0	$0	$0	$0
ECUS AU PEN	$0	$0	$0	$0	$0
ECUS EU GULF PEN	$ 600,000	$310,000	$ 230,000	$180,000	$0
ECUS MED	$ 550,000	$ 290,000	$220,000	$170,000	$0
ECUS WCSA-ECSA	$0	$0	$0	$0	$0
RTW	$ 2,910,000	$1,500,000	$ 1,150,000	$ 890,000	$0
Total AAE Benefits	$ 98,210,000	$34,940,000	$ 17,220,000	$ 4,680,000	$0

Note that incremental values may be affected by rounding
Note: Benefits are updated to 2012 values in Section 14 Selected Plan

7.2 Meeting Area and Tide Delay Benefits

Meeting area and tide delay benefits are based on the reduction in transit time required to navigate Savannah Harbor as a result of channel modifications, which reduce congestion within the harbor. Transportation cost savings were estimated in terms of the reduction in harbor transit times and consequent vessel delays. Transit costs were estimated by analyzing conditions that are most likely to occur in the absence of channel deepening or meeting area (without-project conditions) and compare those results to the transit times/costs that were derived when including the channel deepening and meeting area alternatives. The economic benefits were determined using the HarborSym model.

HarborSym is a Monte Carlo simulation model of vessel movements at a port which is based on transit rules on the waterway. HarborSym represents a port as a tree-structured network of reaches, docks, anchorages, and turning areas. Vessel movements are simulated along the reaches, moving from the bar to one or more docks, and then exiting the port. Features of the model include intra-harbor vessel movements, tidal influence, and incorporation of turning areas and anchorages. The driving parameter for the HarborSym model is a vessel call at the port. A HarborSym analysis revolves around the factors that characterize or affect a vessel movement within the harbor.

7.2.1 Meeting Area Benefits

For the future without-project condition at Savannah Harbor, the current channel alignment is considered to be the existing condition for each channel depth being modeled for the deepening study. Given current channel dimensions (500 foot width), two Post-Panamax vessels are not allowed to meet (pass or overtake) while transiting the harbor. As a result, a Post-Panamax vessel exiting the harbor would cause a transit

delay for an arriving Post-Panamax vessel. This would also occur for the reverse scenario. All other vessel classes in the system are allowed to pass/overtake while transiting the harbor with the exception of a loaded Liquid Natural Gas (LNG) vessel. When an LNG vessel enters the system, all other vessels are restrained until it has reached its dock. The purpose of this HarborSym analysis is to determine if the inclusion of a meeting area(s) would decrease time delays associated with Post-Panamax vessels transiting the harbor. For this reason, the HarborSym model was run at each potential depth. The without-project transit times/costs were compared to the transit times and costs for meeting area alternatives, which consist of two separate meeting areas and a combination of the two.

The Long Island meeting area alternative consists of an 8,000 foot Meeting Area located from approximately Station 14 to 22 (Corps of Engineers Annual Survey data 1996). This alternative has 1,000 foot transitions and provides for an additional width of 100 feet, making this channel segment 600 feet wide. This alternative is located closest to the entrance of the Savannah River System. The Long Island meeting area would allow two Post-Panamax vessels to pass once inside the harbor channel, thus decreasing the voyage time/cost for this vessel class.

The Oglethorpe meeting area consists of a 4,000 foot Meeting Area located from approximately Station 55 to 59 (Corps of Engineers Annual Survey data). This alternative has 1,000-foot transitions and provides for an additional width of 100 feet. The location is approximately one mile upstream from the Elba Island LNG terminal. The Oglethorpe meeting area would expand the width of the channel to 600 feet and would allow for two Post-Panamax vessels to pass once inside the harbor channel, thus decreasing the voyage time/cost for this vessel class.

The Long Island – Oglethorpe Alternative is the inclusion of both meeting areas within the Savannah River System. Post-Panamax vessels would be allowed to pass in both locations.

The fleet of vessels calling at Savannah Harbor and the number of vessel calls includes the containership fleet, the LNG fleet, and the general cargo fleet. The container ship fleet, number of vessel calls, and operating drafts are identical to that used for the transportation cost savings model. The LNG fleet is based on historical LNG vessel movements within the harbor and planned improvements at the Elba Island LNG Terminal.

During the base year, the LNG terminal is anticipated to initially operate at 60 percent capacity, increasing linearly throughout the project life to 80 percent capacity by 2030. The fleet was held constant from 2030 till the end of the period of analysis. Note, at 100 percent capacity, the possible number of calls could reach approximately 200. These vessels take approximately 4 hours round trip to transit the harbor channel and spend on average 24 to 30 hours at the dock, depending on the size of the vessel. Table 7-4 displays the annual number of calls forecast each year and the size of each vessel class.

Table 7-4: LNG Vessel Fleet (bcm) (2015-2030)

Year	Total Vessels	BU SAMRA 266,000 17.4%	AL HUWAILA 217,000 12.7%	MERSK ARWA 165,500 23.9%	LUSAIL 145,000 23.5%	BRITISH TRADER 135,000 22.5%
2017	126	22	16	30	30	28
2020	136	24	17	32	32	30
2025	151	26	19	36	35	34
2030	167	29	21	40	39	37

The General Cargo vessel class will not benefit from channel modification at Savannah Harbor (i.e., deepening nor the addition of meeting areas); however, determining the annual number of general cargo vessels calling Savannah Harbor was critical for properly assessing harbor congestion. Any vessel not identified as a container or LNG vessel was included in this vessel class.

Using Waterborne Commerce data provided for the years 2001 through 2008, a growth rate was estimated for forecasting the number of General Cargo vessels. The average annual growth for this period was 3.6 percent. Using Georgia Ports Authority data for 2006, an annual vessel fleet was determined for the base year of the project, 2017, and for every five year increment until 2030 (Table 7-5). The forecast was then held constant through the end of the period of analysis. The fleet for each future year was then distributed to the general cargo docks in the same percentages as the 2006 vessel fleet.

Table 7-5: General Cargo Fleet – Annual Vessel Calls (2017-2030)

Year	Vessels
2017	1,867
2020	2,068
2025	2,468
2030	2,946

Container ship operating drafts are based on the drafts developed in the transportation cost savings model. LNG vessel operating drafts were developed through discussion with the Bar Pilots and an assessment of historical data. All LNG vessel calls were modeled at a 40-foot operating draft. Containership operating costs used in the meeting area analysis are the same as the operating costs used in the transportation cost savings model. LNG vessel operating costs were developed specifically for the analysis.

Using the output data for transit costs provided by HarborSym, annual benefits were determined for each meeting area alternative at each project depth. The values provided for the model run years were interpolated to attain benefits for the years between, remaining constant after 2030 when TEU capacity is forecasted to be reached. Average annual meeting area benefits were developed using the Federal

Discount Rate for FY11 of 4.125%, and a 50 year project life. Table 7-6 displays the average annual benefits, rounded to the nearest ten thousand, for each Meeting Area alternative at each project depth.

Table 7-6: Meeting Area Average Annual Benefits

Average Annual Benefits			
	Long Island	**Oglethorpe**	**Long Island/Oglethorpe**
44 Foot Depth	$400,000	$385,000	$717,000
45 Foot Depth	$401,000	$387,000	$722,000
46 Foot Depth	$407,000	$393,000	$731,000
47 Foot Depth	$450,000	$387,000	$730,000
48 Foot Depth	$424,000	$373,000	$723,000

Note: Benefits are updated to 2012 values in Section 14 Selected Plan

7.2.2 Tide Delay Reduction Benefits

Tide benefits were estimated as the reduction in the average tide delay cost of a vessel class and calculated by comparing the existing condition of -42 feet with the alternative project depths (-44, -45, -46, -47, and -48 feet). Currently, due to underkeel requirements and vessel sailing drafts, there is a portion of the annual fleet that cannot transit the Savannah Harbor River System without tidal assistance. With additional channel depth, the transit restrictions are decreased allowing the vessel to call on the harbor with fewer delays.

The tide delay benefit analysis was performed by evaluating the anticipated vessel fleet at each proposed project depth and the projected sailing draft distribution at that depth. Underkeel clearances used in the benefits analysis include:

- Handy Size – 3.5 feet;
- Sub-Panamax – 3.75 feet;
- Panamax – 4.0 feet;
- Post-Panamax Generation 1 – 4.2 feet; and
- Post-Panamax Generation 2 – 4.3 feet.

These underkeel clearances are consistent with current vessel clearances required by the Harbor Pilots.

Benefits were derived by calculating the difference in the average vessel transit costs for each impacted vessel class for the without-project condition (-42 feet MLLW) and each of the alternative deepening alternatives (-44 feet through -48 feet MLLW) A -43-foot project was not evaluated since -43 feet MLLW was not an alternative evaluated for deepening benefits.

The HarborSym model was used to calculate tide delay benefits, which would result from the reduction in tide delay times, for each channel deepening alternative. Meeting areas were not included in the model runs to ensure that the benefits generated were due to additional depth only. The HarborSym model was run for each

of the five channel depth alternatives and the -42 foot project depth for the following years: 2017, 2020, 2025, and 2030. The average transit cost for the initial scenario run of each Panamax, Post-Panamax (Generation 1 and 2), and LNG vessel was determined and compared to the average transit cost in the system when an additional one foot of depth was added. Since all other inputs remain the same (Speed in Reach, Docking/Undocking Times, Loading Rates, etc…) benefits are calculated using the reduction in the average transit cost for each of the affected vessel. The vessel operating costs methodology is the same as that used in the Meeting Area analysis. The values provided for the model run years were then interpolated to attain benefits for the years between. Tide delay benefits were held constant from 2030 when port capacity is forecast to be reached (Table 7-7).

Table 7-7: Tide Delay Benefits

Year	42 to 44 Foot	44 to 45 Foot	45 to 46 Foot	46 to 47 Foot	47 to 48 Feet
2017	$ 1,036,564	$ 554,120	$ 450,832	$ 304,875	$ 186,724
2018	$ 1,080,214	$ 586,951	$ 510,291	$ 342,354	$ 233,941
2019	$ 1,123,863	$ 619,781	$ 569,750	$ 379,832	$ 281,158
2020	$ 1,167,512	$ 652,611	$ 629,208	$ 417,311	$ 328,375
2021	$ 1,221,220	$ 711,386	$ 668,777	$ 431,174	$ 358,815
2022	$ 1,274,929	$ 770,161	$ 708,346	$ 445,036	$ 389,256
2023	$ 1,328,637	$ 828,936	$ 747,915	$ 458,898	$ 419,696
2024	$ 1,382,346	$ 887,711	$ 787,484	$ 472,761	$ 450,137
2025	$ 1,436,054	$ 946,486	$ 827,053	$ 486,623	$ 480,577
2026	$ 1,452,883	$ 978,093	$ 833,076	$ 519,738	$ 499,960
2027	$ 1,469,713	$ 1,009,699	$ 839,099	$ 552,853	$ 519,343
2028	$ 1,486,542	$ 1,041,306	$ 845,122	$ 585,969	$ 538,725
2029	$ 1,503,371	$ 1,072,912	$ 851,145	$ 619,084	$ 558,108
2030	$ 1,520,200	$ 1,104,519	$ 857,168	$ 652,199	$ 577,490

Average annual tide delay reduction benefits were developed using the Federal Discount Rate for FY11 of 4.125% and a 50-year project life (Table 7-8).

Table 7-8: Average Annual Benefits - Tide Delay Reduction

Project Depth	Cumulative Benefits
42 to 44	$1,408,000
44 to 45	$2,366,000
45 to 46	$3,146,000
46 to 47	$3,702,000
47 to 48	$4,190,000

Note: Benefits are updated to 2012 values in Section 14 Selected Plan

7.2.3 Cumulative Benefits – Meeting Area and Tide Delay Reduction

Table 7-9 displays the benefits of both the Meeting Area and tide delay benefits. The numbers have been rounded.

Table 7-9: Cumulative Benefits – Meeting Areas and Tide Delay Reduction

Project Depth	Tide Benefits	Long Island	Total Benefits
42 to 44	$ 1,408,000	$ 400,000	$ 1,808,000
44 to 45	$ 2,366,000	$ 401,000	$ 2,767,000
45 to 46	$ 3,146,000	$ 407,000	$ 3,553,000
46 to 47	$ 3,702,000	$ 450,000	$ 4,152,000
47 to 48	$ 4,190,000	$ 424,000	$ 4,614,000
Project Depth	**Tide Benefits**	**Oglethorpe**	**Total Benefits**
42 to 44	$ 1,408,000	$ 385,000	$ 1,793,000
44 to 45	$ 2,366,000	$ 387,000	$ 2,753,000
45 to 46	$ 3,146,000	$ 393,000	$ 3,539,000
46 to 47	$ 3,702,000	$ 387,000	$ 4,089,000
47 to 48	$ 4,190,000	$ 373,000	$ 4,563,000
Project Depth	**Tide Benefits**	**Long Island/Oglethorpe**	**Total Benefits**
42 to 44	$ 1,408,000	$ 717,000	$ 2,125,000
44 to 45	$ 2,366,000	$ 722,000	$ 3,088,000
45 to 46	$ 3,146,000	$ 731,000	$ 3,877,000
46 to 47	$ 3,702,000	$ 730,000	$ 4,432,000
47 to 48	$ 4,190,000	$ 723,000	$ 4,913,000

7.3 Total Average Annual Equivalent Project Benefits

Table 7-10 presents the total average equivalent project benefits, including transportation cost savings, meeting areas, and tide delay reduction benefits.

Table 7-10: Total Average Annual Equivalent Incremental Deepening Benefits

Project Depth	Transportation Cost Savings	Tide Delay Benefits	Meeting Area Benefits	Total Project Benefits	Incremental Benefits
-44	$98,210,000	$1,408,000	$717,000	$100,335,000	
-45	$133,150,000	$2,366,000	$722,000	$136,238,000	$35,903,000
-46	$150,370,000	$3,146,000	$731,000	$154,247,000	$18,009,000
-47	$155,040,000	$3,702,000	$730,000	$159,472,000	$5,225,000
-48	$155,040,000	$4,190,000	$723,000	$159,953,000	$481,000

Note: Values discounted 50 years at 4.125%
Note: Benefits are updated to 2012 values in Section 14 Selected Plan

8 Alternative Plan Evaluation: Environmental Impacts

This plan has been formulated and evaluated in accordance with Council on Environmental Quality (CEQ) Regulations for Implementing NEPA (40 CFR 1500-1508), and the Corps' NEPA compliance requirements (US Army Corps of Engineers NEPA implementing regulations, 33 CFR Part 230 (which incorporate the Council on Environmental Quality Regulations for Implementing NEPA, 40 CFR 1500-1508)). The planning of USACE-sponsored and other Federal projects must ensure that project-related adverse environmental impacts have been avoided or minimized to the extent practicable and that remaining unavoidable significant adverse impacts are mitigated. USACE regulations require a Cost Effectiveness/Incremental Cost Analysis (CE/ICA) be performed to identify the most cost-effective mitigation plan.

The plan was developed as directed in the authorization for the project. This study was conducted under authority provided by the Congress of the United States pursuant to the Water Resources Development Act of 1999 (Public Law 106-53, Section 102(b)(9)). The wording of the authorization is as follows:

> The project authorized by subparagraph (A) may be carried out only after— (i) the Secretary, in consultation with affected Federal, State of Georgia, State of South Carolina, regional, and local entities, reviews and approves an environmental impact statement for the project that includes—
>
> (I) an analysis of the impacts of project depth alternatives ranging from 42 feet through 48 feet; and
>
> (II) a selected plan for navigation and an associated mitigation plan as required under section 906(a) of the Water Resources Development Act of 1986 (33 U.S.C. 2283(a)); and
>
> (III) the Secretary of the Interior, the Secretary of Commerce, the Administrator of the Environmental Protection Agency, and the Secretary approve the selected plan and determine that the associated mitigation plan adequately addresses the potential environmental impacts of the project.
>
> MITIGATION REQUIREMENTS- The mitigation plan shall be implemented before or concurrently with construction of the project.

Avoidance and minimization were pursued wherever that course of action presented itself as a feasible option. Avoidance and minimization efforts were integral to project planning and influenced channel design, dredged material placement locations, dredged material placement techniques, and mitigation plan formulation. The remaining unavoidable adverse impacts to ecological resources are addressed by the mitigation plan. Mitigation may include restoration, enhancement, creation, preservation, and compensation. Critical to the development of the mitigation plan is the identification of projected environmental impacts.

Analyses of potential environmental impacts commenced in the early phases of the General Re-Evaluation process and were one of the main focus areas as the study neared completion. The study process included both the Corps' NEPA compliance requirements and additional steps taken as a result of the conditional authorization of this project (WRDA 1999). The conditional authorization requires that the Secretary of the Interior, Secretary of Commerce, and Administrator of the Environmental Protection Agency, with the Secretary of the Army, approve the selected plan and determine that the associated mitigation plan adequately addresses the potential environmental impacts. Public involvement has been a major component of environmental impact assessment. The SEG, which includes concerned members of the general public and agency officials, was instrumental in identifying potential environmental impacts, identifying appropriate impact assessment tools and techniques, and identifying mitigation measures.

The environmental impact/mitigation planning process followed a general framework of:

- Impact avoidance;
- Impact assessment;
- Impact minimization;
- Identification of mitigation measures;
- Assessing mitigation measure effectiveness;
- Mitigation plan selection; and
- Monitoring and adaptive management.

The remainder of this chapter describes some of the key avoidance and impact assessment efforts conducted for this study.

8.1 Impact Avoidance

Three impact avoidance measures were identified and implemented in the project planning process. Impact avoidance measures include: modified channel design, dredged material placement location selection, dredged material placement technique selection, and mitigation plan design.

8.1.1 Modified Channel Design

Modification of typical navigation channel design is a major component of the impact avoidance measures developed in the study. Environmentally sensitive channel design for each of the alternative plans includes maintenance of the existing channel side slopes and extending them downward, thereby narrowing the channel slightly at each

alternative depth increment. More typically, channel design would maintain the existing bottom width and extend the side slopes outward. The channel cross section used for the Savannah Harbor deepening alternatives is shown in Figure 7-1. The major effect of this decision is a reduction in the amount of dredging and a reduction in disturbance to sediments adjacent to the upper slope of the existing channel. This avoidance measure also minimizes impacts to adjacent high ground and structures located along the riverbank. This design modification also reduces the effective width of the deepened navigation channel but not to an extent that impacts one-way navigation by the design vessel.

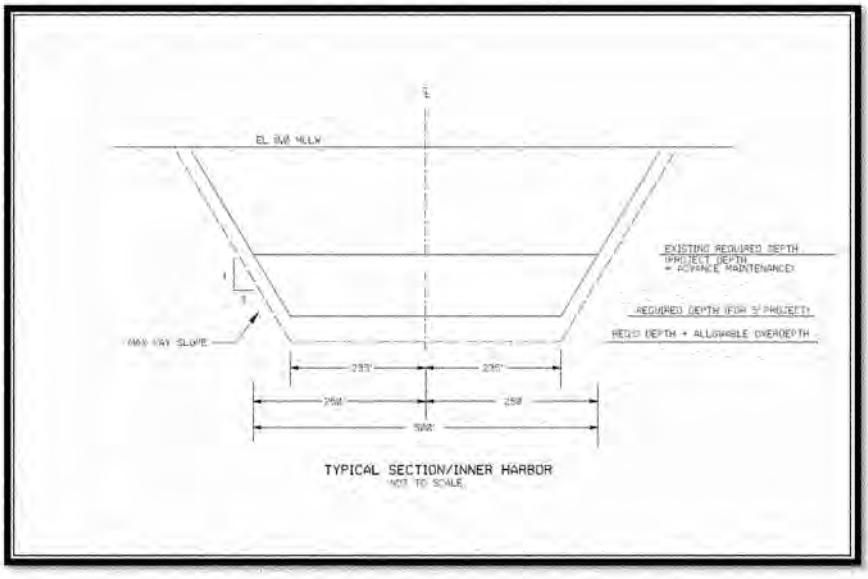


Figure 8-1: Typical Channel Cross Section

The Savannah District retained the ERDC to conduct a ship simulation study. That study is described in detail in the Engineering Appendix of the GRR. The study uses state-of-the-art computer models and Savannah Harbor ship pilots to identify how vessels would handle in various flow and weather conditions. The study identified the minimum size channel needed to safely pilot the design vessel through the harbor under a variety of weather conditions. This includes analysis of the width of the channel and required bend wideners. This study confirmed the need for most of the initial design features contained in the conditionally authorized plan (channel width, size of turning basin) but indicated that some bend wideners would not be necessary (see Table 6-6). These unnecessary bend wideners were removed from the alternative plans presented in this GRR. Minimizing channel dimensions, within the parameters

required for safe navigation, also avoids impacts associated from construction of unneeded features.

8.1.2 Dredged Material Placement Location Selection

Use of existing DMCAs, as opposed to creating one or more new DMCAs, avoids the environmental impacts associated with expanding the footprint of Savannah Harbor's existing network of containment areas. The Savannah Harbor Navigation Project has DMCAs that it has constructed over the years and uses on a regular basis (see Figure 1-2). Establishing a new DMCA is difficult in this harbor, and the adverse environmental impacts associated with a new area would likely be substantial and significant. Use of the existing sites requires coordination with ongoing operations and assessment of the effects of deposition of these sediments on the useful life of those DMCAs. Included in the project cost estimates is the cost of restoring lost O&M capacity due to deposition of new work materials.

8.1.3 Alternative Disposal Methods or Beneficial Use of Dredged Sediments

A number of alternative disposal methods or beneficial use of dredged sediments were evaluated, including nearshore placement and beach nourishment, creation of shorebird nesting habitat, restoration of the riverine shoreline, creation of tidal marsh and wetlands, production of bricks, capping of the cadmium-laden sediments, and use of material for future dike raisings. Beneficial use opportunities will be employed for a portion of the inner harbor dredged materials. Material from stations 67+000 to 80+125 and from 90+000 to 103+000 will be used as either capping material for cadmium-laden sediments in 14A/B or for future dike raising materials in 13A as detailed in the section below and in the Engineering Appendix Section 11.0. A discussion of the use of dredged materials for nearshore placement and beach renourishment is included later in this section. Other proposed beneficial uses of the inner harbor material that were considered as part of SHEP are detailed below:

- Using dredged material to create shorebird nesting habitat is a practice currently employed by the District. In accordance with past mitigation requirements, the District has created several "bird islands" within the existing DMCAs. When the DMCAs are maintained in a wet condition, these islands provide nesting and roosting habitat for shorebirds, including threatened and endangered species. Implementation of the proposed action will not affect this ongoing activity.

- To offset shoreline erosion, the Corps considered placement of dredged materials to restore and protect the riverine shoreline in the inner harbor. The Corps determined, however, that the size of the dredging equipment employed to remove the sediments could potentially cause adverse impacts (turbidity, destruction of habitat) if the sediments were pumped onto the riverbank in large quantities.

- Similar to shoreline restoration, the Corps evaluated using dredged materials to create tidal marsh or wetlands. The Corps determined that discharge of dredged material in open waters to create wetlands would result in adverse impacts to valuable fish and wildlife habitat in the inner harbor. Creation of such environments in the ocean is not cost effective, as the benefit of its construction would be offset by costs required to protect the created habitat from wave action.

- The non-Federal sponsor has funded studies to assess using dredged materials within the DMCAs to manufacture bricks. Should the non-Federal sponsor wish to pursue this option as beneficial use, then the Corps would support its implementation.

In light of the volume of new work sediments that would need to be removed to deepen the harbor and the limited window in which hopper dredges are allowed to work in Savannah, the Corps evaluated other equipment and placement options that could be used to reduce the total construction period and minimize new work dredging and deposition costs. Several alternative plans were considered, including beneficial uses of dredged sediments.

The Corps followed an iterative process to develop a plan for the new work entrance channel sediments. The work started with an engineering determination of sediment quantities to be removed at various channel depths and the composition (i.e., percent fines and percent sands) of those sediments. A review of previous information was conducted, including: the LTMS (USACE 1996); the Draft 2003 ERDC Report on Nearshore Placement at Tybee Island; and changes to the GA CZM Program that incorporate Georgia House of Representatives Bill 727 (HB 727).

The LTMS authorized placing maintenance sediments in feeder berm sites within the nearshore area off Tybee Island and adjacent to the entrance channel (see Figure 1-9). The LTMS also authorized placing maintenance sediments on eroded portions of Tybee Island.

Based on the sites designated and approved in the LTMS for the deposition of maintenance material into nearshore feeder berm sites, the 2003 ERDC Report refined the analyses identified several specific nearshore sites that would feed sediment to Tybee Island beach and dampen wave action on the coastline. The sites were identified in locations that would minimize subsequent migration of the sediments into the navigation channel.

The Corps then developed a sediment placement plan with cost identified as a priority criterion. The plan was reviewed from an environmental perspective with consultation from the Georgia Department of Natural Resources-Coastal Resources Division (GA DNR-CRD), which provided additional placement scenarios to consider. The Corps also discussed the work with The City of Tybee Island's (Tybee Island) coastal

engineering consultant. The proposed plan was subsequently revised to incorporate the views of GA DNR-CRD and Tybee Island's consultant. During that period, Corps engineers were also consulted to determine pumping distances that could be achieved without the use of booster pumps (which would greatly increase cost) and what placement designs would not cause adverse currents or result in rapid migration of deposited sediments toward the shipping channel. The previously described information was then synthesized and integrated into a revised sediment placement plan.

The Corps provided GA DNR-CRD staff and Tybee Island's coastal engineering consultant with the updated plan at a meeting on July 13, 2006. Following the meeting, the plan was again revised to address items identified during the meeting. The plan was later presented to the Stakeholders Evaluation Group in September 2006 and the Corps again received comments.

The proposed plan was based on a compilation of information provided by Corps geotechnical engineers; discussions with Corps coastal engineers; discussions with GA DNR-CRD for information on CZM and HB 727 compliance, recreational and commercial boat usage off of Tybee Island, and general environmental acceptability issues; and information from Tybee Island's coastal engineering consultant concerning issues that directly affect the Tybee Island beaches.

The Corps included the following assumptions in the design of the sediment placement plan for the entrance channel sediments:

- A 30-inch pipeline dredge can pump sediment a total distance of about 3 miles without a booster pump and without substantially reducing its productivity. The placement design would be based on there not being a need for a booster pump.

- A loaded hopper dredge generally needs about 25 feet of water under its keel. Hopper dredges (with pump ashore capability) may not be able to reach all locations, since the nearshore water depths off Tybee Island are less than 15 feet mean high water.

- For each entrance channel reach from Stations 4+000 to -98+600, the dredge quantities in cubic yards for the greatest dredging depth (i.e., -48 foot depth) was used for all placement sites.

As a result of the extensive coordination with GA DNR-CRD and the City of Tybee Island, the Corps proposed in the DEIS to place new work and maintenance sediments in the nearshore area off Tybee Island which would provide beneficial use of dredged material and comply with the Georgia Coastal Management Program, including the changes that incorporate Georgia HB 727. The proposed dredged material placement

plan also included two sites (Site 11 and Site 12) which would have been constructed from material from the entrance channel extension to provide additional fish habitat in the area.

Most of the sites were authorized in the LTMS to receive maintenance material from the Savannah Harbor entrance channel. Sites 11 and 12 were developed during SHEP planning to provide fish habitat. The specific Site 2 Extension design was developed to provide a pathway for sediments to migrate to the shoreline. The ERDC Nearshore site is also a design development of the previously approved "feeder berm" and is considered a part of the feeder berm system approved under the LTMS.

The new work sediment that would have been placed into the nearshore feeder berm sites would have been material with a fines content of 20 percent or less. The GA DNR-CRD and the City of Tybee Island have since requested that these sites not be used for new work sediment from the project because they prefer material with a fines content of 10 percent or less. They also requested that Sites 11 and 12 not be used because of potential adverse effects to fish habitat and commercial and recreational fishing. Based on comments from EPA, Site 4, Site 5, Site 6, Site 11, and Site 12 are beyond the 3-mile line and would also require site designation studies. Consequently, use of these dredged material placement sites for new work material was removed from the project. New work dredged sediments from the SHEP would be placed into the existing DMCAs or the approved ODMDS.

8.1.4 Dredged Material Placement Technique Selection

Sediment testing and analyses performed in 1997 and 2001 indicated a potential for elevated levels of cadmium associated with Miocene-aged sediments underlying the navigation channel. Additional testing in 2005 specifically examined the concentration and distribution of cadmium within sediments which would be dredged according to alternative plans. Approximately 350 sediment samples were taken at 2-foot intervals from 45 cores distributed throughout the harbor, but concentrating in areas where initial analyses indicated higher cadmium concentrations were present. This core data was analyzed and used to estimate the potential average cadmium concentration in new work sediments by Station. The sediments between Stations 17+000 and 45+000 were estimated to contain an average cadmium concentration of 21.42 mg/kg. None of the other ranges had an average cadmium concentration of greater than 6.89 mg/kg, which is well below the Effects Range Median (ERM) of 9.6 mg/kg, indicating little potential for environmental impact.

The naturally-occurring cadmium is not uniformly distributed, but some locations showed concentrations at levels that would cause adverse environmental impacts if the sediments were exposed to oxidizing conditions. The original dredging plan was to excavate the new work sediments and deposit them in the closest DMCA that was available for this project. Such a plan would have resulted in the cadmium being deposited in several DMCAs, possibly resulting in adverse impacts at several sites. The initial modified placement plan isolated the cadmium-laden sediments in one

confined DMCA and covering it with a 2-foot capping layer, which is sufficient for biological protection purposes and to ensure that the sediments will not be disturbed during future dike raisings.

An evaluation of the DMCAs in this area of the harbor (14A, 14B, and Jones/Oysterbed) indicated that DMCA 14A was the best site to use for isolation of the cadmium-laden sediments for following reasons:

- Its elevation is lower than the adjacent disposal sites, which allows the cadmium-laden sediment to be placed at a lower elevation, leaving room for the capping material;
- After the sediment is capped, there would be greater future potential to extend the life of the disposal area by subsequent dike raisings than in other disposal areas that are presently at a higher elevation;
- Weirs are already located on the front side of the disposal area; thus, the cadmium-laden sediment could be pumped to the back side of the disposal area. This provides a greater factor of safety by having the material farther away from the navigation channel should the front side of the dike experience shoreline erosion which might compromise the dike; and,
- This area would also afford greater protection as almost the entire front side of the dike has erosion protection already in place, mostly in the form of rip rap.

The initial review of cadmium within the navigation channel (Savannah Harbor Expansion Project: Cadmium Report, August 2006) was based on average cadmium (mg/kg) per reach. The report identified the reach between Stations 17+000 and 45+000 with 5,015,846 cubic yards (CY) of cadmium-laden material as the only area in the harbor that needed special handling. That amount, plus the cap amount of 1,860,000 CY for a total for cadmium-related sediment of 6,875,846 CY easily fit in DMCA 14A (7,000,000 CY capacity). A later review of cadmium concentration, taking into account individual high points of concentration as well as average cadmium concentration per reach, resulted in additional reaches being designated as having high concentrations of cadmium and, therefore, requiring special handling.

The resultant increase in the amount of special handling material and differing locations of this material meant that all of the material could not be placed in DMCA 14A; therefore, another site for the placement of the excess cadmium-containing sediments (beyond what was to be placed in 14A) needed to be identified. Re-evaluation of DMCA's 14B and Jones/Oysterbed (Jones Island portion) indicated that the DMCA 14B was the best site based on costs and engineering requirements. Consequently, all cadmium-laden sediments would be placed in DMCA 14A and/or 14B.

8.2 Impact Assessment

Although the Corps hoped to avoid adverse impacts to the environment, rarely can a major construction project be implemented without causing some adverse effects. The type, location, and level of these impacts must be known before actions can be evaluated to avoid those impacts, reduce those impacts or provide appropriate mitigation. Most impacts that could be expected to occur from this proposed project would result from either loss of uplands adjacent to the (expanded) navigation channel or changes to the aquatic environment within the harbor. Other potential impacts could also result, such as changes in shoreline erosion, salinity intrusion into the groundwater, air emissions, etc.

For impacts to uplands adjacent to the deeper navigation channel, Savannah District retained the Corps' Engineering Research and Development Center (ERDC) to conduct a ship simulation study. That study is described in detail in the Engineering Appendix of the GRR. The study used (1) state-of-the-art computer models, and (2) ship pilots from the Savannah Pilots Association who maneuver vessels through the harbor on a daily basis to identify how vessels would handle in various flow and weather conditions. The study identified the minimum size channel needed to safely pilot the design draft vessel through the harbor. This includes the width of the channel and required bend wideners. It also provides information on the value of meeting areas within the channel. This study confirmed most of the initial design features (channel width, size of turning basin) and indicated that some bend wideners would not be necessary. This increased the confidence in the effectiveness and safety of the proposed design, while also minimizing impacts associated from construction of unneeded features. The District conducted a second ship simulation study of the entrance channel in 2010 to evaluate two designs for extending the entrance channel. The study confirmed either design would be acceptable from an engineering design criteria perspective.

The District conducted two studies to identify potential impacts to riverine shorelines. The first was a Ship Wake Study conducted by the Corps' Engineering Research and Development Center. They measured the waves produced at four critical locations in the harbor – Tybee North Beach, Fort Pulaski, South Carolina side of the Bight, and City Front – and predicted changes to those waves resulting from the fleet of larger vessels expected to call at the port with a deeper harbor. That study is described in detail in the Engineering Appendix to the GRR. Soils engineers within the District took that information and evaluated the effects on the adjacent shores from those changes in waves. Although most of those four locations presently experience substantial erosion, the District's soils engineers concluded that the proposed harbor deepening would not cause noticeable changes in the ongoing erosion.

For potential impacts to the nearby shorelines, Savannah District divided the issue into two distinct areas – one the ocean shoreline and the other the riverine shoreline. These two areas retain separate and distinct qualities from an engineering perspective, and the causes of erosion differ greatly between them. For the ocean shoreline, the District again secured the assistance of the Corps' Engineering Research and Development

Center (ERDC). That organization conducted a Coastal Erosion Study that is described in detail in the Engineering Appendix of the GRR. The study concluded that deepening of the entrance channel as envisioned in any of the deepening alternatives would not measurably increase erosion that is occurring at Tybee Island or other adjacent barrier islands.

For potential impacts to the groundwater, Savannah District conducted a substantial study of the geology beneath the river and the water moving through the various layers of that resource. The scope of the study was reviewed by natural resource agencies and scientists involved in the study of the Floridan aquifer prior to it being implemented to ensure those experts believed that it was sufficient to address the issues. The District performed much of the physical sampling, as it possessed the needed open-water drilling equipment, and it retained the consulting and engineering firm of CDM to conduct the computer modeling portions of the study. That study is described in detail in the Engineering Appendix of the GRR. The conclusions of the study are that the proposed channel deepening is not expected to increase the downward migration of salinity into the drinking water aquifer in any measurable amount. The study identified the large volume of water withdrawn in Savannah as the primary source of the present cone of depression that exists in the aquifer and extends outward from that location.

For potential impacts to air quality, Savannah District evaluated air emissions from container vessels using the harbor. After EPA reviewed the results of that study, the District expanded it to include all vessels calling at the port, the landside equipment that handle the cargoes transported by those vessels, and air toxics in those emissions. The evaluation is based on the vessel fleet and cargo projections developed for the economic analysis. The District followed procedures outlined by EPA for air quality analyses at ports. The analysis did not identify any significant adverse impacts to air quality that would result from implementation of the proposed harbor deepening alternatives. The Air Emission Inventory is included as a separate appendix (Appendix K) in the EIS.

For changes to the aquatic system, Savannah District followed a combined approach of consultants and in-house staff to enhance and apply state-of-the-art hydrodynamic and water quality models to assess potential impacts from the project. The District and the Cooperating Agencies followed this approach to produce the best information that could reasonably be developed to identify changes that could be expected from the project. Development and approval of use of these models on this project, which took from 1999 through 2005, is described in detail in the Engineering Appendix that accompanies the GRR. As the models were being developed, the Corps consulted with natural resource agencies to determine what type of information they would need to evaluate all aspects of the proposed project. After the agencies approved use of the models, the tools were applied and the modeling was performed (2006 and 2007). This was somewhat of an iterative process. On occasion, the agencies discovered their requested model runs and analysis were not helpful. Subsequently, the agencies identified other informational needs that did enable a thorough evaluation of project

impacts. Several reports were ultimately produced as a result of this process. On occasion, several versions of a particular report were produced as more information became available, or if the Corps later responded to agency requests for additional data and different perspectives. The hydrodynamic-related impacts predicted from the various alternatives are described in detail in the Environmental Consequences section of the EIS. The major hydrodynamic-related reports that were provided to the agencies during the course of the study are shown in Table 8-1.

Table 8-1. Savannah Harbor Expansion Project – Modeling Reports

Report	Title	Author	Date
Water Quality Mitigation	*Oxygen Injection Design Report Savannah Harbor Expansion Project*	Tetra Tech, Inc.	October 2010
Model Calibration (EFDC & WASP)	*Development of the Hydrodynamic and Water Quality Models for the Savannah Harbor Expansion Project*	Tetra Tech, Inc.	January 2006
Fishery Impacts	*Habitat Impacts of the Savannah Harbor Expansion Project*	Tetra Tech, Inc.	October 2006
Chloride Model Development (Superseded)	*Savannah Harbor Expansion Project – Chloride Data Analysis and Model Development*	Tetra Tech, Inc.	November 2006
Water Quality Impacts	*Water Quality Impacts of the Savannah Harbor Expansion Project*	Tetra Tech, Inc.	February 2007
Marsh Modeling Report	*Simulations of Water Levels and Salinity in the Rivers and Tidal Marshes in the Vicinity of the Savannah National Wildlife Refuge, Coastal South Carolina and Georgia*	US Geological Survey	June 2006
Chloride Impacts	*Chloride Impact Evaluation Impacts of Harbor Deepening Only*	USACE Savannah District SAS-EN	February 2007
Hurricane Surge Impacts	*Hurricane Surge Modeling*	USACE Savannah District SAS-EN	September 2005
Chloride Impacts (Superseded)	*Savannah Harbor Expansion Project Evaluation of Chloride Impacts with Proposed Mitigation Plan*	USACE Savannah District SAS-EN	December 2007
Fishery Impacts (SNS Impacts Superseded)	*Savannah Harbor Expansion Project Evaluation of Fishery Habitat Impacts with Proposed Mitigation Plan*	USACE Savannah District SAS-EN	January 2010
Hurricane Surge Impacts	*Savannah Harbor Expansion Project Evaluation of Hurricane Surge Impacts with Proposed Mitigation Plan*	USACE Savannah District SAS-EN	December 2007
Wetland Impacts	*Savannah Harbor Expansion Project Evaluation of Marsh/Wetland Impacts with Proposed Mitigation Plan*	USACE Savannah District SAS-EN	November 2007
Water Quality Impacts	*Savannah Harbor Expansion Project Evaluation of Water Quality Impacts with Proposed Mitigation Plan*	USACE Savannah District SAS-EN	September 2009
Wetland Impacts	*Savannah Harbor Expansion Project Mitigation Evaluation for Marsh/Wetland Impacts*	USACE Savannah District SAS-EN	November 2007
Wetland Impacts (Sensitivity Analysis)	*Savannah Harbor Expansion Project Sensitivity Analysis of Proposed Navigation Meeting Areas*	USACE Savannah District SAS-EN	September 2009

Report	Title	Author	Date
Wetland Impacts (Sensitivity Analysis Obsolete)	*Savannah Harbor Expansion Project Sensitivity Analysis of Proposed Sill on Middle River*	USACE Savannah District SAS-EN	September 2009
Wetland Impacts	*Wetland/Marsh Impact Evaluation*	USACE Savannah District SAS-EN	February 2007
Wetland Impacts (Obsolete)	*Savannah Harbor Deepening Project ATM Marsh Succession Model Marsh/Wetland Impact Evaluation*	USACE Mobile District SAM	May 2007
Wetland Impacts (Obsolete)	*Savannah Harbor Deepening Project USGS/USFWS Marsh Succession Model Marsh/Wetland Impact Evaluation*	USACE Mobile District SAM	June 2007
Fishery Impacts	*Savannah Harbor Expansion Project Evaluation of Adult SNS (Summer) Habitat Impacts with Proposed Mitigation Plan*	USACE Savannah District SAS	March 2011
Fishery Impacts	*Savannah Harbor Expansion Project Evaluation of Adult SNS (Winter) Habitat Impacts with Proposed Mitigation Plan*	USACE Savannah District SAS	March 2011
Fishery Impacts	*Savannah Harbor Expansion Project Evaluation of Juvenile SNS (Winter) Habitat Impacts with Proposed Mitigation*	USACE Savannah District SAS	March 2011
Chloride Model Development	*Chloride Modeling Savannah Harbor Expansion Project*	Tetra Tech, Inc. & Advanced Data Mining Services, LLC	December 2010
Chloride Impacts	*Assessment of Chloride Impact from Savannah Harbor Deepening*	Arthur Freedman Associates, Inc.	April 2011

Based on the results of the various studies, Table 8-2 on the following page summarizes the project-related impacts of the harbor deepening alternatives without mitigation.

Table 8-2. Summary of Project-Related Impacts without Mitigation

	DEPTH ALTERNATIVES				
	44-Foot	**45-Foot**	**46-Foot**	**47-Foot**	**48-Foot**
Salinity	Move further into estuary	Same effect, but greater amount	Same effect, but greater amount	Same effect, but greater amount	Same effect, but greater amount
Freshwater Wetlands	-551 acres	-967 acres	-1,057 acres	-1,177 acres	-1,212 acres
Brackish Marsh (Loss)	- 7.2 acres	Same	Same	Same	Same
Dissolved Oxygen	Reductions at mid-depth and bottom	Same effect, but greater amount	Same effect, but greater amount	Same effect, But greater amount	Same effect, but greater amount
Fisheries	**Loss (-) of Acceptable Habitat**				
- Striped bass spawning	- 8.0 % (-83.0 acres)	- 12.2 % (-127.0 acres)	- 13.0 % (-135.0 acres)	-18.1 % (-188.0 acres)	- 19.7 % (-205.0 acres)
- Striped bass eggs	-9.7 % (-163.0 acres)	- 11.2 % (-188.0 acres)	- 15.9 % (-266.0 acres)	-20.5 % (-344.0 acres)	-24.5 % (-411.0 acres)
- Striped bass larvae	-13.5% (-76.0 acres)	- 18.6 % (-105.0 acres)	- 21.0 % (-119.0 acres)	-13.8 % (-78.0 acres)	- 13.8 % (-78.0 acres)
- American shad (Jan)	0 %	0 %	0 %	0%	0 %
- American shad (May)	0 %	0 %	0 %	0%	0 %
- American shad (Aug)	0 %	0 %	0 %	0 %	0 %
- Shortnose sturgeon adult (January)	- 0.5% (-20.0 acres)	- 0.5 % (-20.0 acres)	-0.8 % (-32.0 acres)	-0.8% (-32.0 acres)	-1.1 % (-44.0 acres)
- Shortnose sturgeon adult (August)	- 3.2 % (- 45.0 acres)	- 6.4 % (- 89.0 acres)	- 9.5 % (- 132.0 acres)	-13.3 % (185.0)	- 15.80 % (- 220.0 acres)
- Shortnose sturgeon juvenile (January)	-5.0 % (-86.0 acres)	-10.4 % (-179.0 acres)	-15.9 % (-274.0 acres)	- 19.0 % (-328.0 acres)	- 21.6 % (-373.0 acres)
- Southern flounder	- 0.3 % (-6.0 acres)	- 2.4 % (-45.0 acres)	- 2.4 % (-45.0 acres)	-7.8 % (-146.0 acres)	0.0 %
Chlorides @ City's M&I Water Treatment Plant	Max hourly increase of 77 mg/L	Max hourly increase of 105 mg/L	Max hourly increase of 121 mg/L	Max hourly increase of 149 mg/L	Max hourly increase of 170 mg/L
Drinking Water Aquifer	Same type of effect, but less than 45-foot alternative	Same type of effect, but less than 46-foot alternative	Same type of effect, but less than 47-foot alternative	Same type of effect, but less than 48-foot alternative	Increase flow through confining unit by 3-4%
Hurricane Surge	Minor, max increase in WSE of 0.3 feet	Minor, max increase in WSE of 0.5 feet	Minor, max increase in WSE of 0.6 feet	Minor, max Increase in WSE of 0.8 feet	Minor, max increase in WSE of 0.9 feet
Beach Erosion	Minor, within accuracy of evaluation	Same	Same	Same	Same
Bank Erosion due to ship traffic	No measurable addition to ongoing erosion	Same	Same	Same	Same
Shoaling	Minimal upstream shift	Same	Same	Same	Same
Velocity	Theoretical reduction, but not measurable	Same	Same	Same	Same

Table 8-3 is a summary of project impacts of the harbor deepening alternatives after implementation of various mitigation measures designed to minimize adverse impacts of the SHEP. Because of predicted changes in the salinity regime, residual impacts remain to tidal freshwater marsh for the 45-, 46-, 47-, and 48-foot depth alternatives and salt marsh for all depth alternatives considered (see Table 8-3). Mitigation is also required to offset 15.68 acres of brackish marsh that would be lost due to excavation requirements of the project. Mitigation is included for impacts to Striped bass spawning, egg, and larval habitat, and adult and juvenile Shortnose sturgeon winter habitat. Mitigation is included to offset expected increases in chloride concentrations in Abercorn Creek at the City of Savannah's water intake, which would occur during high tides and low flow conditions.

Table 8-3 Summary of Project-Related Impacts with Mitigation

	DEPTH ALTERNATIVES				
	44-Foot	**45-Foot**	**46-Foot**	**47-Foot**	**48-Foot**
Salinity	Move further into estuary up Front River	Same effect, but greater amount	Same effect, but greater amount	Same effect, But greater Amount	Same effect, but greater amount
Freshwater Wetlands (Conversion)	+ 322 acres	- 32 acres	- 201 acres	-223 acres	- 337 acres
Brackish Marsh (Conversion)	+ 488 acres	+ 861 acres	+959 acres	+964 acres	+1068 acres
Salt Marsh (Conversion)	- 808 acres	-828 acres	-757 acres	-740 acres	-730 acres
Brackish Marsh (Loss)	-15.68 acres	Same	Same	Same	Same
Dissolved Oxygen	Minimal Net improvement	Same	Same	Same	Same
Fisheries	**Loss (-) or Gain (+) of Acceptable Habitat**				
- Striped bass spawning	- 2.9 % (-30.0 acres)	- 9.2 % (-96.0 acres)	- 10.0 % (-104.0 acres)	-13.5 % (-140.0 acres)	- 16.1 % (-167.0 acres)
- Striped bass eggs	- 9.4 % (-157.0 acres)	+5.2 % (+87.0 acres)	0 %	-11.1 % (-186.0 acres)	-10.8 % (-181.0 acres)
- Striped bass larvae	-5.6 % (-32.0 acres)	+ 1.7 % (+9.0 acres)	+ 5.6 % (+32.0 acres)	-5.0 % (-28.0 acres)	-3.5 % (-20.0 acres)
- American shad (Jan)	-0.2 % (- 9.0 acres)	-0.2 % (-9.0 acres)	- 0.2 % (-9.0 acres)	-0.2 % (-9.0 acres)	- 0.2 % (-9.0 acres)
- American shad (May)	- 0.2 % (-12.0 acres)	- 0.2 % (-11.0 acres)	- 0.2 % (-11.0 acres)	-0.2 % (-11.0 acres)	- 0.2 % (-11.0 acres)
- American shad (Aug)	-0.3 % (-16.0 acres)	-0.3 % (-15.0 acres)	-0.2 % (-11.0 acres)	-0.2 % (-11.0 acres)	-0.2 % (-11.0 acres)
- Shortnose sturgeon adult (January)	-3.9 % (-153.0 acres)	-4.6 % (-179.0 acres)	-6.2 % (-240.0 acres)	- 6.9 % (-266.0 acres)	- 8.4 % (-326.0 acres)
- Shortnose sturgeon adult (August)	+19.0 % (+260.0 acres)	+9.8 % (+134.0 acres)	+7.3 % (+100.0 acres)	+6.5 % (+89.0)	+2.8 % (+39.0 acres)
- Shortnose sturgeon juvenile (January)	- 6.7% (-220.0 acres)	- 7.0 % (-231.0 acres)	-7.3 % (-238.0 acres)	-7.6% (-251.0 acres)	-11.5 % (-376.0 acres)
- Southern flounder	+74.1 % (+1387.0acres)	+ 54.2 % (+1014.0acres)	+ 57.3 % (+1072.0acres)	+57.3 % (+1072.0acres)	+ 52.9 % (+989.0 acres)
Chlorides @ City's M&I Water Treatment Plant	Max hourly increase of 4 mg/L	Max hourly increase of 4 mg/L	Max hourly increase of 4 mg/L	Max hourly increase of 4 mg/L	Max hourly increase of 4 mg/L
Drinking Water Aquifer	Same type of effect, but less than 45-foot alternative	Same type of effect, but less than 46-foot alternative	Same type of effect, but less than 47-foot alternative	Same type of effect, but less than 48-foot alternative	Increase flow through confining unit by 3-4%
Hurricane Surge	Minor, Max increase in WSEL = 0.5 ft	Minor, Max increase in WSEL = 0.6 ft	Minor, Max increase in WSEL = 0.7 ft	Minor, Max Increase in WSEL= 0.8ft	Minor, Max increase in WSEL = 0.8 ft
Beach Erosion	Minor, within accuracy of evaluation	Same	Same	Same	Same
Bank Erosion due to ship traffic	No measurable addition to ongoing erosion	Same	Same	Same	Same
Shoaling	Minimal upstream shift	Same	Same	Same	Same
Velocity	Theoretical reduction, but not measurable	Same	Same	Same	Same

Additional discussion of the various impact analyses and mitigation studies are provided in the paragraphs that follow.

8.2.1 Groundwater Impacts

To evaluate potential impacts to the groundwater, Savannah District conducted an aquifer evaluation study entitled *Supplemental Studies to Determine Potential Groundwater Impacts to the Upper Floridan Aquifer* (June 2007). This was a substantial study that examined the hydrogeologic framework beneath the navigation channel to determine how much proposed dredging activities would contribute to increased chloride levels in the Upper Floridan aquifer. The scope of the study was developed in cooperation with State and Federal natural resource agencies and the SEG prior to it being implemented to ensure those experts believed that it was sufficient to address the issues. The Savannah District performed much of the physical sampling and data analysis, as it possessed the needed open-water drilling equipment, and it retained a consulting engineering firm to conduct the computer modeling portions of the study. That study is described in detail in the Engineering Appendix of the GRR.

The study results indicated that increased salinity in the Savannah River and the reduced thickness of the confining layer associated with the proposed dredging (assuming a 6-foot improvement) will not significantly affect the timing of breakthrough of chlorides along the navigation channel in the Upper Floridan aquifer. Furthermore, the aquifer study results showed that the proposed dredging would have minimal impacts on water quality in production wells that tap the Upper Floridan aquifer in and around the City of Savannah. The study was subject to an Independent Technical Review and an External Peer Review, which concurred with the study findings.

Although construction of the SHEP is expected to have an insignificant effect on the downward migration of saltwater into aquifer, the Georgia DNR- EPD and SC DHEC requested that a monitoring plan be implemented to detect any potential chloride migration into the aquifer that could be caused from channel deepening. A copy of the Section 401 Water Certifications from both states is included in Appendix Z. Monitoring of chloride levels in the Upper Floridan aquifer would be conducted along critical groundwater flow paths to ensure that the SHEP does not result in the significant migration of chlorides downward through the confining layer that could move towards production wells in the Savannah area. A discussion of the groundwater monitoring requirements can be found in Paragraph 5.05 of Chapter 5 of the EIS and in EIS-Appendix L (Cumulative Impacts). The monitoring plan contains specific requirements in regards to how and when the monitoring is to be conducted, as well as the establishment of benchmark chloride concentrations to protect Savannah area production wells. The monitoring would involve the establishment of sentry wells along critical groundwater flow paths which would be installed near the top of the aquifer to monitor downward migration of chlorides through the confining unit and deeper in the aquifer to monitor how horizontal flow of freshwater mixes with and

dilutes the chloride. Monitoring wells would be established up-gradient of critical groundwater flow paths to provide information on the background chloride concentrations associated with groundwater withdrawals in the Savannah area independent of SHEP dredging activities. Annual monitoring of these wells would be conducted for the life of the project, and differences in the long-term trends of chloride concentrations in the sentry and background wells would be used to distinguish impacts of the SHEP from impacts of groundwater withdrawal on chloride concentrations in the aquifer.

8.2.2 Erosion Impacts

Savannah District conducted investigations to determine potential impacts to the nearby shorelines. The issue was divided into two distinct areas – the ocean shoreline and the riverine shoreline. These two areas retain separate and distinct qualities from an engineering perspective, and the causes of erosion differ greatly between them. For the ocean shoreline, the District secured the assistance of ERDC. ERDC conducted a Coastal Erosion Study (*Impacts of Savannah Harbor Expansion Project*, October 2006) which is described in detail in the Engineering Appendix of the GRR. The study concluded that deepening of the entrance channel as required by the channel deepening alternatives would not measurably increase erosion that is occurring at Tybee Island or other adjacent barrier islands. Computations show that channel deepening will not have any measurable effect on the North Tybee Island shoreline.

The District conducted two studies to identify potential impacts to riverine shorelines. The first was a Ship Wake Study, *Ship Forces on the Shoreline of the Savannah Harbor Project* (August 2006), conducted by the Corps' Engineering Research and Development Center. The analysis measured the waves produced at four critical locations in the harbor: Tybee North Beach, Fort Pulaski, SC side of the Bight, and River Front. The analysis predicted changes to waves resulting from the fleet of more deeply loaded vessels expected to call with a deeper harbor. That study is described in detail in the Engineering Appendix to the GRR. Geotechnical engineers within the Savannah District took that information and evaluated the effects on the adjacent shores from changes in waves (*Savannah Harbor Expansion Bank Erosion Study*, November 2006 and updated in 2011with a revised fleet forecast).

Erosion along River Street is not considered a factor because the shoreline there is already adequately protected by bank protection and structures. The Bight area (from about Stations 40+000 to 50+000) was also not considered a factor because the area is currently being stabilized. The shoreline at Fort Jackson was stabilized in 2003 and therefore is not projected to experience increased erosion due to channel deepening. Erosion losses at Fort Pulaski have been measured to be as much as three feet of shoreline lost per year under without-project and with-project conditions. Under current traffic predictions and forecasts, the bank erosion at Fort Pulaski expected to result from harbor deepening would be less than 1/2 inch at the end of the 50-year project life, an amount that would not be measureable in the field in light of the erosion caused by other factors.

In addition, the Savannah District has recently constructed shoreline protection at the DMCAs along the river: therefore, DMCAs 13A, 14A, and 14B are protected from long-term shoreline erosion. The District expects to implement bank protection on Jones/Oysterbed Island in the near future, so it can be assumed to be protected in the without project condition. With a deepened harbor, fewer ships are expected to call (when compared to without project condition). As a result, the proposed deepening is not expected to impact the shoreline of the confined disposal areas to any measurable degree.

Based on these factors, the Corps believes that the proposed harbor deepening alternatives would not result in major or significant adverse impacts to ocean or river shorelines.

8.2.3 Air Quality Impacts

Georgia and South Carolina each have a State Implementation Plan ("SIP") approved or promulgated under Section 110 of the CAA. A Conformity Determination is not required because 40 CFR 93.153 (b) states, "For Federal actions not covered by paragraph (a) of this section, a conformity determination is required for each pollutant where the total of direct and indirect emissions in a nonattainment or maintenance area (emphasis added by the writer) caused by a Federal action would equal or exceed any of the rates in paragraphs (b)(1) or (2) of this section." Since both Chatham and Jasper Counties have been designated by the States as attainment areas, a Conformity Determination is not required. Over the life of the project (from 2016 to 2066) the proposed harbor deepening will not interfere with the area remaining in attainment of the NAAQS under Section 110 of the Clean Air Act.

To identify potential impacts to air quality from the proposed harbor deepening, the Corps conducted an air quality analysis in 2006. The investigation quantified emissions from deep-draft containerships that call at the port, are expected to call in the future, and considered how those emissions would change as a result of the proposed harbor deepening. The Corps provided its report to the US Environmental Protection Agency (EPA) Region 4 office for review and comment. As a result of their review, EPA requested the analysis be expanded.

In response to EPA Region 4's request, the Corps prepared an Air Emission Inventory for the Port of Savannah (*Air Emissions Inventory Report for the Port of Savannah*, August 2011). The objective of the inventory was to expand the Corps' 2006 air quality analysis to the entire harbor to more completely assess air quality impacts from the proposed harbor deepening. This more detailed assessment evaluates the air emissions from all cargo-carrying vessels and landside cargo handling equipment at both the GPA and privately-operated terminals at the port. It also compares these emissions for both the "With" and "Without Project" (No Action) alternatives. In addition to the criteria pollutants that are traditionally evaluated when one discusses air emissions, estimates of "air toxics" emitted at the Port were also calculated. The Air Emission Inventory for the Port of Savannah, dated August 2011 can be found in Appendix K of the Final EIS.

Any of the proposed harbor deepening alternatives would reduce air emission levels in the Port of Savannah from what they would be with the present 42-foot navigation channel, because under each alternative fewer vessels would be transiting the harbor. The beneficial effect increases with the amount of deepening. Harbor deepening would result in temporary increases in air emissions during the initial construction. However, since those temporary increases would be distributed along the length of the channel -- roughly a third of which is in the ocean on the entrance channel -- they would not require mitigation

9 Alternative Plan Evaluation: Mitigation Planning

As discussed in the preceding paragraphs, the SHEP is not expected to have any measurable effect on groundwater (upper Floridan aquifer), shoreline erosion, beach erosion at Tybee Island, or air quality. However, studies conducted during the SHEP indicated that the project would adversely affect tidal freshwater marsh, saltmarsh, brackish marsh, the dissolved oxygen regime in Savannah Harbor (without mitigation), Striped bass habitat, Shortnose sturgeon habitat, and cause an increase in chloride levels at the City of Savannah's water intake on Abercorn Creek during low flows and high tides. A mitigation plan was developed to address the remaining significant adverse impacts of the various harbor deepening alternatives under consideration that could not be avoided.

9.1 Mitigation Measure Identification

The mitigation planning process began early in the General Re-evaluation process, and it became one of the main focus areas as the General Re-Evaluation study progressed. The process included working with the SEG to identify and evaluate potential mitigation measures. A list of conceptual mitigation measures was collaboratively developed in 2002, with input from the natural resource agencies identified on the following page, as well as the SEG and the public.

- USFWS Ecological Services

- USFWS Savannah Coastal Refuges
- US EPA
- NOAA Fisheries - Habitat Protection Division
- NOAA Fisheries - Protected Resources Division
- GA DNR - Coastal Resources Division
- GA DNR - Wildlife Resources Division
- GA DNR - Environmental Protection Division
- GA Department of Transportation
- SC Department of Natural Resources
- SC Department of Health and Environmental Control
- Stakeholders Evaluation Group

The group identified measures that could conceivably be implemented to improve conditions for the following resources: wetlands; fisheries; water quality; groundwater; sediment placement & beach erosion; and cultural & historic resources. The complete list of conceptual mitigation measures can be found in EIS Appendix C.

9.2 Marsh Mitigation Plan Development

One of the major mitigation components of the design of the mitigation plan was recognition that tidal freshwater marshes are highly valued ecologically in the estuary. Measures were considered during the mitigation plan development to eliminate or reduce impacts to that resource. After considering several potential measures, rerouting of freshwater down Back and Middle Rivers was identified as a potentially feasible way to reduce salinity increases to tidal freshwater marshes located along those rivers. The following section discusses these efforts in some detail, but extensive hydrodynamic modeling was performed of potential flow rerouting measures, alternate sizes of those measures, and combinations of those measures. The Corps consulted with the Wetlands Interagency Coordination Team to assess the performance of those measures and help identify the best flow rerouting plan. One flow rerouting plan was identified as best reducing impacts from the 44-foot depth alternative, while a larger flow rerouting plan was identified as most cost effective in reducing freshwater wetland impacts from the other depth alternatives.

Another major component in the design of the mitigation plan was also intended to reduce impacts to tidal freshwater marshes along Back and Middle Rivers. That measure was filling the Sediment Basin (at the downstream end of Back River), which would reduce upriver movement of salinity to those marshes. During the initial interagency discussions about the potential filling of the Sediment Basin, the South Carolina Department of Health and Environmental Control and USFWS expressed substantial concern about the potential water quality impacts of filling the entire basin. They were concerned that the sediment placement operations would (1) exacerbate recurring low dissolved oxygen levels in that portion of the harbor, and (2) allow fine-

grained sediments to spread up into shallower portions of Back River, leading to sedimentation in that critical area. Because of these concerns, the Corps minimized the volume of material that would be included in the design to fill the Sediment Basin. Hydrodynamic modeling indicated that a narrow sill at the downstream end of the Basin would still allow salinity to cross over and move upstream. This would negate the intent of the measure, which is to reduce the movement of salinity up Back River. The final design consists of a broad sill that will restrict upstream salinity movement. New work sediments would be placed to construct the broad sill, but the extent of that placement was minimized to avoid the potential adverse impacts identified by the natural resource agencies.

The third major component in the design of the mitigation was recognition that dissolved oxygen levels in the harbor commonly reach critically low values during the summer months. Reductions in those levels from harbor deepening should be avoided or minimized. Section 9.3 will discuss actions taken to address this issue.

The fourth major component in the design of the mitigation was recognition of the threatened and endangered species that reside in the harbor or its entrance channel. Although the Corps regularly includes measures to protect these species in its construction contracts, it emphasized analysis of potential impacts from deepening the harbor on these species. Within the inner harbor, analyses were conducted to quantify potential adverse impacts to Shortnose sturgeon. Although one mitigation feature would improve the volume of Shortnose sturgeon acceptable habitat in the summer months, separate mitigation was found to be warranted for impacts to sturgeon winter habitat. Section 9.4 will discuss actions taken to address this issue. The design of the entrance channel extension included particular attention to potential impacts to whales and sea turtles which could be encountered in that area.

Tidal freshwater marshes were identified by the USFWS as the single most critical natural resource in the harbor; therefore, mitigation planning focused on reducing project impacts to that resource. Salinity is the primary determining factor in the conversion of tidal freshwater marshes, so that parameter was identified as the focus of the mitigation modeling efforts. In addition to directly determining the type of marsh that would occur on a site, salinity also affects dissolved oxygen levels, another parameter of high importance in deeper areas of the harbor. The intent was to identify alterations that could be made in rivers and tidal creeks to reduce salinity levels in critical areas of the estuary (Figure 9-1).

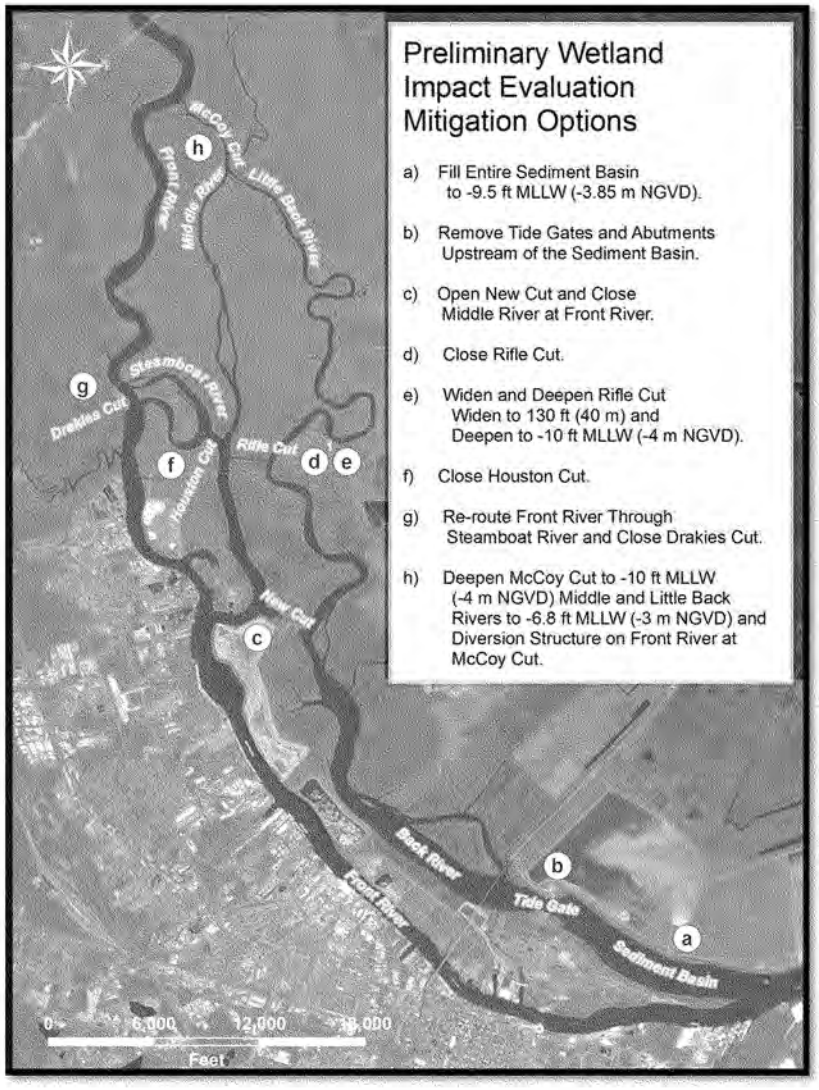


Figure 9-1: Mitigation Options

A total of 38 flow alterations at 7 locations were evaluated. Natural resource agencies reviewed initial modeling results in July 2006, and the interagency team jointly identified alterations to pursue further. Based on the effectiveness of each flow altering measure observed in the initial modeling and on the preliminary estimates of construction cost, the 5 best measures were ranked in the order of decreasing cost effectiveness (Table 9-1). Note that the naming conventions in Figure 9-1 do not match the naming conventions in Table 9-1. Different naming conventions were used intentionally to differentiate among actions being considered in different points in time during the mitigation planning process.

Table 9-1: Preliminary Mitigation Measure Ranking

Mitigation Option	Added Mitigation Component
C	Deepen McCoys Cut
D	Fill Sediment Basin
A	Close Middle River and Houston Cut; Open New Cut
E	Remove Tidegate
B	Re-Route Flow Through Steamboat River

An incremental approach was implemented to evaluate the way measures could be effectively combined. Because some measures result in similar effects, the order in which they are combined is important. As a result of additional modeling performed after the interagency meeting and considering potential implementation difficulties, a dual approach (Table 9-2 below) was developed to evaluate the effectiveness for individual measures and combinations of measures. The dual approach primarily resulted from uncertainties about the potential adverse effects of (1) filling the Sediment Basin on harbor maintenance activities, and (2) relocating the downstream end of Middle River in Mitigation Option A. Additional modeling would be performed to determine whether the path including plans identified in Table 9-2 as Plans 1-2-3 or Plans 1-4-5 were more effective. After making that determination, two other Mitigation Options would be evaluated: (1) removing the Tidegate (Option E) and (2) rerouting flow through Steamboat River (Option B). The natural resource agencies concurred in this approach in August 2006.

Table 9-2: Mitigation Planning Dual Approach: Measures and Combinations

Mitigation Plan	Mitigation Option Combination	Added Mitigation Component
1	C	McCoys Cut
2	C + D	Sediment Basin
3	C + D + F	Rifle Cut
1	C	McCoys Cut
4	C + A	Middle River, New Cut, Houston Cut
5	C + A + D	Sediment Basin
6	3 or 5 + E	Tidegate
7	3 or 5 + B	Steamboat River

With the various channel depths considered, over 160 modeling runs were required to evaluate the effects of each mitigation plan. The modeling was conducted for each of the five depth alternatives. The results of the modeling are summarized in Table 9-3 prepared for the -48-foot deepening alternative (as an example).

Table 9-3: Preliminary Marsh Mitigation Evaluation: -48 foot Deepening Alternative

	Marsh Acreage	Net Acres Adversely Impacted
Existing Conditions	4,072	------
Deepening Only (No Mitigation)		1,932
Plan 1		988
Plan 2		988
Plan 3		834
Plan 4		1,334
Plan 5		325

Notes: Evaluation conducted assuming average river flows and 50% salinity exceedance values. The initial wetland mitigation analyses were conducted on the maximum depth alternative (48-foot) to assess the effectiveness of each plan in addressing the maximum impacts. The acres of freshwater marsh identified as being impacted could be affected by an increase in salinity over the 0.5 ppt threshold.

Similar information was developed for three alternate scenarios which were considered as sensitivity analyses. One scenario used 2001 drought flows, rather than the average river flows. Two other scenarios included different amounts of sea-level rise – 25 or 50 cm over the 50-year life of the project. The adverse impacts to freshwater wetlands were generally the same or less in the three sensitivity analyses. That trend did not always hold up when the 50-cm of sea-level rise was considered. Under that scenario, the flow re-routing plans would not be as effective in reducing

adverse impacts to freshwater wetlands. Some of the wetlands that would be protected by the flow-altering mitigation measures would have already converted to brackish marsh as a result of the saltwater intrusion from the sea-level rise, even without a further harbor deepening. In general, of the four scenarios that were considered, the modeling shows the largest amount of adverse impacts to tidal freshwater wetlands would occur with average river flows and the existing sea level.

The results of this modeling were discussed at an interagency meeting in June 2007. Several agreements were reached at the meeting, including the following:

- 50%-tile exceedance value of salinity was identified as the best single measurement across the range of river stations and river flows;
- Use average river flows for the basic impact evaluation since that flow better represents the entire range of flows;
- Use existing sea level for the basic impact evaluation since it best represents what occurs near the time of construction;
- The path with Mitigation Plans 1-4-5 appears to be unacceptable because it substantially reduces the height of the tide range in critical areas of the estuary;
- Use Mitigation Plan 3 as a base for analysis of Plans 6 and 7;
- All tidal freshwater marshes within the estuary possess the same ecological value;
- Evaluate the feasibility of grading down a high ground site to produce tidal freshwater wetlands;
- An oxygen injection system should remove the impacts identified to American shad and likely result in net improvements in habitat volume;
- An oxygen injection system should remove the impacts identified to Southern flounder and likely result in net improvements in habitat volume;
- Average river flows (50%-tile) are appropriate for identifying project impacts to Striped bass;
- Further increases in flow are also not likely to be effective at increasing Striped bass habitat, since even flows at the 80% cumulative frequency level do not reduce the adverse effects of a harbor deepening;
- Training walls are not likely to be equally effective each year at increasing Striped bass habitat because the spawning location likely shifts with river flows, rendering the structures ineffective during some flow conditions;
- Examine closing the lower arm of McCoys Cut as a means of increasing Striped bass habitat; and
- Examine including a flow partitioning structure at the junction of Little Back and Middle Rivers as a potential adaptive management tool to increase Striped bass habitat.

The agencies suggested a slightly different methodology to graphically quantify impacts to the wetlands. The Corps used that alternate approach for the remainder of the study, so the numerical results of this iteration (Table 9-4) are not directly comparable with the initial impact quantification (Table 9-3). Additional modeling was conducted of the flow-altering components of the mitigation plans, and additional plans were developed to try to identify a plan that would be more effective in reducing wetland impacts. The additional modeling identified five new flow-altering plans: 3A, 3B, 3C, 6A, and 6B. Those plans are described in detail in both the Engineering Appendix and the EIS. The effectiveness of these plans at reducing adverse impacts to freshwater marshes (<0.5 ppt) that would result from construction of the 48-foot project is displayed in Table 9-4.

Table 9-4: Marsh Mitigation Plan Evaluation: -48 Foot Deepening Alternative

	Marsh Acreage	Net Acres Adversely Impacted
Existing Conditions	4,072	------
Deepening Only (No Mitigation)	2,860	1,212
Plan 3	3,584	488
Plan 3A	3,531	541
Plan 3B	3,406	666
Plan 3C	3,383	689
Plan 6	3,715	357
Plan 6A	3,735	337
Plan 6B	3,610	462
Plan 7	3,772	300

Note: The initial wetland mitigation analyses were conducted on the maximum depth alternative (48-foot) to assess the effectiveness of each plan in addressing the maximum impacts. The acres of freshwater marsh identified as being impacted could be affected by an increase in salinity over the 0.5 ppt threshold.

Preliminary cost estimates had been developed for each of the flow-altering measures and combined to assess each mitigation plan's cost effectiveness. Those costs were combined to estimate the cost of the entire flow-altering plan. The cost effectiveness of the marsh mitigation plans for the 48-foot depth alternative is presented in Table 9-5.

Table 9-5: Marsh Mitigation Plan Cost Effectiveness: -48 Foot Deepening Alternative

	Net Acres Adversely Impacted	Acres Mitigated	Preliminary Construction Cost (1,000s)	Cost/Acre Mitigated
Plan 3	488	724	$50,500	$70,000
Plan 3A	541	671	$51,700	$77,000
Plan 3B	666	546	$30,400	$56,000
Plan 3C	689	523	$32,600	$62,000
Plan 6	357	855	$51,600	$60,000
Plan 6A	337	875	$52,900	$60,000
Plan 6B	462	750	$32,800	$44,000
Plan 7	300	912	$196,400	$215,000

Note: The initial wetland mitigation analyses were conducted on the maximum depth alternative (48-foot) to assess the cost effectiveness of each plan in addressing the maximum impacts. The acres of freshwater marsh identified as being impacted could be affected by an increase in salinity over the 0.5 ppt threshold. The column showing "Acres Mitigated" is the reduction in acreage of marsh impacts resulting from the mitigation plan.

Although Plan 7 may have other possible ecological benefits, the preliminary cost estimate indicates that it would be quite expensive. The Corps expects the remaining impacts to other resources could be mitigated at a lower total cost than what would occur with Plan 7; therefore, this plan was deemed as not being cost-effective and was dropped from further consideration. For the 45-, 46-, 47- and 48-foot depth alternatives, Plan 6B was found to be the least cost per acre, but the impact acreage was determined to be unacceptable.

Using this information, including consideration of impacted acreage, the Corps determined that Plan 6A is the most cost-effective flow-altering component for the 45-, 46-, 47- and 48-foot depth alternatives, while Plan 6B is better for the 44-foot depth alternative. Plan 6A includes the following features, which are designed to change the hydraulics of the Middle, Little Back, and Back Rivers: McCoy Cut diversion structure, channel deepening on McCoy Cut to -4m NGVD and Upper Middle and Little Back Rivers to -3m NGVD, fill entire sediment basin to -3.85m NGVD by constructing a submerged sill, close Rifle Cut, remove Tidegate abutments and piers, and close the lower (western) arm of McCoy Cut.

As shown in Table 8-3, impacts to tidal freshwater marsh would remain (except for the 44-foot project) even with implementation of the flow rerouting plans. Residual impacts to tidal freshwater marshes would be -32 acres for the 45-foot project, -201 acres for the 46-foot project, -223 acres for the 47-foot project and -337 acres for the 48-foot project. Ideally, mitigation for these remaining impacts to tidal freshwater marsh would involve restoration or creation of tidal freshwater wetlands in the estuary. However, no feasible means could be identified by the Wetland ICT to accomplish this type of mitigation. Consequently, preservation was the mitigation option selected to satisfy the remaining tidal freshwater marsh mitigation requirements of the SHEP.

For impacts to freshwater wetlands, the Corps used Savannah District's Standard Operating Procedures (SOP), which is used on a daily basis by natural resources agencies in Georgia to evaluate impacts and mitigation on projects requiring Section 404 permits. Although the SOP was developed by the interagency Mitigation Banking Review Team for actions permitted through Savannah District's Regulatory Division, it can also serve as a framework to quantify impacts from civil works projects. USEPA Region 4 suggested the Corps consider use of the SOP for this project. The SOP uses several factors to quantify the ecological impacts and benefits expected from various project actions. For impacts, those factors include the type of impact, the duration of the impact, the type of vegetation being impacted, and the preventability of the impact. For restoration, the factors include the expected improvement in hydrology and vegetation, timing of the restoration, maintenance that is expected to be needed, monitoring which would be performed, and control over the land to reduce future impacts. For preservation, the factors include the degree of threat to the identified lands, the type of vegetation occurring on the lands, and the control over the land to control future impacts.

The Corps applied the SOP to this project, using the acreage outputs from the hydrodynamic model at various salinity levels. It also evaluated the extent of the impact that would occur to existing marshes -- conversion of one inter-tidal marsh type to another, and the benefit that would occur to marshes as a result of the flow-altering features. Development pressures on waterfront properties in this estuary were also factored into the assessment. In Georgia, the natural resource agencies' policy is that acceptable mitigation should consist of at least 50 percent restoration. For this project, restoration through the flow-altering features would comprise 58 percent of the total wetland mitigation for the 48-foot alternative, 60 percent for the 47-foot and 46-foot alternatives, and 65 percent for the 45-foot alternative. The following table (Table 9-6) summarizes the results of the SOP calculations for the 48-foot alternative to provide an example of how wetland mitigation requirements were calculated for the various project depth alternatives. The units shown in the table are calculated through use of the SOP to quantify the amount of mitigation required and the counter-balancing environmental value of various mitigation actions.

Table 9-6: Summary of SOP Calculations: 48-Foot Alternative

	Freshwater Marsh	Brackish Marsh	Salt	Total
Adverse Impact				
Acres	337		730	
SOP Units	3033		4672	7705
Restoration				
Acres		1068		
SOP Units		4485.6		
Preservation				
Acres		2683		
SOP Units		3219.6		

Mitigation (4485.6 + 3219.6= 7705) is equal to Impacts (7705)

The SOP calculations determine the minimum number of acres that need to be acquired and preserved to acceptably mitigate for the expected wetland impacts. Table 9-7 shows the amount of acres that would have to be acquired and preserved for each depth alternative.

Table 9-7: Wetland Preservation Calculations

Depth Alternative	Minimum Acres Needed
44-Foot	0
45-Foot	1,643
46-Foot	2,188
47-Foot	2,245
48-Foot	2,683

Savannah District consulted the USACE Center of Expertise for Ecosystem Restoration to confirm that the Regulatory SOP was a technically sufficient method of determining the amount of acres that the Project would need to acquire and preserve to compensate for adverse impacts to wetlands. The Center concurred that the SOP was a technically sound technique. They noted that -- as with other techniques -- its results depend heavily on the values assigned to specific parameters in the analysis. They also noted that with the approach followed in this application, much of the mitigation requirement was being driven by conversion of salt marsh to brackish marsh, an activity which was reportedly a goal of the natural resource agencies for this estuary.

9.2.1 Identification of Lands to be Acquired

The USFWS and the Savannah National Wildlife Refuge have identified properties within the estuary that they believe are ecologically valuable and provide positive contributions to the goals of the Refuge and enhance the area's fish and wildlife resources. The latest version of the Refuge's Acquisition Plan is dated July 2007 and is included in the document titled "Final Environmental Assessment and Land Protection Plan; Proposed Expansion of Savannah National Wildlife Refuge". This plan is being updated, and the USFWS has provided the Corps a Draft Map which reflects the latest approved expansion plan for the SNWR. The Corps proposes to acquire lands from the Refuge's Acquisition Plan and provide them to the USFWS to manage as additions to the Savannah National Wildlife Refuge, to mitigate for the remaining wetland impacts from this project. The USFWS previously identified the ecological value of those properties and believes they would be valuable additions to, and advance the goals of, the Savannah Refuge. The Refuge has the authority to accept these lands, since the lands are already included in the Refuge's approved Acquisition Plan. The USFWS would manage these properties using funds obtained through the Department of Interior's normal budget process.

Although there are 45,836 acres in the Refuge's approved Acquisition Plan, not all of those properties would provide the type of habitat that is desired as mitigation for this project. The project would acquire properties from the Refuge's Acquisition Plan that best meet the needs of the project. Those needs would be met by properties that are dominated by freshwater wetlands. The Corps has consulted with the Refuge and will lean heavily on the Refuge's identified priorities.

The Corps has completed its initial assessment of properties in the SNWR's Acquisition Plan to determine potential properties that could meet the wetland mitigation needs of the SHEP. This assessment (Consideration of 2008 USEPA/USACE Mitigation Rule) is in Appendix C of the Final EIS. The lands proposed for preservation consist of bottomland hardwoods, maritime forest and uplands dominated by deciduous forest and regrowth. The bottomland hardwoods are classified as palustrine, forested, broad-leaved deciduous systems that are both temporarily and seasonally flooded. Preserving these areas would ensure wildlife habitat is protected in perpetuity. Moreover, the additional lands would buffer the SNWR from future threats of development such that changes in land use would not occur immediately adjacent to existing areas of the Refuge that do contain estuarine emergent wetland characteristics. Thus, the acquisition and preservation of wetland and upland buffer would provide a functional replacement for the minor conversion of the only wetland function (i.e., fish and wildlife habitat) that would be expected as a result of the freshwater to brackish marsh conversion.

Due to the unique nature of the impact (i.e., vegetative conversion), the Corps would also conduct extensive monitoring to ascertain the magnitude of the marsh conversion that does occur. If impacts to tidal freshwater marsh exceed those expected, funds would be available to purchase additional lands for preservation. A monitoring plan has been developed (See Appendix D of the Final EIS) that would establish 12 marsh

monitoring sites in transitional areas that are predicted to most likely experience a vegetative shift as a result of the channel deepening. Seven of the marsh monitoring sites have already been established and were monitored by the USGS Florida Fish and Wildlife Cooperative Research Unit. The five new monitoring locations were chosen to expand monitoring in highly sensitive marshes, in other areas of marsh where significant salinity changes are possible under a variety of scenarios, and to monitor community shifts both vertically (up and down river) and laterally (interior versus exterior). The data collected from this monitoring would be used along with the hydrodynamic and water quality models to quantify indirect impacts to freshwater marsh and saltmarsh. These sites would be monitored during the one year of Pre-construction monitoring, during construction and for 10 additional years of Post-Construction Monitoring.

9.2.2 Salt Water and Brackish Wetland Compensation

Approximately 15.68 acres of brackish marsh would be lost as a result of various excavation requirements of the project (Table 9-8) for any of the project depth alternatives evaluated. The excavation requirements (in regards to the amount of wetlands that would be affected) for all five channel depth alternatives are the same. There are six locations where brackish marsh would be excavated. The first two locations are in the SNWR where approximately 2.2 acres would be removed at Station 102+600 and 0.8 acres would be removed as part of the Kings Island Turning Basin expansion. The project would remove brackish marsh from two locations on Hutchinson Island where approximately 3.4 acres would be excavated at Station 88+000 and 0.8 acres at Station 70+00. The project also provides for removal of the Tidegate Structure abutments on both the Georgia and South Carolina sides of the river. Removal of the Tidegate Structure abutment on the Georgia side would result in the loss of about 7.63 acres of brackish marsh while about 0.85 acres would be lost on the South Carolina side of the River.

Table 9-8: Impacted Wetland Characteristics

Location	Wetland Acres Affected by Excavation
Refuge Lands	
Station102+600	2.2
Kings Island Turning Basin - GA	0.8
Non-Refuge Lands	
Station 88+000 - GA	3.4
Station 70+000 - GA	0.8
Tidegate - GA	7.63
Tidegate - SC	0.85
Total	15.68

A previously-used sediment placement area (DMCA 1S) within Savannah Harbor was identified as having the greatest opportunity to support the long term success of a restored salt and brackish marsh system. DMCA 1S is located adjacent to the

confluence of Front River and Middle River, and it is located within the boundaries of the Savannah National Wildlife Refuge. Much of the site is currently "high ground" as a result of the previous sediment disposal actions, which were terminated at least 20 years ago. The Corps hosted a site visit on August 10, 2009, and the natural resource agencies approved the concept of grading down the site to restore it to a marsh. The proposed restoration area is approximately 40.3 acres. A 1.7 acre site adjacent to the 40.3 acre SHEP mitigation site was graded down by GPA several years ago as mitigation for work at their facilities. The SHEP wetland mitigation site and GPA's existing saltmarsh acreage (1.7 acres) would provide a contiguous 42.0 acre wetland.

The USACE used the Regulatory SOP to determine the exact number of acres that would be required for restoration. The 15.68 acres of impact to salt and brackish marsh equates to approximately 138 mitigation credits. Calculations derived from the SOP indicate that approximately 28.8 acres of restored marsh would be required to mitigate for the 15.68 acres of impact. The Corps intends to restore approximately 40.3 acres of saltmarsh at DMCA 1S. The roughly 11.5 acres of excess restored saltmarsh would be credited to the Savannah Harbor Navigation Project as "advance mitigation" and used when the need arises for small amounts of marsh mitigation to compensate for wetland impacts from O&M actions. These excess wetland mitigation credits could also be used to for any additional wetland mitigation needs for the SHEP.

Restoration of the DMCA 1S site would occur by grading it down to an elevation that would allow the growth of *Spartina alterniflora* (i.e., +7.6 to +7.8 MLLW). The elevation range was selected after inspecting and surveying the elevations of natural marsh that is immediately adjacent to the proposed restoration site. Once the new elevations have been established, the approximately 40.3-acre site would be allowed to naturally vegetate at the expected rate shown in Table 9-9. As requested by the USFWS, a "feeder creek" system would be constructed toward the interior of the restored marsh. The creek would provide another mechanism of ensuring adequate exchange of brackish, surface water with pore waters that are located on the interior of the site.

Table 9-9: Re-Vegetation Rate for Created Marsh

Time Period	Percent Vegetative Cover
Construction	0
Year 1	15
Year 2	25
Year 3	40
Year 4	60
Year 5	80
Year 6	85
Year 7	90

The Corps would monitor the site for a period of seven years, and the success of the brackish marsh would be based on meeting or exceeding the annual values defined for the percent of vegetative coverage for *Spartina alterniflora* shown in the above table. The Corps would provide annual reports of the performance monitoring to the Wetland Interagency Coordination Team (ICT) for review. If the site does not revegetate at those rates, the Corps would plant *Spartina alterniflora* to provide the basis for subsequent growth across the entire site. The ICT would identify/recommend corrective actions.

The restoration of wetlands at DMCA 1S would also include a monitoring plan for invasive species and an invasive species control plan that could be implemented if required. If invasive species are identified, they would be removed from the site via hand grubbing or another method approved by the Wetland ICT.

The marsh restoration site (DMCA 1S) is located within the SNWR. However, the Corps and the GDOT still maintain a dredged material disposal easement on the site. The Corps and the GDOT would relinquish this easement.

9.3 Dissolved Oxygen Mitigation Plan Development

Dissolved oxygen is a critical resource in the harbor that experiences problematically low levels during the warm summer months. USEPA issued a "no discharge" TMDL for dissolved oxygen in the harbor in 2006 due to the severity of the problem. EPA issued a revised Draft TMDL in 2010 that would allow some discharge of oxygen depleting substances, but still requires a dramatic reduction in the basin-wide level of those discharges. The states of Georgia and South Carolina are working cooperatively with the point source dischargers and EPA to develop a plan that would fulfill the intent of EPA's revised TMDL.

Dissolved oxygen studies previously conducted for the Savannah Harbor Ecosystem Restoration Study were incorporated in this project. As part of that study, 25 different methods of improving dissolved oxygen levels in Savannah Harbor were examined. The analysis concluded that oxygen injection is the most cost-effective method for raising dissolved oxygen levels in the harbor.

After the flow re-routing components of the marsh mitigation plan were identified, additional hydrodynamic and water quality modeling was performed to refine the oxygen injection system design. The refined modeling indicated that three oxygen injection system sites, each with multiple Speece Cones, would be required. Facilities would be required at two locations to support three injection sites (Figure 9-2). The oxygen injection requirements for each depth alternative are summarized in Table 9-10.

Table 9-10: Dissolved Oxygen System Requirements

Depth Alternative	Number of Cones Operated	Number of Cones Installed	Capacity to Increase D.O. (lbs/day)
44-foot	9	11	36,000
45-foot	8	10	32,000
46-foot	9	11	36,000
47-foot	10	12	40,000
48-foot	11	13	44,000

All three oxygen injection sites (one near Georgia Power's Plant McIntosh, one at Hutchinson Island – west, one at Hutchinson Island – east) would be needed for each channel depth alternative. The systems would be land-based with water being withdrawn from the river through pipes, then super-saturated with oxygen and returned to the river. The water intake structure would include screens to reduce the intake of trash and other suspended solids. The screens would be sized to keep flow velocities from exceeding 0.5 foot per second to minimize entrainment of fish larvae. The intake and discharge would be located along the side of the river and would not extend out into the navigation channel.

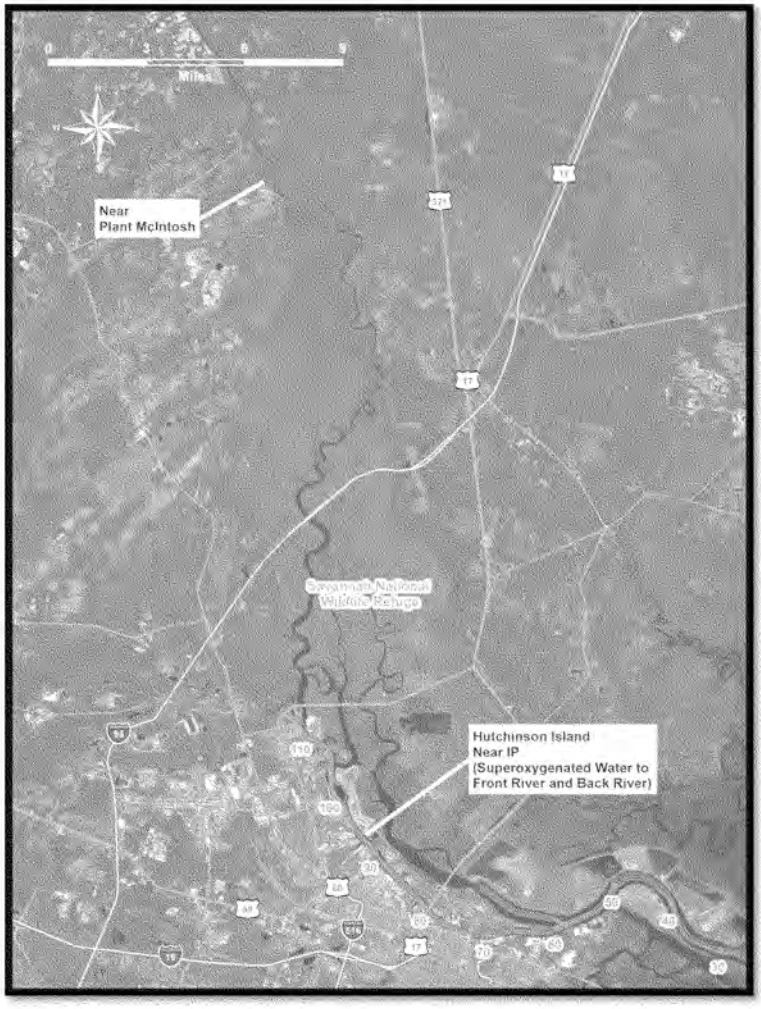


Figure 9-2: Proposed Locations for Dissolved Oxygen Improvement Systems

In the summer of 2007, the Georgia Ports Authority funded a full-scale demonstration project of an oxygen injection system. The summer is typically a time of low dissolved oxygen levels in the harbor. The demonstration was conducted to obtain information of the effectiveness of this design and address concerns expressed by natural resource agencies with application of this general design in an estuarine

environment. Agencies had expressed concern about (1) whether an injection system could be effective in the harbor, and (2) whether dissolved oxygen levels would be too high near the discharge site and adversely affect fishery resources.

The demonstration project supported the following findings:

- The injection system could increase dissolved oxygen levels in the harbor;
- Oxygen injection takes about three days to begin to reduce mid-channel dissolved oxygen deficits and the oxygen improvement near the injection site extends for at least seven days after oxygen addition ceases;
- The super-oxygenated water dispersed quickly into the river and excessively high dissolved oxygen levels were not observed near the injection point; and
- Tidal flow brought new water into the injection area and no short-circuiting was observed.

The demonstration confirmed that the injection system effectively added the required mitigation amount of dissolved oxygen to the harbor and reduces in-stream dissolved oxygen deficits during critical summer conditions. The demonstration also confirmed the soundness of the prototype design.

Modeling to determine dissolved oxygen impacts in the harbor originally excluded point source dischargers. This was intentional to gain understanding of project impacts without any outside influences. However, after the dissolved oxygen mitigation was developed, the models were re-run with the point source discharges included (per request from NOAA to fully describe Shortnose sturgeon impacts) and it was discovered that mitigation goals for water quality were not achieved with the preliminary dissolved oxygen system design. Therefore, additional cones were added to meet the water quality mitigation goals throughout the harbor with a more real-world condition of point source loads being included. The final design also includes one additional Speece Cone at each site location, which would be used as a spare when maintenance or repairs are required.

9.4 Shortnose Sturgeon Mitigation Plan Development

As shown in Table 8-3, adverse impacts (increased salinity) to adult and juvenile winter habitat would remain even after the injection of oxygen and implementation of the flow rerouting measures for all project depths evaluated. The natural resource agencies were consulted about potential ways to address remaining impacts. Neither the natural resource agencies nor the Corps could identify any measures that could be implemented in the estuary that would restore sturgeon habitat or enhance existing habitats. The habitat suitability analysis indicated that the main issue determining the quantity of acceptable sturgeon habitat in the estuary is salinity. The reductions in volume of acceptable habitat stem from increases in salinity to unacceptable levels at sites that presently provide suitable habitat characteristics. The fish could move further upstream to areas possessing lower salinity levels. Those habitats may have excess carrying capacity, but that is unknown, and those upstream sites may possess other factors that make them less suitable or unsuitable to sturgeon. Since no

measures to address remaining impacts to Shortnose sturgeon habitat could be identified in the estuary, it was decided to evaluate habitat improvement measures elsewhere in the Savannah River Basin. One potential measure is to provide Shortnose sturgeon access to traditional foraging and spawning habitat above the lowest dam (New Savannah Bluff Lock and Dam) on the river.

The Corps acknowledged that removal of the lowest dam on the river, the New Savannah Bluff Lock and Dam (NSBL&D) at Augusta, Georgia, which is operated by the Corps, would be the preferred method to allow sturgeon and other anadromous fish to access upstream habitat. The Corps also acknowledged that removal of the lock and dam would benefit the ecosystem. However, removal of the New Savannah Bluff Lock and Dam is not a feasible mitigation alternative for the following reasons:

- The lock and dam is a Congressionally-authorized project; therefore, the Corps is obligated to maintain the project as Congress provides funding for such actions.
- The current authorization language (WRDA 2000) amended in Omnibus Act 2001 calls for repair and rehabilitation of the lock and dam structure, construction of a fish passage, and conveyance of Lock and Dam to the City of North Augusta.
- Removal of the structure would adversely impact the freshwater supply of eight major users.

Since removal of the NSBL&D is not feasible, a fish passage structure around the NSBL&D at Augusta, Georgia, which is operated by the US Army Corps of Engineers, was recommended. A fish passage structure around the structure would allow migrating fish to move past the dam, which would initially open up an additional 20 miles of habitat upstream of the dam to reaches Shortnose sturgeon had used in the past. After some other actions (fish passage structures at two dams above the New Savannah Bluff Lock and Dam) are taken by others, an additional 30 miles of riverine habitat upstream of the dam would become available to Shortnose sturgeon. The structure would also open up the river to American shad and other anadromous fish species, thereby helping those impaired populations. There is also evidence that some of the Savannah Harbor Striped bass population spawn in upstream areas near the fall line which could also benefit from the fish passage structure. In June 2007, representatives of the resource agencies confirmed that the fish passage structure appears to be the best measure within the basin to effectively compensate for the predicted loss in Shortnose sturgeon habitats.

The previously approved horseshoe rock ramp design would also allow fish to move downstream, thereby ensuring young fish spawned upriver could access other habitats needed in later life stages. The horseshoe rock ramp bypass was designed to capture 5 percent of the river flow. Based on some of the comments received on the Draft EIS, some of the agencies believed the bypass would need to carry more of the river flow to successfully pass Shortnose sturgeon. Consequently, the Corps convened an interagency workshop on April 25-27, 2011 to discuss and evaluate mitigation options

available. Numerous options were evaluated in regards to fish passage at the NSBL&D. Using the input from the agencies at the workshop, the Corps screened the potential fish passage options and prepared preliminary designs for three fish passage alternatives. Since all three designs would achieve the objective of Shortnose sturgeon passage at the NSBL&D and would also accommodate the larger Atlantic sturgeon and readily pass other anadromous species such as American shad and Striped bass, the Off-Channel Rock Ramp Design was selected as the preferred design because it is the most cost effective.

9.5 Striped Bass Mitigation Plan Development

As shown in Table 8-3, adverse impacts remain for Striped bass spawning, egg and larval habitat even with the flow rerouting measures for all of the project depth alternatives evaluated (except for Striped bass egg and larval habitat for the 46-foot Project). The adverse effects are most pronounced in the adult spawning habitat.

In general, salinity was the main factor in reducing the quantity of acceptable habitat. Some areas did fail the velocity criteria. The placement of structures to increase velocity in those locations was determined inadequate by the agencies. Therefore, they recommended that hard structures not be used to improve flow velocities to increase Striped bass habitats. The agencies could not identify any other measures that could be implemented in the estuary to restore or enhance Striped bass habitats.

The loss of 10 percent of spawning, egg development or larvae habitats could limit the size of the Savannah River population of Striped bass. The agency representatives concluded that the only means of addressing that impact would be through a stocking program. Through such a program, the project would provide additional fish to the population to compensate for the limiting nature of the reduced spawning and early development habitats. The Wildlife Resources Division (WRD) of the Georgia Department of Natural Resources conducted a striped bass stocking program in this river in the late 1990's. The Corps coordinated with GA DNR-WRD and confirmed that a stocking program could compensate for the impacts identified to Striped bass.

The costs for a full stocking program to replace 100 percent of the young would be appropriate mitigation if the project were expected to adversely impact 100 percent of the existing spawning or early life stage habitat in the estuary. However, since the alternatives being considered are not expected to result in impacts that severe, the extent of the stocking that would be needed could be reduced to the amount of habitat predicted to be impacted by the project. The percentage of habitat loss could be multiplied by the cost for a full-scale stocking program to determine the amount of funding that would compensate for the habitat loss that is expected.

The potential adverse impacts to Striped bass habitat were quantified for three life stages and three river flows. That information must be consolidated to arrive at a single value to represent adequate compensation across all those conditions. It is appropriate to use the maximum impact value for a given river flow across the three

life stages. An individual fish would have to pass through each of those life stages to enter the population, so the life stage that was impacted the most would define the maximum impact of the project for a given river flow.

Using that approach, the maximum adverse impacts expected to Striped bass habitat can be consolidated by river flow as shown in Table 9-11. A weighted average impact was calculated based on drought flows occurring 25 percent of the time, average flows occurring 50 percent of the time, and high flows occurring 25 percent of the time.

Table 9-11: Striped Bass Weighted Average Impact

Channel Depth Alternative	Spawning 50% Flows	Eggs 50% Flows	Larvae 50% Flows	Combined Adverse Impact
44-Foot	-2.9 %	-9.4 %	-5.6 %	17.0 %
45-Foot	-9.2 %	5.2 %	1.7 %	2.9 %
46-Foot	-10.0 %	-0.0 %	5.6 %	5.0 %
47-Foot	-11.1 %	-5.0 %	-13.5 %	26.9 %
48-Foot	-16.1 %	-10.8 %	-3.5 %	27.8 %

With that weighted average impact value and the costs of a complete stocking program, one can calculate the compensation required to mitigate for each depth alternative. The GA DNR-WRD provided information on the costs to rehabilitate and operate some of GA DNR-WRD's facilities at their Richmond Hill hatchery to conduct a Striped bass stocking program capable of producing 40,000 Phase II fish each year. The costs included initial expenses of $3.1 million, annual expenses of $203,000 to operate the program, and recurring costs of between $30,000 and $50,000 for equipment replacement. These costs represent an annualized cost of roughly $466,700 for a complete Striped bass stocking program. Based on that average annual value, compensation detailed in Table 9-12 would be required:

Table 9-12: Striped Bass Annual Mitigation Costs

Channel Depth Alternative	Weighted Average Impact	Annual Program Funding
44-Foot	17.0%	$79,335
45-Foot	2.9%	$13,534
46-Foot	5.0%	$23,334
47-Foot	26.9%	$125,536
48-Foot	27.8%	$129,737

The mitigation plan proposes to fund that compensation as a lump sum. Using an interest rate of 4.125 percent over 50 years to obtain the present worth of that annual funding stream, the lump sum payments detailed in Table 9-13 would be required:

Table 9-13: Striped Bass Lump Sum Compensation Value

Channel Depth Alternative	Annual Program Funding	Lump Sum Payment
44-Foot	$79,335	$1,668,000
45-Foot	$13,334	$285,000
46-Foot	$23,334	$491,000
47-Foot	$125,536	$2,640,000
48-Foot	$129,737	$2,728,000

Using the FY12 discount rate of 4 percent, the lump sum payment for the 47-foot depth alternative would be $2,672,000.

An evaluation of the impacts of SHEP on Striped bass habitat would be conducted during years 2, 4, and 9 of the Post-Construction monitoring to ensure that impacts do not exceed what is expected. The field data collected during the monitoring would be used in conjunction with the hydrodynamic and water quality models to conduct this assessment. Adaptive management funds would be available to provide further mitigation for Striped bass habitat should the study show that is warranted.

9.6 Chloride Mitigation Plan Development

9.6.1 Chloride Impacts to Savannah's Municipal and Industrial Water Treatment Plant

Deepening the Savannah River to the Garden City Terminal would allow salinity to move farther upstream to the extent that chloride concentrations would increase at the City of Savannah's water intake and at other industrial intakes. Impacts of increased chloride concentrations at the City of Savannah's water intake during periods of drought (low river flow) include potential increases in lead and disinfection by-product concentrations in the municipal water system and could increase maintenance costs for the City's municipal water distribution system. Increased chloride concentrations associated with the SHEP could also impact industrial production and maintenance costs for industrial users of Savannah River water.

The City of Savannah's 62.5 million gallon per day (MGD) capacity municipal and industrial water treatment plant obtains surface water through an intake on Abercorn Creek. The intake is located in Effingham County, Georgia about two miles from the confluence of Abercorn Creek and the Savannah River, and about 11 miles upstream of the SHEP upstream limits. The City presently operates the plant at around 30 MGD. That rate has increased in recent years as the western part of Effingham County has grown rapidly. Additionally, the City of Savannah is under a directive from the State of Georgia to decrease groundwater usage, which would increase future demand for surface water from the Abercorn Creek intake.

The City withdraws water from Abercorn Creek for both municipal and industrial uses. Municipal water requires that chlorides be within the 250 mg/l (or 250 ppm) drinking-water standard established by the EPA. This level is specified as a threshold of taste and odor detection and not as a health hazard. Distribution pipelines and some industrial processes are sensitive to chloride concentrations much lower than the drinking water standard. In the past, City contracts with industrial customers included a provision that chloride concentrations be below 12 mg/l (or 12 ppm). That criterion is not included in current contracts, but the industries still require water with very low chloride concentrations. The City's Water Treatment Plant does not treat for chlorides. Industrial users must bear the economic burden of any increased maintenance costs at their facilities due to chloride concentrations.

As part of the Savannah Harbor Expansion Project, the Savannah District conducted a number of studies to evaluate impacts to the City of Savannah's intake on Abercorn Creek. An impact prediction tool was developed. The details of the development are outlined in the report titled *Savannah Harbor Expansion Project - Chloride Data Analysis and Model Development* dated November 15, 2006 which is included in the Engineering Investigations Supplemental Materials. Projection of chloride impacts due to harbor deepening and wetland mitigation using this method are documented in two reports *Chloride Impact Evaluation Impacts of Harbor Deepening Only* dated February 2007 and *Savannah Harbor Expansion Project Evaluation of Chloride Impacts with Proposed Mitigation Plan* dated December 2007 which are both included in the Engineering Investigations Supplemental Materials.

Study findings predicted only negligible changes to the chloride concentrations from harbor deepening. The predicted impacts were less than 1 mg/l and would occur only during low river flows (less than 6,000 cfs measured at Clyo, GA). The impact analysis concluded that the impacts to chloride concentration in Abercorn Creek from a harbor deepening would not be significant. Both an independent technical reviewer and the City of Savannah expressed concern during their review of the impact prediction tool and the analysis. The predicted impacts were reported in the November 2010 Draft GRR and EIS documents.

In response to the City's concerns, the Corps decided to collect additional data which could be used to refine the predictive model. The Corps consulted with the City of Savannah to develop a scope of work for collection of additional chloride data that it could use to refine its tool to predict chloride levels with a harbor deepening. USGS and GPA participated in development of the scope of work. Data collection was performed from early 2009 through summer 2010. In addition to chloride data, velocity measurements and flow data were collected at Three Mouths, which is the confluence of Abercorn, Bear, and Little Collis Creeks, to better calibrate the flow split in the hydrodynamic model at that location. The Corps used this new data, the City's original chloride data, and subsequent daily chloride measurements collected by the City of Savannah, to refine the modeling methodology.

The revised modeling methodology, development and calibration, is described in the report titled *Chloride Modeling Savannah Harbor Expansion Project Savannah, Georgia* dated December 31, 2010, and is included in the GRR Engineering Appendix Supplemental Materials. A Corps Agency Technical Review (ATR) was performed on the updated model methodology and the report by a USACE South Atlantic Division Regional Technical Expert for Water Resources Engineering and ERDC staff. An Independent External Peer Review (IEPR) was conducted by Battelle, Inc. Comments from these rigorous reviews were incorporated into the modeling and analysis for SHEP impacts determination.

The updated impact analysis indicates that the proposed harbor deepening would increase chloride levels at the City's water intake under drought conditions during high tide. Under those conditions, maximum daily average chloride levels are predicted to be 62 mg/l with a maximum hourly chloride level projected as185 mg/l for the 47-foot project. However, the long-term average chloride level is only predicted to increase from 11 to 13 mg/l. The predicted chloride concentrations with harbor deepening do not approach the drinking water standard (250 mg/l), even under the worst-case drought conditions (drought-of-record).

Analyses were also conducted to assess the potential corrosion impacts of increased chloride concentrations. Corrosion of steel water distribution pipes could result in increased life-cycle costs for the pipe distribution networks and corrosion of lead and copper could cause unsafe levels of copper and lead ions in the water. In their February 2011comment letter to the Corps, the City estimated a 12% decrease in life expectancy of pipelines corresponded to an increased replacement cost of $22 million. The City owns and maintains about 750 miles of water distribution pipeline, 60% of which is steel.

Consequently, an investigation and analysis of water system chloride concerns was conducted. That report, completed April 29, 2011 is titled *Assessment of Chloride Impact from Savannah Harbor Deepening* and is included in the Engineering Supplemental Materials. The conclusion of the analysis was that copper and lead corrosion were likely not an issue and that steel corrosion could be controlled by raising the pH of the treated water supplied to the distribution system. The study also recognized that increasing pH to reduce corrosivity could result in the formation of disinfection byproducts (DBPs), such as trihalomethanes and bromates, which are suspected carcinogens and regulated by the National Primary Drinking Water Standards.

The Assessment of Chloride Impact from Savannah Harbor Deepening suggested additional laboratory analyses to confirm its conclusions. Consequently, more detailed laboratory analyses were performed at the water treatment plant to replicate the City's current water treatment process and evaluate the impact of increasing chlorides on the plant water and treatment process, including analysis of DBP formation. The report titled *City of Savannah Seawater Effects Study* dated December 2011 which is included in the GRR Engineering Appendix Supplemental Materials

presented evidence that two significant impacts could be expected to drinking water quality from increased chlorides – increased lead concentrations and formation of disinfectant byproducts (DBPs).

Based on laboratory analyses, lead concentrations in the water samples were shown to increase 2-4 times compared to existing conditions as chloride concentrations increased from 10 mg/l to 50 mg/l. Although additional investigations would be required to assess lead concentrations for the end user, the ideal concentration of lead in drinking water is zero. Therefore, it is not acceptable to increase lead concentration in drinking water even though the regulatory threshold is not exceeded. Any increase in lead concentration is considered an increased health risk.

The City of Savannah uses free chlorine as a disinfectant against pathogens in their water treatment process, as do many water suppliers. However, free chlorine can react with dissolved natural organic matter present in the water to form byproducts. These disinfection byproducts (DBPs) are regulated under the Disinfectants and Disinfection Byproducts Rule (D/DBPR). The D/DBPR is a Federal regulation that limits the concentration of DBPs that water suppliers can allow in public drinking water. Potential cancer, reproductive and developmental health risks can result from exposure to DBPs.

The lab analysis presented in *City of Savannah Seawater Effects Study* showed that DBPs are affected by increasing chlorides in two ways:

- Increasing chloride concentrations due to SHEP causes an increase in chlorine required to treat the water. The additional disinfectant required to achieve treatment goals causes the formation of additional byproducts; and
- As chlorides are pushed further upstream with harbor deepening, bromides, which are another component of seawater, are pushed further upstream as well. Brominated compounds can react with chlorine to form bromine-containing DBPs. The rate of DBP formation is also affected by the presence of bromide in the source water.

Both of these conditions are expected to occur under SHEP, with some DBPs projected to increase above the permitted level when chlorides exceed about 60 mg/l.

9.6.2 Mitigation for Impacts at City of Savannah's Water Treatment Plant

Several chloride mitigation options were identified early in the study process, in the event that mitigation for increased chloride concentrations due to harbor deepening would be warranted. These potential chloride mitigation options include:

- Increased flows at Bear Creek (tributary to Abercorn Creek);
- Increased groundwater withdrawals;
- Increased releases from Thurmond Dam;
- Desalination and other water treatment options;

- Construction of a supplemental water intake farther upstream; and
- Storage impoundment construction.

Mitigation for chloride impacts will be accomplished through construction and operation of a storage impoundment, which will provide raw water to the City of Savannah treatment plant during periods of high chloride spikes (low flow in the Savannah River accompanied by high tides). The storage impoundment will be located on GPA property at the Savannah International Trade Park (Figure 9-3). Operation and maintenance activities associates with this mitigation feature would be the responsibility of the City of Savannah.

Based on extensive updated modeling efforts to predict chloride increases by frequency, concentration, and duration, along with multi-variable bench-scale laboratory analysis on-site at the City's water treatment plant, the best solution to mitigate for chloride impacts due to harbor deepening is to remove the influence of the increased seawater intrusion. This can be accomplished most cost-effectively by a storage impoundment, which would store acceptable raw water for use during periods of high chloride spikes, which occur during very low river flows and high tides. The Engineering Appendix discusses the alternatives considered and concludes that the raw water storage alternative (including the proposed design capacity) is the more cost-effective option to mitigate against both increasing lead corrosion and increasing DBP formation that is expected to occur with higher chloride concentrations. For more detail, the CDM report entitled "Savannah Seawater Effects Study", included in the Engineering Supplemental Materials, contains a description of the alternatives considered and their implementation costs.

The Corps identified 6 potential locations between the City's water intake and its treatment plant for siting a raw water storage impoundment. The District provided its initial assessment of the locations to the City for comment and inspected each site. As a result of those assessments, the Corps eliminated 4 of the sites (see Section 5.02.15 of the EIS, which discusses the site alternatives in detail). The City of Savannah expressed concerns about the future availability of specific tracts in this rapidly-developing portion of the County. In response, the Corps identified Parcel 3 of the Savannah International Trade Park, located near Mulberry Grove, which is already owned by the Georgia Ports Authority (Figure 9-3). Selection of that parcel would ensure the site is available when needed.

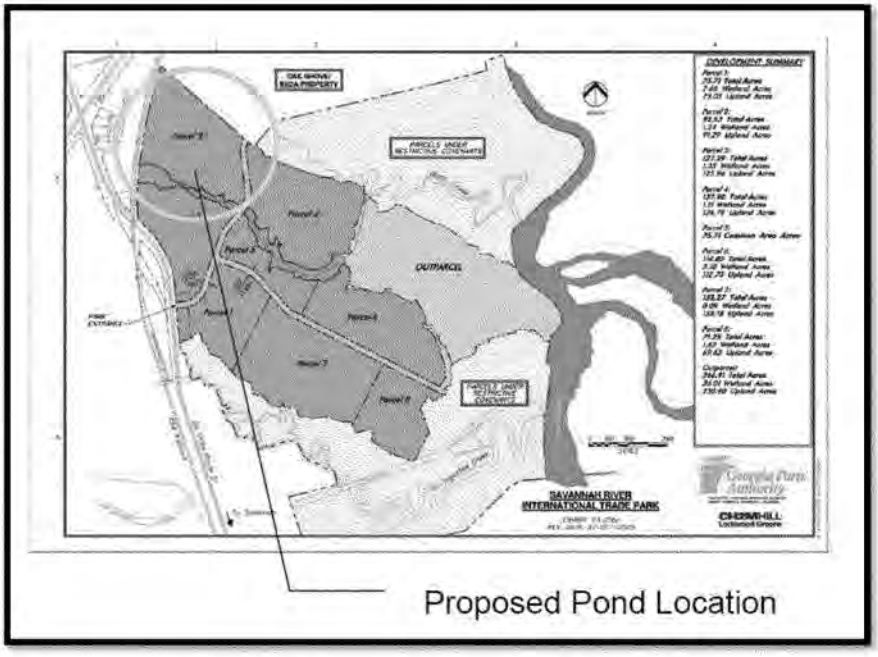


Figure 9-3: Proposed Impoundment Location

Design considerations for the raw water storage impoundment include:

- The GA DNR-EPD, in their Section 401 Water Quality Certification for Savannah Harbor Expansion, stated that any mitigation remedy selected shall be based on the maximum plant capacity of 62.5 mgd. They also stated that any mitigation remedy shall be constructed in conjunction with the channel deepening;
- A firm raw water pumping capacity of 75 mgd at the existing Abercorn Creek intake. Design constraints based on firm pumping capacity as opposed to the actual pumping capacity of 100 mgd is standard engineering practice and is required by the GA DNR-EPDs *Minimum Standards for Public Water Systems* published in May of 2000;
- 20% of the storage volume will be unusable due to access limitations and sedimentation;
- A performance goal of limiting the chloride concentration at the treatment plant to 40 mg/l during the model predicted worst-case scenario and to 25 mg/l 99 percent of the time.

A series of statistical analyses were used to determine the appropriate size for a raw water impoundment for use at the City's drinking water supply plant for all project depths under these design considerations noted previously. The impoundment required would range from 28.0 million gallons (total impoundment volume) for a project depth of 44 feet, 38.0 million gallons for the 45-foot project, 58.0 million gallons for the 46-foot project, 97.0 million gallons for the 47-foot project to 150 million gallons for the 48-foot project.

Details of the design can be found in the report titled *City of Savannah Seawater Effects Study* included in the GRR Engineering Appendix Supplemental Materials. Important aspects of the design include:

- Dual 36" influent and effluent pipes to connect the impoundment to the existing raw water pipeline (to provide redundancy at the tie-in points and allow for maintenance to occur during times when the impoundment is in use);
- A pump station containing four vertical turbine pumps to convey flow out of the impoundment and back into the raw water lines;
- A mechanical mixer in the center of the impoundment to help maintain oxygen levels throughout the impoundment's depth, reducing the likelihood of algae growth and the associated taste and odor issues;
- A powdered activated carbon silo and feed system to be used on an intermittent basis during severe taste and odor episodes;
- A 24" drain pipe to be used to empty the impoundment during periodic maintenance cleaning; and,
- One or more in-situ chloride meters to be installed in Abercorn Creek to provide data for operational decision making.

Model predictions indicate that high chloride levels will occur diurnally, coincident with high tide. An early warning system on Abercorn Creek would be required to provide data to the operator in a timely manner to know when valve and pump changes are needed.

Operation of the impoundment consists of pumping raw water from the existing Abercorn Creek intake to the storage impoundment during occurrences of low chlorides. The raw water would then be pumped from the storage impoundment to the City's water treatment plant. During occurrences of high chloride levels in Abercorn Creek, pumping from Abercorn Creek would cease, avoiding the high chloride levels in the creek. Water from the impoundment would continue to be pumped to the City's existing water treatment plant to meet the industrial and municipal demands. When chloride concentrations on Abercorn Creek return to acceptable levels during low tide, pumping from the creek would resume and the storage impoundment would be refilled and be available for use during the next high tide.

Based on the drought-of-record flow conditions experienced in November 2008, that worst-case event would have required use of the storage impoundment for 14 consecutive days. The total impoundment storage volume represents only about 32 hours of water usage at plant capacity. However, the chloride content of Abercorn

Creek will rise and fall with each tidal cycle; so the impoundment would be partially refilled during low tide twice each day. The impoundment was designed such that the minimum volume needed to limit the maximum concentration to 40 mg/l and the 99th percentile concentration to 25 mg/l at the City's water treatment plant (see Engineering Appendix Section 7.7.11, which contains a discussion regarding determination of optimum impoundment capacity).

Although it would be located on high ground in an existing industrial park, construction of the storage impoundment (including its pumping station and inflow and outflow pipes) may result in minor adverse impacts to wetlands. Savannah District will conduct detailed surveys during the final design and follow the interagency-approved Savannah District Regulatory SOP to quantify the extent of any mitigation that may be needed. The Corps would coordinate the results of the SOP calculations with GA and the Federal natural resource agencies.

9.7 Secondary Impacts

It is important to note that the total cargo handled at Garden City Terminal is not projected to change due to implementation of the SHEP. Therefore, secondary impacts associated with additional cargo traffic are not anticipated. The project will allow vessels that use the channel to sail more deeply and more efficiently. This will be especially important as the larger Post-Panamax vessels replace older, smaller vessels. Fewer vessel calls would be required to deliver the same total volume of cargo. These vessels are projected to be loaded with cargo for Savannah as well as other ports, as is currently the case.

The number of TEUs handled at the GCT is expected to increase in the without project condition until the facility reaches its capacity of 6.5 million TEUs around 2020. Improvements at the Garden City Terminal, improvements of highway infrastructure, construction of distribution centers, etc. are expected to continue in the without project condition to support the growth of the terminal. These secondary impacts will occur with or without construction of the SHEP.

9.8 Cumulative Impacts

The environmental impacts from deepening the harbor were examined on a cumulative basis. Significant resources which could be affected by a harbor deepening were examined. The District considered the effects of past, present, and expected future impacts to those resources. That allowed the impacts from the proposed harbor deepening to be placed in a proper context, so that one can better identify the significance of the effects predicted by the proposed action.

Tidal freshwater wetlands were identified as being significant in the harbor. They have experienced substantial declines in acreage over the years as a result of many factors, including human development of the lowlands surrounding the river. Dissolved oxygen levels in the harbor are at a critical threshold. This parameter is

being strictly managed by the Federal and State natural resource agencies to ensure the harbor's waters can provide its desired uses. The drinking water aquifer is a resource of major concern. Substantial impacts to that resource would have major economic and possibly environmental effects. Erosion of Tybee Island, located adjacent to and down-drift from the entrance channel, is a concern. Fishery resources in the harbor are a concern. The harbor contains numerous species that are managed on both the Federal and State level. Endangered species which reside in or use the harbor are a concern. The cumulative impact analysis for the SHEP is found in Appendix L in the EIS.

Savannah District believes the proposed harbor deepening could be accomplished in an environmentally-acceptable manner. The proposed alternatives contain mitigation plans for all significant adverse impacts.

10 Alternative Plan Evaluation: Costs

This chapter presents the detailed alternative plan evaluation that was conducted to identify the NED plan. The detailed alternative plan evaluation was prepared in accordance with Corps' guidance on formulation and evaluation of deep draft navigation projects as described in:

- The Planning Guidance Notebook, ER 1105-2-100 (22 April 2000);
- National Economic Development Procedures Manual: Deep Draft Navigation, IWR Report 10-R-4 (November 1991);
- Digest of Water Resource Policy and Authorities, EP 1165-2-1 (30 July 1999);
- Policy for Implementation and Integrated Application of the USACE Environmental Operating Principles and Doctrine, ER 200-1-5 (30 October 2003);
- Engineering and Design for Civil Works Projects, ER 1110-2-1150 (31 August 1999); and
- Planning in a Collaborative Environment, EC 1105-2-409 (31 May 2005).

10.1 Identification of Alternative Plan Elements

Each of the alternative plans carried forward for detailed analysis includes shared elements, which are integral to the project design, and incremental elements which constitute the differences between the alternatives. The shared elements are included in each of the alternative plans. Shared plan elements include:

- Preparation and restoration of DMCA 14A & 14B so that these disposal areas can be used to isolate cadmium-laden sediments. Preparation and restoration activities include clearing, grubbing, dike improvements, drainage modifications, geotextile placement in support of dike improvements, and habitat restoration;

- Channel widening at the three bends (Jones Island Range, Lower Flats Range, and Fort Jackson Range) identified for design vessel passage by the ship simulation analysis; and
- Extension of the Kings Island Turning Basin to a 1,600 foot diameter as identified in the ship simulation study.

The incremental elements of the alternative plans include:

- Channel deepening from the sea to Garden City Terminal in one-foot increments from -44 feet MLLW to -48 feet MLLW; and
- Channel widening to create meeting areas (locations were ships heading in opposite directions can pass each other) at two incremental locations:
  - Long Island; and
  - Oglethorpe.

10.2 Detailed Descriptions of Alternative Plans

Detailed descriptions of alternative plans include location of plan elements, description of the purpose and implementation of the plan element, and dredging and excavation quantities of each plan element. The environmental impacts of each alternative plan are presented in Chapter 8: Alternative Plan Evaluation: Environmental Impacts.

10.2.1 Shared Plan Elements

DMCA 14A Modifications

Preparation of DMCA 14A and 14B prior to the placement of cadmium-laden sediments includes clearing and grubbing vegetation and raising the DMCA 14A back confinement dike to elevation 22 MLLW using material from DMCA 14B. Material removed from Area 14B will also be used to raise the dikes at containment area 13B. Geotextile will be used beneath the back dike as a counterweight to control settlement and movement of the soft foundation beneath the improved back dike. After the last of the cadmium-laden sediments have been placed in DMCA 14A and/or 14B, the dredged sediment will be covered with approximately 2 feet of suitable clean material. After the cadmium and cover has been placed, the dikes, finger dike, weirs, and bird habitat will be raised to about elevation 28 feet MLLW. Weir and drainage modifications will be made based on the new configuration. Bird habitat on the DMCA will be restored.

Bend Wideners

Three bend wideners were recommended by the Ship Simulation Analysis conducted on the *Susan Maersk* (the design vessel). The recommendations of the analysis are:

- Widen the bend at the Jones Island Range to the north (it is currently widened to the south);
- Widen the bend at the Lower Flats Range to the north, and

- Widen the Fort Jackson Range to the north.

Kings Island Turning Basin

The Ship Simulation Analysis indicated a 1,600-foot diameter turning basin would be adequate for turning the design vessel.

Meeting Areas

A potential meeting area at Marsh Island was considered but not recommended for detailed investigation due to existing land uses. Two meeting areas were considered in this analysis: Long Island Meeting Area and Oglethorpe Meeting Area. A third alternative was considered, which include both meeting areas together. The meeting area analysis estimated benefits due to reductions in the estimated time required to navigate Savannah Harbor as a result of channel modifications (meeting areas). Transit times and transportation costs were estimated in terms of reduced vessel delays.

There are no utility relocation costs projected for the meeting area alternatives. There are cadmium laden sediments in both of the alternative meeting areas. Cadmium laden sediments from the Long Island Meeting Area will be placed in DMCA 14A/14B and Cadmium-laden sediments from the Oglethorpe Meeting Area will be placed in DMCA 14A. Therefore, modifications to DMCA 14A and 14B are a common element of meeting area construction. Construction and investment costs for the meeting area alternatives are calculated in October 2010 dollars. Average annual costs and benefits are calculated using the FY 2011 Federal discount rate of 4.125 percent.

Table 10-1 presents the Meeting Area dredged material volumes for each depth increment. These Meeting Area volumes are included in the overall deepening material volume estimates.

Table 10-1: Dredged Material Volume Estimates[1]: Meeting Areas (cubic yards)

	Project Depth (- feet MLLW)				
Meeting Area	**-44**	**-45**	**-46**	**-47**	**-48**
Long Island	350,859	384,096	417,783	450,941	484,231
Oglethorpe	362,348	384,089	405,461	426,336	446,541

[1] Includes two feet of allowable over-depth

10.2.2 Incremental Project Elements

Incremental Channel Depth

Each alternative plan is based on the full length of the channel being deepened on existing side slopes, with the exception of six channel bends which will be cut to maintain existing bottom widths, and three channel bends that require widening based on the Ship Simulation Analysis. Note that one channel bend would be deepened on existing side slopes similar to the rest of the channel. Each depth increment includes Meeting Area dredged material volumes.

Table 10-2 presents the dredged material volumes for each one-foot increment of depth, including allowable two feet of over-depth dredging. The table also presents the source area of the material (by range) and the projected dredged material placement location. Figures 1-8 and 1-9 in the sub-chapter 1.4 Existing Navigation Project identify the dredged material disposal locations.

Table 10-2: Dredged Material Volume Estimates:[1] Incremental Deepening Alternatives (cubic yards)

		Project Depth (Feet Below MLLW)				
Range (000's)	**Placement Site**	**-44**	**-45**	**-46**	**-47**	**-48**
-98 to -57	ODMDS	1,667,123	2,242,371	2,925,432	3,736,308	4,613,909
57 to -53	ODMDS	156,623	235,127	313,391	391,437	469,252
-53 to -40	ODMDS	646,796	975,843	1,304,385	1,632,346	1,959,186
-40 to -30	ODMDS	505,693	771,105	1,038,620	1,305,921	1,573,800
-30 to -20	ODMDS	529,910	801,974	1,076,638	1,352,115	1,628,379
-20 to -10	ODMDS	473,047	746,614	1,028,399	1,311,222	1,594,871
-10 to 00	ODMDS	346,997	532,621	723,394	917,064	1,110,713
00 to 4	ODMDS	101,482	166,705	235,626	305,674	375,403
4 to 6	Jones Oyster Is.	48,128	87,346	130,559	174,073	217,263
6 to 30[A]	14B	1,264,730	1,756,993	2,258,262	2,759,203	3,259,272
30 to 45[2]	14A	684,583	1,052,928	1,426,462	1,802,866	2,181,609
45 to 51[2]	14B	324,752	508,740	699,013	892,307	1,088,128
51 to 57[B]	14A	652,793	801,504	951,201	1,101,114	1,251,494
57 to 67[C]	14 A & B	588,884	807,450	1,026,002	1,244,681	1,463,393
67 to 80	13A	444,210	691,727	944,611	1,196,291	1,446,786
80 to 90	14A	380,724	570,368	759,169	946,436	1,132,066
90 to 103[D]	13A	1,438,457	1,803,823	2,169,594	2,533,434	2,895,175
Totals		10,254,932	14,553,239	19,010,758	23,602,492	28,260,699

[1] Includes 2 feet of allowable over-depth and widening for Long Island and Oglethorpe passing areas
[2] Cadmium-laden sediments from Miocene clays in ranges 24 to 45 to be placed in DMCA 14A
[A] Includes Long Island Meeting Area, Station 14 to 22
[B] Includes Oglethorpe Meeting Area, Station 55 to 57
[C] Includes Oglethorpe Meeting Area, Station 57 to 59
[D] Includes Kings Island Turning Basin

10.3 Alternative Plan Costs

Potential project costs include construction costs (including mitigation), real estate costs, economic costs (interest during construction), engineering and design, supervision and administration, and operation and maintenance costs (Engineering Appendix: Chapter 13 Cost Engineering). Project costs also include any associated non-Federal costs (non-cost shared), such as berth deepening, landside infrastructure, or other modifications that must be incurred in order for project benefits to be realized. The only associated costs included in the analysis are berth deepening costs (non-Federal). There are no other associated costs. All costs are calculated using October 2010 dollars, a 50-year project life, and all discounting is conducted at the FY 2011 Federal discount rate (4.125%).

The Current Working Estimate (CWE) is for construction and non-construction features and includes all work necessary to deepen the harbor to a new design depth ranging from 44 to 48 feet below MLLW. The existing design depth for the Savannah Harbor is 42 feet below MLLW. Existing advance maintenance depths range from 2 to 6 feet below the design depth.

The CWE includes new deepening quantities, advance maintenance and 2-feet allowable overdepth quantities, removal of incidental O&M sediment, meeting area dredge requirements, required mitigation features including oxygen injection system, raising existing disposal area dikes, cadmium sediment removal, removal of the Confederate vessel CSS Georgia, Real Estate, Planning, Engineering and Design, Construction Management, and the addition of Navigation Aids.

Cost Estimates were prepared under guidance given in the Corps of Engineers Regulation ER 1110-2-1302, *Civil Works Cost Engineering* and Engineering Technical Letter ETL 1110-2-573, *Engineering and Design: Construction Cost Estimating Guide for Civil Works*. The Corps of Engineers Dredge Estimating Program (CEDEP) was used in developing dredging costs throughout the project for medium hopper dredges and large pipeline cutterhead dredges. A Cost Risk Analysis was conducted by the Center of Expertise at Walla Walla District to support contingency percentages for risk and uncertainty.

10.3.1 Construction Cost Narrative

Construction elements which comprise the construction costs of each incremental depth alternative include:

- Modifications to DMCA 14A and 14B to isolate cadmium laden sediments;
- Removal and preservation of CSS Georgia;
- Dredging and placement of dredged material from three bend wideners;
- Dredging and placement of material from the Kings Island Turning Basin extension;
- Dredging and placement of material from channel deepening;

- Dredging and placement of material from meeting area construction;
- Real estate costs for Kings Island Turning Basin extension;
- Interest during construction;
- Engineering and design (E&D) and supervision and administration (S&A); and
- Garden City Terminal berth deepening (associated cost, not Federally cost shared).

There are no other associated costs other than berth deepening, identified above. There are no utility relocations and, therefore, no utility relocation costs associated with the alternative plans.

The following sub-sections describe the cost assumptions used to develop alternative plan costs in the Code of Accounts framework.

Lands and Damages (01) – The estimated cost was furnished by the Real Estate Division, Savannah District and is discussed in the Real Estate Appendix. A contingency of 25% was established for this account and reviewed during the Cost Risk Analysis. All real estate costs are at the October 2010 price level.

Fish and Wildlife Facilities (06) – This account includes costs for mitigation including a fish passage structure at New Savannah Bluff Lock and Dam, salinity mitigation for deepening the harbor, creation of a marsh habitat at Disposal Area 1S, removal of the Tidegate structure, a raw water storage impoundment with mechanical mixing, and oxygen injection systems to inject oxygen at three (3) locations along the harbor.

Emphasis was placed on accuracy of quantities, material characteristics, and detail costs during evaluation of alternative plans to develop the CWE Plan. The reasonableness of costs developed was evaluated based on historical data, discussions with industry, crew production rates and construction methods based on similar projects.

A Fish Passage structure at New Savannah Bluff Lock and Dam will be constructed to allow fish passage upstream of the dam. The structure would consist of an off-channel rock ramp constructed around the South Carolina side of the dam. The primary construction tasks involve excavation of approximately 275,000 cubic yards of material around the end of the dam and placement of 116,000 tons of rip rap and boulder weir stone. Existing 12 foot high overflow gates 1 and 5 would be replaced with 15 foot high lift gates, making them uniform with gates 2, 3 and 4. The fish passage will carry all of the river flow during low flow periods, up to a typical flow of 8,000 cfs, at which time the lift gates will gradually be opened to pass larger flows without causing an increase in upstream flood elevations.

A combination of features will be constructed to mitigate for potential salinity impacts in the river as described by Mitigation Plans 6A and 6B. More detail of all these features are described in Chapter 8.1 of the Engineering Appendix. McCoy's Cut Diversion feature is diverting a portion of flow from Front River into the upstream

areas at McCoy's Cut. This feature includes constructing a diversion structure with 168 tons of sheet pile wall and 7,100 tons of GADOT Armor Stone at the entrance to McCoy's Cut. Additionally, a portion of lower western McCoy's connection will be closed using over 5,100 tons of GADOT TYPE 1 stone.

McCoy's Cut and upper portions of Middle River and Little Back River will be deepened to accommodate the additional diverted flow. Estimated deepening quantities excavated for McCoy's Cut, Middle and Little Back Rivers will be 315,000 cubic yards. This material will be disposed of in the existing Dredge Confined Disposal Facilities used for dredged material disposal.

Rifle Cut waterway will be closed using 3,300 cubic yards of fill sediment and 2,500 tons of GADOT, Type 1 rip rap to improve flow diversion.

Additional features include removal/demolition of the Tidegate structure piers and abutment (elevated walkways and associated appurtenances) as well as the Tidegate embankment removal to widen the river. The approximately 1,000,000 cubic yards of embankment at the Tidegate abutments will be removed and disposed of in either the Broad Berm fill area, if it is suitable fill, or existing confined dredged material disposal areas.

A submerged stone Broad Berm will be constructed at the confluence of Back River with Front River. The berm is located downstream of the Tidegate and Sediment Basin. The berm will be constructed of 97,000 tons of GADOT, TYPE 1 stone to -9.5 MLLW. In addition, a Broad Berm fill, upstream or behind the stone broad berm, will require 1.2 million cubic yards of suitable (sandy) fill material. The suitable fill is assumed to come from existing dredge confined disposal areas and/or the embankment removal at the Tidegate.

Marsh restoration of 40.3 acres will be conducted at the current location of Disposal Area 1S to an elevation of +7.6 ft MLLW. Construction includes excavation/grading of 435,000 cubic yards of material with assumed disposal into existing confined disposal areas.

A proposed public access Boat Ramp on Hutchinson Island includes a 2-lane concrete boat ramp with floating dock, 20 space trailer parking, handicap-accessible and single car parking spaces.

Onsite oxygen injection systems will be constructed at two locations along the river to supply oxygen to three injection sites. The two oxygen injection systems sites will have multiple Speece cones to generate oxygen into the harbor.

A Raw Water Storage Impoundment will be constructed in order to stabilize and reduce any necessary chloride concentrations before being pumped into the City of Savannah's water treatment plant. An earthen embankment with HDPE liner,

mechanical mixing system, four (4) pump stations rated at 21 MGD each, and a powdered activated carbon treatment system will be included in the construction.

Navigation, Ports, and Harbors (12) – The amounts of dredged material to be removed for each project alternative will vary as described in Table 10-2.

Also included in Account 12 are costs for raising existing disposal area dike elevations/capacity, debris removal, new navigation aids, and removal/containment of cadmium sediment dredged from the river. Pricing was developed assuming both medium hopper dredges and large pipeline cutterhead dredges may be used.

Average bank heights for new work dredging are approximately 5-6 feet. Quantities include 2 feet of allowable pay overdepth (to assure sufficient depths are met for design traffic). An economic analysis of advanced maintenance was conducted for the selected plan which determined that historical advanced maintenance areas and depths should be included in the maintenance program

The Corps of Engineers Dredge Estimating Program (CEDEP) was used to determine dredging average unit costs for each reach of location along the 38 miles. Significant factors input into CEDEP for determining unit prices and dredging time includes: Dredge Area, Dredge Depth-bank height, Non-pay overdepth cubic yardage, Material Factors – silt, sand, and clay, Pumping Distance or Haul Distance to Disposal Areas, EWT- Effective Work Time when dredging, Production cy/hr when dredging, Production cy/day average, and other monthly costs – such as land equipment, field office overhead, turtle monitoring, site specific maintenance costs, pipeline wear costs and fuel pricing. All of these factors are critical for developing a reasonable price estimate for various locations and conditions. The equipment most likely to be used for dredging excavation was assumed to be:

- A hydraulic pipeline dredge for the Inner Harbor (Stations 4+000 to 103+000), about 19 miles. Dredge material will be placed into existing confined disposal areas 13A, 14A, 14B and Jones Oyster Island; and
- A combination of hydraulic pipeline (loading scows & tug hauled) and hopper dredges for the Outer Ocean Bar (Stations 4+000 to –98+600), about 19 miles. Material will be placed in the existing EPA approved ODMDS (Figure 1-9).

The cost estimate for all dredging construction anticipates two contracts and covers a four-year period of concurrent work. The Inner Harbor will be one contract and the Ocean Bar will be another contract.

Cultural Resource Preservation (18) – This account includes the costs for removal of remnants of the CSS Georgia and was provided by Savannah District archeologist. The costs are based on discussions with the various archeological firms who are experienced in removal and conservation of historical shipwrecks in tidal waters. The CSS Georgia has been impacted severely over the years due to O&M dredging operations.

Planning, Engineering and Design (30) – The costs included in this account (5% of construction costs) were furnished by those responsible for performing each activity during PED. This account includes plans and specifications, field investigations and surveys, cost estimates, engineering during construction, and project management.

Construction Management (31) – This account (2.5% of construction costs) includes supervision and administration of the contracts by construction management, hydrologic surveys during construction, contracting personnel during construction, environmental/physical monitoring, and adaptive management following monitoring phases.

Project Cost and Schedule Risk Analysis: Contingency -- An overall project contingency of 25% was developed during a cost/risk analysis conducted with the Project Delivery Team (PDT) and Walla Walla District Cost Center of Expertise. The final CRSA, Cost Risk Report, Risk Register, Cost models and sensitivity analysis are included in Appendix C-Engineering, Attachment 4.

10.3.2 Incremental Dredging-Related Costs

Total dredging related costs for navigation improvements are presented in Table 10-3. The costs to improve berthing areas are included as a project-cost because berth deepening is required to obtain project benefits and are therefore included in all benefit-cost calculations. Berth deepening is a non-Federal expense (WRDA 1986).

Table 10-3: Dredging Related Costs: Incremental Deepening Alternatives (October 2010 Dollars)

	-44 ft	-45 ft	-46 ft	-47 ft	-48 ft
Real Estate	$120,625	$160,000	$160,000	$160,000	$160,000
Dredging*	$144,964,265	$176,884,623	$202,698,168	$228,917,615	$255,112,951
Dike Raising	$13,063,316	$14,726,445	$17,771,089	$20,142,328	$22,512,789
Berth Areas	$4,326,414	$4,511,299	$4,661,629	$4,693,564	$4,964,826
Nav Aids	$5,025,000	$5,025,000	$5,025,000	$5,025,000	$5,025,000
Total	$167,499,620	$201,307,366	$230,315,885	$258,938,506	$287,775,566

*Includes debris removal, Pre-Eng & Design costs, and Construction Mgmt. Note that totals may be affected by rounding

10.3.3 Incremental Mitigation Costs

Total mitigation-related costs are presented in Table 10-4.

Table 10-4: Mitigation-Related Costs: Incremental Deepening Alternatives (October 2010 Dollars)

	-44 ft	-45 ft	-46 ft	-47 ft	-48 ft
Real Estate	$4,580,625	$15,393,250	$17,506,250	$18,445,625	$21,665,625
Dissolved Oxygen	$67,428,750	$64,053,750	$67,428,750	$70,803,750	$74,178,750
CSS Georgia	$13,914,375	$13,914,375	$13,914,375	$13,914,375	$13,914,375
McCoys Cut Modifications	$4,327,049	$13,437,024	$13,437,024	$13,437,024	$13,437,024
Rifle Cut Modifications	$828,914	$828,914	$828,914	$828,914	$828,914
Tidegate & Embankment Sediment Basin Modifications	$21,545,225	$21,545,225	$21,545,225	$21,545,225	$21,545,225
Fish Passage	$29,392,561	$29,392,561	$29,392,561	$29,392,561	$29,392,561
Boat Ramp	$29,577,470	$29,577,470	$29,577,470	$29,577,470	$29,577,470
Salt Marsh Restoration	$624,953	$624,953	$624,953	$624,953	$624,953
Striped Bass	$17,594,949	$17,594,949	$17,594,949	$17,594,949	$17,594,949
Storage Impoundment	$2,085,000	$356,250	$613,750	$3,300,000	$3,410,000
Monitoring and Adaptive Mgmt	$25,187,500	$25,187,500	$25,187,500	$25,187,500	$25,187,500
Total	$58,792,500	$59,818,750	$60,160,000	$60,195,000	$60,468,750
	$275,879,870	$291,724,970	$297,811,720	$304,847,345	$311,826,095

Includes Pre-Eng & Design and Construction Mgmt. Note that totals may be affected by rounding

Construction and investment costs for the channel deepening alternatives are calculated in October 2010 dollars. Table 10-5 presents the construction costs for each construction element, and the sum of construction costs for each depth increment. Table 10-6 shows the investment cost and the total investment costs for each alternative depth increment. Investment costs are calculated as interest during construction using the FY 2011 Federal discount rate of 4.125 percent. The construction costs of each incremental depth alternative consist largely of dredging costs. Contingencies were calculated separately for each construction element.

10.3.4 Total Incremental Construction Costs

Table 10-5 presents total construction costs for each alternative plan. Major components of construction costs including real estate, mitigation and monitoring, navigation features, pre-engineering and design, and construction management are separately identified. The Real Estate total includes the cost of navigation-related and mitigation-related real estate. The Mitigation and Monitoring total in Table 10-5 excludes real estate costs. Mitigation-related real estate costs are itemized in Table 10-4.

Table 10-5: Total Construction First Costs: Incremental Deepening Alternatives (October 2010 Dollars)

	-44 ft	-45 ft	-46 ft	-47 ft	-48 ft
Real Estate	$120,625	$160,000	$160,000	$160,000	$160,000
Mitigation & Monitoring	$275,879,870	$291,724,970	$297,811,720	$304,847,345	$311,826,095
Navigation Features	$167,378,995	$201,147,366	$230,155,885	$258,778,506	$287,615,566
Pre-Eng. & Design	$21,933,037	$23,873,642	$25,522,693	$27,257,824	$28,887,677
Construction mgt.	$10,966,519	$11,936,821	$12,761,346	$13,628,912	$14,443,838
Total	$476,279,046	$528,842,799	$566,411,644	$604,672,587	$642,933,176

Note that totals may be affected by rounding

10.3.5 Interest During Construction

Interest during construction (IDC) is the opportunity cost of capital, which is an economic cost incurred while construction funds are expended but benefits have not yet begun to accrue. Interest during construction is included in all benefit-cost calculations but is not a financial cost of the project. A preliminary four-year construction schedule from fiscal year 2013 through the end of fiscal year 2016 was used to calculated interest during construction (Table 10-6). The timing of expenditures is based on the construction schedule presented in Figure 11-1: Selected Plan Construction Schedule. A similar construction schedule was created for each depth increment, and used in the interest during construction calculations. Calculations are based on the annual cost estimates calculated in October 2010 dollars (Table 10-5) using the FY 2011 Federal discount rate of 4.125%. Costs were compounded at mid-year intervals, and land costs were included in the first year of construction.

Table 10-6: Total Investment Costs including Interest During Construction

	-44 ft	-45 ft	-46 ft	-47 ft	-48 ft
Investment Cost	$476,279,046	$528,842,799	$566,411,644	$604,672,587	$642,933,176
IDC	$39,823,189	$43,324,293	$45,897,342	$48,681,944	$50,737,498
Total Investment Cost	$516,102,234	$572,167,092	$612,308,986	$653,354,531	$693,670,675

Note that totals may be affected by rounding
Note: Costs are updated to 2012 values in Section 14 Selected Plan

10.3.6 Operation and Maintenance Costs

Operation and maintenance costs generated by the project are defined as those incremental operations and maintenance costs which are in addition to the costs already required to operate and maintain the currently authorized project under without-project conditions. Analysis of historical maintenance dredging patterns and the hydrodynamic analysis of without and with-project conditions indicate that only very minor changes in hydraulic conditions at the inner harbor (bottom width will decrease but cross-sectional area will increase) would result from channel deepening. Inner harbor operation and maintenance dredging costs will increase because material that would be removed from the Sediment Basin under existing and without-project conditions will be dispersed throughout the channel under with-project conditions. Outer harbor maintenance dredging costs will increase only slightly due to the extended channel.

Projected increases in maintenance dredging volumes and costs due to channel deepening are based on full-width maintenance of the channel. Current practice is to conduct maintenance dredging of critical shoals in the navigation channel to the limit of funding and to seek additional funding for the remainder of critical shoals and other shoals growing in the sides of the channel. Due to narrower channels (channel construction using existing side slopes), there is a possibility of project cost greater than those in Table 10-7 due to this narrower channel which may cause edge shoaling to move into the channel.

Other additional improvement-related operation and maintenance costs include:

- Annual maintenance and periodic replacement of oxygen system components;
- Periodic maintenance dredging at McCoys Cut;
- Annual debris removal at the New Savannah Bluff Lock & Dam fish passage;
- Annual maintenance of CSS *Georgia* artifacts; and
- Long-term monitoring to verify predictions and assumptions concerning mitigation affects.

Table 10-7 presents incremental annual operations and maintenance costs generated by the project. Note that operations and maintenance costs are slightly higher with a -44-foot project than with a -45-foot or -46-foot project because there are more Speece cones required for the dissolved oxygen system with a -44-foot project (see section 9.3 Dissolved Oxygen Mitigation Plan Development).

Table 10-7: Total Annual O&M Costs: Incremental Deepening Alternatives (October 2010 Dollars)

	-44 ft	-45 ft	-46 ft	-47 ft	-48 ft
Inner Harbor Dredging	$2,672,080	$2,672,080	$2,672,080	$2,672,080	$2,672,080
Outer Harbor Dredging	$46,589	$48,155	$48,938	$49,199	$50,373
Dissolved Oxygen System	$1,311,000	$908,500	$1,110,000	$ 1,210,400	$1,311,000
CSS Georgia	$20,000	$20,000	$20,000	$ 20,000	$20,000
NSBLD Fish Passage	$50,000	$50,000	$50,000	$ 50,000	$50,000
McCoys Cut	$114,000	$114,000	$114,000	$ 114,000	$114,000
Storage Impoundment	$506,000	$506,000	$506,000	$ 506,000	$506,000
Long-term Monitoring	$428,400	$428,400	$428,400	$428,400	$428,400
Total	$5,148,069	$4,747,135	$4,949,418	$5,050,079	$5,151,853

10.3.7 Total Average Annual Equivalent Costs

Table 10-8 presents the total Average Annual Equivalent (AAEQ) project costs for each alternative deepening plan and the incremental AAEQ cost for each successive deepening plan increment. All average annual equivalent costs are calculated with a 4.125% discount rate over a period of 50 years.

Table 10-8: Average Annual Equivalent (AAEQ) Project Costs: Incremental Channel Deepening Alternatives

Alternative Channel Depth	Total AAEQ Construction and Investment Costs	Annual Maintenance Costs	Total Project AAEQ Costs	Incremental AAEQ Costs
-44	$26,490,763	$5,148,069	$31,638,832	
-45	$29,156,703	$4,747,135	$33,903,838	$ 2,265,006
-46	$31,065,490	$4,949,418	$36,014,908	$ 2,111,070
-47	$33,017,246	$5,050,079	$38,067,325	$ 2,052,417
-48	$34,934,319	$5,151,853	$40,086,172	$ 2,018,847

Note: Discount rate = 4.125%, period 50 years; totals may be affected by rounding. Costs for the Selected Plan at the FY12 price level and discount rate of 4 % are shown in Section 14

10.4 Value Engineering Analysis

Even though the quality of work on this project will be thoroughly verified through the Independent, Internal Technical Peer Review and External Peer Review, it is still necessary to subject projects to the Value Engineering (VE) Study Process. The VE regulation, ER 11-1-321 Change 1, dated 1 Jan 2011 requires certification that all feasibility reports undergo the VE process. VE is a process used to assess project functions in order to determine alternative means of achieving the equivalent function while increasing the value and the benefit to cost ratio of the project. In the end, it is hoped that the project will realize a reduction in cost, but increased value is the focus of the process, rather than simply reducing cost. In September 2006, it was determined that a VE Study would be performed as early as feasibly possible on the Expansion Project. The project schedule was modified over 2006 and 2007 to incorporate additional study requirements. After the scope of the study was finalized, the VE Study was conducted in May 2008.

The VE Study process is a five-phase process as outlined below:

Phase I Information (4-12 hours)
The PDT provides information about the project and "walks" the VE Study team through the study. The better the information, the more thorough and organized the presentation, the less time the VE study will ultimately take. The Team studied drawings, figures, descriptions of project work, and cost estimates to fully understand the work to be performed and the functions to be achieved.

Phase II Brainstorming (2-4 hours)
The VE Study team brainstorms ideas for revising the proposed design of the channel and the mitigation plan with the PDT. There is no discussion, just the presentation of ideas.

Phase III Analysis (4-8 hours)
The VE Study team reviews each one of the brainstorming ideas, applying a rational decision making process as to the merits of each one. This phase incorporates relevant design criteria and policy to either accept or reject each idea.

Phase IV Development (7 days)
This phase is conducted only by the VE Study team. Viable ideas are reviewed, developed, and then published. The priority ideas are developed into written proposals by VE team members during an intensive technical development session. Proposal descriptions, along with sketches, technical support documentation, and cost estimates are prepared to support implementation of ideas.

Phase V Presentation and Final Report
Presentation is a two-step process. First, the VE Study Report is distributed for review to all appropriate project supporters and decision makers. Review comments are coordinated for decision on any proposals recommended by the study report. Final

coordination may include a formal presentation conference for recommendation of actions to be taken on specific VE proposals.

Many real and perceived issues had to be addressed before construction of the navigation improvement project could proceed. These issues have been studied by the Project Delivery Team (PDT) and have been reviewed by various governmental agencies and private concerns that have an interest in this project. All of the items addressed and the conclusions reached by the PDT are presented in this GRR. The VE Study team was briefed on the pertinent issues and on the PDT's determinations and findings. Issues that required engineering and/or construction solutions were the focus of the VE Team's examination of planning assumptions and were the basis for brainstorming alternate ways of achieving project goals.

Findings and recommendations from the VE team are presented in full in their report titled *Value Engineering Study Summary Report* which is included in Appendix C, Engineering Investigations, Attachment 3 - Supplemental Materials.

The VE Study identified $34,221,436 in potential savings for project construction. Each of the proposals included in the VE Study recommendations was evaluated by the Engineering team to determine constructability and performance to meet project requirements. A summary of the team's findings is included in Table 14.0-1 of the Engineering Appendix. Overall, all of the major design changes proposed (for savings more than $1 million) were not considered to be viable alternative designs.

The major savings identified were for proposals 4 and 7 were both for alternative methods for constructing the McCoys Cut diversion structure. After further analysis, it was determined that an error had been made in the original rock volume for this structure. When the revised volume was carried through to the cost estimate for this structure, the actual cost for construction of a rock structure was $400,000, which was much less than the cost previously estimated for this feature or the costs estimated for proposals 4 and 7. Modification of this structure was not determined to be cost effective. Some of the smaller project recommendations, such as reuse of concrete from the Tidegate or use of sand from Disposal Area 2A for the sand sill at Rifle Cut (proposals 3 and 6) may be cost effective and will be considered during the planning, engineering and design phase of this contract, when more site specific information is available.

Subsequent to the Value Engineering Study the design for the overall project was modified to include additional mitigation features. The following features were added to the project:

- Increase in the number of oxygen systems -- $21 million;
- Increase in the dimensions of the NSBL&D fish passage -- $21 million;
- Construction of a recreational boat ramp in Back River -- $600,000;
- Restoration of brackish marsh in Disposal Area 1S -- $11 million; and

- Construction of a raw water impoundment -- $25 million.

The methods of construction for the majority of the added features for mitigation are almost identical to the other methods of mitigation that were included in the VE study. Since there were no VE proposals accepted as a result of the VE study, it was determined that no additional value engineering study was required at that time. Value Engineering proposals which would result in cost savings to the project will continue to be considered through the design and construction of the project, as USACE guidance requires the project features to the re-evaluated during the design phase prior to construction.

Value Engineering Proposals which would result in cost savings to the project will continue to be considered throughout the design and construction of this project.

11 Plan Comparison

The P&G requires that the NED plan be identified and described in detail. The NED plan is the plan which maximizes net benefits and; therefore, makes the greatest contribution to the federal objective. USACE policy allows deviation from the NED plan when there is a preference for a plan that is less costly than the NED plan. Deviations from the NED plan may also be more costly than the NED plan, but the non-Federal partner must bear all project costs greater than the costs of the NED plan. The more costly plan must also provide benefits which are equal to or greater than the NED plan.

This chapter describes the plan selection process, which is based on impacts to the four accounts: National Economic Development (NED), National Ecosystem Restoration (NER), Regional Economic Development (RED), and Other Social Effects (OSE). A system of accounts analysis was used to identify and compare the impacts of no action and of each alternative plan.

11.1 Net Benefits of Alternative Plans

The alternative plan net benefits presented in Table 11-1 are calculated as the difference between the total annual average equivalent (AAEQ) costs and benefits of each alternative. The incremental net benefits of the alternative plans are decreasing with successive plan increments, but remain positive overall, which indicates that the incremental benefits of each successive alternative are greater than the incremental costs.

Table 11-1: Economic Analysis of Alternative Deepening Plans (FY 2011)

Alternative Plan Depth	Total AAEQ Costs	Total AAEQ Benefits	Total Net Benefits	Incremental Net Benefits	Benefits/ Costs
-44	$29,372,000	$100,335,000	$ 70,963,000		3.4
-45	$31,636,000	$136,238,000	$104,602,000	$33,639,000	4.3
-46	$33,747,000	$154,247,000	$120,500,000	$15,898,000	4.6
-47	$35,799,000	$159,472,000	$123,673,000	$3,173,000	4.5
-48	$37,817,000	$159,953,000	$122,136,000	- $1,537,000	4.2

Average annual benefits based on 4.125%, 50 years, and FY 2011 prices
Note: Benefits are updated to 2012 values in Section 14 Selected Plan for the Selected Plan

Table 11-1 includes the AAEQ costs and AAEQ benefits of the Meeting Area alternatives dredged to the plan depth, which are presented in Table 11-2. Meeting areas were assessed as separable elements of the alternative deepening plans. The net benefits of combining the Long Island Meeting Area and the Oglethorpe Meeting Area are greater than the net benefits of either meeting area alone at each of the alternative depths (Table 11-2). The combination of meeting areas provides the greatest net benefits to the alternative deepening plans.

Table 11-2: Meeting Area Average Annual Equivalent Net Benefits

Long Island Meeting Area			
	Benefits	Costs	Net Benefits
44 foot Project Depth	$400,000	$135,000	$265,000
45 foot Project Depth	$401,000	$143,000	$258,000
46 foot Project Depth	$407,000	$148,000	$259,000
47 foot Project Depth	$450,000	$158,000	$292,000
48 foot Project Depth	$424,000	$169,000	$255,000
Oglethorpe Meeting Area			
	Benefits	Costs	Net Benefits
44 foot Project Depth	$385,000	$189,000	$196,000
45 foot Project Depth	$387,000	$195,000	$192,000
46 foot Project Depth	$393,000	$197,000	$196,000
47 foot Project Depth	$387,000	$206,000	$181,000
48 foot Project Depth	$373,000	$214,000	$159,000
Long Island and Oglethorpe Meeting Areas			
	Benefits	Costs	Net Benefits
44 foot Project Depth	$717,000	$324,000	$393,000
45 foot Project Depth	$722,000	$337,000	$385,000
46 foot Project Depth	$731,000	$345,000	$386,000
47 foot Project Depth	$730,000	$364,000	$366,000
48 foot Project Depth	$723,000	$383,000	$340,000

Average annual benefits based on 4.125%, 50 years, and FY2011 prices
Note: Benefits are updated to 2012 values in Section 14 Selected Plan

11.2 NED Plan Identification

The Principles and Guidelines require that the plan which maximizes net benefits, the NED plan, be identified. The -47-foot plan maximizes net benefits at an average annual equivalent of $174 million. At the next increment (-48-foot plan), there is a decrease in net benefits, which indicates that a plan deeper than the -47-foot plan does not provide greater benefits. Therefore, the -47-foot plan is identified as the NED plan.

The NED Plan consists of the:

- -47-foot deepening alternative, which includes channel bend wideners, and expansion of the Kings Island Turning Basin;
- Long Island Meeting Area at -47 feet; and
- Oglethorpe Meeting Area at -47 feet.

11.3 Summary of Accounts and Plan Comparison

Plan formulation has been conducted for this study with a focus on contributing to NED with consideration of all effects, beneficial or adverse, to each of the four evaluation accounts identified in the Principles and Guidelines (1983).

Plan selection is based on a weighting of the projected effects of each alternative on the four evaluation accounts. The Project Delivery Team reviewed qualitative and quantitative information for major project effects and for major potential effect categories. The alternatives were also compared and contrasted according to their achievement of the additional criteria of (a) effectiveness; (b) completeness; (c) acceptability, and (d) efficiency according to applicable Corps guidelines.

In addition to these four traditional accounts, information on potential risks, uncertainties, and consequences, is also presented in System of Accounts format, for comparison at the same level of scrutiny of the information presented in other accounts. The comparison of final alternatives includes future without-project conditions and future with-project conditions for each alternative plan (Table 11-3). Data presented for comparison of final alternatives includes:

- Costs;
- Benefits;
- Impacts to public facilities;
- Impacts to natural resources;
- Impacts to biological resources;
- Impacts to air quality;
- Impacts to water quality;
- Impacts to cultural resources;
- Impacts to health and safety;
- Contributions to planning objectives;
- Responses to planning constraints;

- Implementation responsibility; and
- Risk and vulnerabilities.

Table 11-3: Savannah Harbor Expansion – System of Accounts

Problem Statement: Container ship transportation at Savannah Harbor operates in an economically inefficient manner under existing and without project conditions.

Item	No Action	44 Foot Depth	45 Foot Depth	46 Foot Depth	47 Foot Depth	48 Foot Depth
A. National Ecosystem Restoration (NER)						
1. Tidal Marsh	Existing freshwater marsh acreage = 4,072 acres; existing brackish marsh acreage = 2,253, existing salt marsh acreage = 2,506	Freshwater Marsh: Indirect impact resulting in increase of 322 acres (8.1%) due to conversion; Salt Marsh: Indirect impact resulting in decrease of 808 acres due to conversion; Brackish marsh: Indirect impact resulting in increase of 488 acres due to conversion. Direct impact resulting in loss of 15.68 acres of brackish marsh through excavation mitigated by restoration of 28.8 acres of brackish marsh. Restoration of an additional 11.5 acres may be performed as advance mitigation.	Freshwater Marsh: Indirect impact resulting in decrease of 32 acres (0.1%) due to conversion; Salt Marsh: Indirect impact resulting in decrease of 828 acres due to conversion; Brackish Marsh: Indirect impact resulting in increase of 861 acres due to conversion, mitigated through acquisition and preservation of 1,643 acres of bottomland hardwoods. Direct impact resulting in loss of 15.68 acres of brackish marsh through excavation mitigated by restoration of 28.8 acres of brackish marsh. Restoration of an additional 11.5 acres may be performed as advance mitigation.	Freshwater Marsh: Indirect impact resulting in decrease of 201 acres (5.2%) due to conversion; Salt Marsh: Indirect impact resulting in decrease of 757 acres due to conversion; Brackish Marsh: Indirect impact resulting in increase of 959 acres due to conversion, mitigated through acquisition and preservation of 2,188 acres of bottomland hardwoods. Direct impact resulting in loss of 15.68 acres of brackish marsh through excavation mitigated by restoration of 28.8 acres of brackish marsh. Restoration of an additional 11.5 acres may be performed as advance mitigation.	Freshwater Marsh: Indirect impact resulting in decrease of 223 acres (5.5%) due to conversion; Salt Marsh: Indirect impact resulting in decrease of 740 acres due to conversion; Brackish Marsh: Indirect impact resulting in increase of 964 acres due to conversion, mitigated through acquisition and preservation of 2,245 acres of bottomland hardwoods. Direct impact resulting in loss of 15.68 acres of brackish marsh through excavation mitigated by restoration of 28.8 acres of brackish marsh. Restoration of an additional 11.5 acres may be performed as advance mitigation.	Freshwater Marsh: Indirect impact resulting in decrease of 337 acres (8.3%) due to conversion; Salt Marsh: Indirect impact resulting in decrease of 730 acres due to conversion; Brackish Marsh: Indirect impact resulting in increase of 1,068 acres due to conversion, mitigated through acquisition and preservation of 2,683 acres of bottomland hardwoods. Direct impact resulting in loss of 15.68 acres of brackish marsh through excavation mitigated by restoration of 28.8 acres of brackish marsh. Restoration of an additional 11.5 acres may be performed as advance mitigation.

Table 11-3: Savannah Harbor Expansion – System of Accounts

Problem Statement: Container ship transportation at Savannah Harbor operates in an economically inefficient manner under existing and without project conditions.

Item	No Action	44 Foot Depth	45 Foot Depth	46 Foot Depth	47 Foot Depth	48 Foot Depth
2. Bottomland Hardwoods	Existing bottomland hardwoods on private land subject to loss through development and harvest	No effect	Acquire and preserve 1,643 acres of bottomland hardwoods.	Acquire and preserve 2,188 acres of bottomland hardwoods.	Acquire and preserve 2,245 acres of bottomland hardwoods.	Acquire and preserve 2,683 acres of bottomland hardwoods.
3. Fisheries						
a. Striped Bass	Georgia DNR continues to operate striped bass stocking program at a 50-year annualized cost of $504,000	Lump sum payment equivalent to 17% increase in striped bass hatchery budget for 50 years compensate for cumulative (multi-life stage) habitat loss of 17.0%	Lump sum payment equivalent to 2.9% increase in striped bass hatchery budget for 50 years to compensate for cumulative (multi-life stage) habitat loss of 2.9%	Lump sum payment equivalent to 5.0% increase in striped bass hatchery budget for 50 years to compensate for cumulative (multi-life stage) habitat loss of 5.0%	Lump sum payment equivalent to 26.9% increase in striped bass hatchery budget for 50 years to compensate for cumulative (multi-life stage) habitat loss of 26.9%	Lump sum payment equivalent to 27.8% increase in striped bass hatchery budget for 50 years to compensate for cumulative (multi-life stage) habitat loss of 27.8%

Table 11-3: Savannah Harbor Expansion – System of Accounts

Problem Statement: Container ship transportation at Savannah Harbor operates in an economically inefficient manner under existing and without project conditions.

Item	No Action	44 Foot Depth	45 Foot Depth	46 Foot Depth	47 Foot Depth	48 Foot Depth
b. Southern Flounder	Existing southern flounder habitat limited by low dissolved oxygen levels	Increase habitat by 74.1%	Increase habitat by 54.2%	Increase habitat by 57.3%	Increase habitat by 57.3%	Increase habitat by 52.9%
c. American Shad	Continue existing population levels and trends	Negligible (less than 0.3 %) loss of habitat in some life stages	Negligible (less than 0.3 %) loss of habitat in some life stages	Negligible (less than 0.3 %) loss of habitat in some life stages	Negligible (less than 0.3 %) loss of habitat in some life stages	Negligible (less than 0.3 %) loss of habitat in some life stages
4. Endangered Species						
a. Sturgeon	No Sturgeon upstream passage to historic spawning area above New Savannah Bluff Lock and Dam, Continue existing population levels and trends	Adult winter habitat loss of 3.9% and juvenile winter habitat loss of 6.7%; gain of 19.0% for adult summer habitat restoration of access to historic spawning area	Adult winter habitat loss of 4.6% and juvenile winter habitat loss of 7.0%; gain of 9.8% of adult summer habitat restoration of access to historic spawning area	Adult winter habitat loss of 6.2%, and juvenile winter habitat loss of 7.3%; gain of 7.3% of adult summer habitat restoration of access to historic spawning area	Adult winter habitat loss of 6.9%, and juvenile winter habitat loss of 7.6%; gain of 6.5% of adult summer habitat restoration of access to historic spawning area	Adult winter habitat loss of 8.4%, and juvenile winter habitat loss of 11.5%; gain of 2.8% of adult summer habitat restoration of access to historic spawning area

Table 11-3: Savannah Harbor Expansion – System of Accounts

Problem Statement: Container ship transportation at Savannah Harbor operates in an economically inefficient manner under existing and without project conditions.

Item	No Action	44 Foot Depth	45 Foot Depth	46 Foot Depth	47 Foot Depth	48 Foot Depth
b. Sea Turtles	Continue existing population levels and trends	May affect but is not likely to adversely affect leatherback, green, and hawksbill sea turtles. Will adversely affect loggerhead and Kemp's Ridley sea turtles. Population protected by implementation of NMFS Reasonable and Prudent Measures and Terms and Conditions of BO	May affect but is not likely to adversely affect leatherback, green, and hawksbill sea turtles. Will adversely affect loggerhead and Kemp's Ridley sea turtles. Population protected by implementation of NMFS Reasonable and Prudent Measures and Terms and Conditions of BO	May affect but is not likely to adversely affect leatherback, green, and hawksbill sea turtles. Will adversely affect loggerhead and Kemp's Ridley sea turtles. Population protected by implementation of NMFS Reasonable and Prudent Measures and Terms and Conditions of BO	May affect but is not likely to adversely affect leatherback, green, and hawksbill sea turtles. Will adversely affect loggerhead and Kemp's Ridley sea turtles. Population protected by implementation of NMFS Reasonable and Prudent Measures and Terms and Conditions of BO	May affect but is not likely to adversely affect leatherback, green, and hawksbill sea turtles. Will adversely affect loggerhead and Kemp's Ridley sea turtles. Population protected by implementation of NMFS Reasonable and Prudent Measures and Terms and Conditions of BO
c. Other	Continue existing population levels and trends	Right whales, manatee, and piping plover may be affected but are not likely to be adversely affected	Right whales, manatee, and piping plover may be affected but are not likely to be adversely affected	Right whales, manatee, and piping plover may be affected but are not likely to be adversely affected	Right whales, manatee, and piping plover may be affected but are not likely to be adversely affected	Right whales, manatee, and piping plover may be affected but are not likely to be adversely affected

Table 11-3: Savannah Harbor Expansion – System of Accounts

Problem Statement: Container ship transportation at Savannah Harbor operates in an economically inefficient manner under existing and without project conditions.

Item	No Action	44 Foot Depth	45 Foot Depth	46 Foot Depth	47 Foot Depth	48 Foot Depth
5. Air Quality	Region to continue in current Attainment status	Minor improvements due to reduced vessel traffic; short-term emissions increases during construction	Minor improvements due to reduced vessel traffic; short-term emissions increases during construction	Minor improvements due to reduced vessel traffic; short-term emissions increases during construction	Minor improvements due to reduced vessel traffic; short-term emissions increases during construction	Minor improvements due to reduced vessel traffic; short-term emissions increases during construction
6. Water Quality						
a. Turbidity	Continue temporary increases in turbidity during periodic harbor maintenance dredging	Temporary increase in turbidity during construction	Temporary increase in turbidity during construction	Temporary increase in turbidity during construction	Temporary increase in turbidity during construction	Temporary increase in turbidity during construction
b. Dissolved Oxygen	Continued low dissolved oxygen levels (below state standards) during Summer months (May - Sept.)	Due to increased salinity and depth, pre-mitigation DO decreases; mitigation fully offsets decrease with incidental improvement	Due to increased salinity and depth, pre-mitigation DO decreases; mitigation fully offsets decrease with incidental improvement	Due to increased salinity and depth, pre-mitigation DO decreases; mitigation fully offsets decrease with incidental improvement	Due to increased salinity and depth, pre-mitigation DO decreases; mitigation fully offsets decrease with incidental improvement	Due to increased salinity and depth, pre-mitigation DO decreases; mitigation fully offsets decrease with incidental improvement

Table 11-3: Savannah Harbor Expansion – System of Accounts

Problem Statement: Container ship transportation at Savannah Harbor operates in an economically inefficient manner under existing and without project conditions.

Item	No Action	44 Foot Depth	45 Foot Depth	46 Foot Depth	47 Foot Depth	48 Foot Depth
c. Salinity	Surface-water salinity threshold (0.5 ppt) upstream to river mile 21.00	Surface-water salinity threshold (0.5 ppt) upstream to river mile 21.59 with impacts to fisheries and dissolved oxygen	Surface-water salinity threshold (0.5 ppt) upstream to river mile 21.78 with impacts to wetlands, fisheries and dissolved oxygen	Surface-water salinity threshold (0.5 ppt) upstream to river mile 21.89 with impacts to wetlands, fisheries and dissolved oxygen	Surface-water salinity threshold (0.5 ppt) upstream to river mile 21.96 with impacts to wetlands, fisheries and dissolved oxygen	Surface-water salinity threshold (0.5 ppt) upstream to river mile 22.26 with impacts to wetlands, fisheries and dissolved oxygen
7. Cultural Resources						
a. CSS Georgia	CSS Georgia preservation as funds become available (currently not scheduled);	Archeological data recovery: excavating, conserving, and curating	Archeological data recovery: excavating, conserving, and curating	Archeological data recovery: excavating, conserving, and curating	Archeological data recovery: excavating, conserving, and curating	Archeological data recovery: excavating, conserving, and curating

Table 11-3: Savannah Harbor Expansion – System of Accounts

Problem Statement: Container ship transportation at Savannah Harbor operates in an economically inefficient manner under existing and without project conditions.

Item	No Action	44 Foot Depth	45 Foot Depth	46 Foot Depth	47 Foot Depth	48 Foot Depth
b. Old Fort Jackson	Shoreline hardened in 2004; no bank erosion expected	No effect	No effect	No effect	No effect	No effect
c. Fort Pulaski	Continued bank erosion at unprotected areas	Negligible increase in bank erosion	Negligible increase in bank erosion	Negligible increase in bank erosion	Negligible increase in bank erosion	Negligible increase in bank erosion

Table 11-3: Savannah Harbor Expansion – System of Accounts

Problem Statement: Container ship transportation at Savannah Harbor operates in an economically inefficient manner under existing and without project conditions.

Item	No Action	44 Foot Depth	45 Foot Depth	46 Foot Depth	47 Foot Depth	48 Foot Depth
8. Total Quality of the Environment	The existing 4,072 freshwater marsh acres within the study area are scarce and highly valued habitat, most of which is within the Savannah National Wildlife Refuge. Expected future conversion of freshwater marsh due to sea-level rise; Continued low dissolved oxygen levels (below state standards) during Summer months (May - Sept.); Continued low population levels and trends for Short nose Sturgeon and Striped Bass.	No significant environmental impacts after mitigation. 332 acre increase (8.1%) in freshwater marsh acreage; SN Sturgeon lifecycle habitat impacts are offset by restoration of access to historic spawning areas; Striped bass lifecycle habitat impacts are offset by increase annual stocking; Incidental improvements to dissolved oxygen	No significant environmental impacts after mitigation. 32 acre freshwater marsh conversion (0.1%) mitigated through acquisition and preservation of 1,643 acres of bottomland hardwoods. SN Sturgeon lifecycle habitat impacts are offset by restoration of access to historic spawning areas; Striped bass lifecycle habitat impacts are offset by increase annual stocking; Incidental improvements to dissolved oxygen	No significant environmental impacts after mitigation. 201 acre freshwater marsh conversion (5.2%) mitigated through acquisition and preservation of 2,188 acres of bottomland hardwoods. SN Sturgeon lifecycle habitat impacts are offset by restoration of access to historic spawning areas; Striped bass lifecycle habitat impacts are offset by increase annual stocking; Incidental improvements to dissolved oxygen	No significant environmental impacts after mitigation. 223 acre freshwater marsh conversion (5.5%) mitigated through acquisition and preservation of 2,245 acres of bottomland hardwoods. SN Sturgeon lifecycle habitat impacts are offset by restoration of access to historic spawning areas; Striped bass lifecycle habitat impacts are offset by increase annual stocking; Incidental improvements to dissolved oxygen	No significant environmental impacts after mitigation. 337 acre freshwater marsh conversion (8.3%) mitigated through acquisition and preservation of 2,683 acres of bottomland hardwoods. SN Sturgeon lifecycle habitat impacts are offset by restoration of access to historic spawning areas; Striped bass lifecycle habitat impacts are offset by increase annual stocking; Incidental improvements to dissolved oxygen

Table 11-3: Savannah Harbor Expansion – System of Accounts

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Item	No Action	44 Foot Depth	45 Foot Depth	46 Foot Depth	47 Foot Depth	48 Foot Depth
B. Regional Economic Development (RED)						
a. Impact on Gross Regional Product	No change	NA			$794,610,000	NA
b. Impact on Income					$511,074,000	
c. Impact on Employment					11,555 job equivalents	
NOTE: The project's potential effect on Regional Economic Development were only examined for the No Action Alternative and the Selected Plan (47-foot depth alternative)						
C. Other Social Effects (OSE)						
a. Health and Safety	Continue existing levels and trends	Meeting areas increase margins of safety during channel transit.	Meeting areas increase margins of safety during channel transit.	Meeting areas increase margins of safety during channel transit.	Meeting areas increase margins of safety during channel transit.	Meeting areas increase margins of safety during channel transit.

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Item	No Action	44 Foot Depth	45 Foot Depth	46 Foot Depth	47 Foot Depth	48 Foot Depth
b. Quality of life; Material well-being; economic development and standard of living; housing; built environment; natural environment; job security	Continue existing levels of recreation opportunities at Savannah National Wildlife Refuge (29,175 acres)	No change to existing levels of recreation opportunities at Savannah National Wildlife Refuge (29,175 acres)	Increase recreation opportunities at Savannah National Wildlife Refuge by increasing overall size by 1,643 acres (5.6%) and increasing buffer zone	Increase recreation opportunities at Savannah National Wildlife Refuge by increasing overall size by 2,188 acres (7.5%) and increasing buffer zone	Increase recreation opportunities at Savannah National Wildlife Refuge by increasing overall size by 2,245 acres (7.7%) and increasing buffer zone	Increase recreation opportunities at Savannah National Wildlife Refuge by increasing overall size by 2,683 acres (9.2%) and increasing buffer zone

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Item	No Action	44 Foot Depth	45 Foot Depth	46 Foot Depth	47 Foot Depth	48 Foot Depth
c. Effects on educational, cultural, and recreational opportunities	No Effect	CSS Georgia archeological data recovery; provide increased cultural and education opportunities; cumulative incidental benefits of increased dissolved oxygen; restored upstream fish passage; increased striped bass stocking; increased submerged structures (resulting from Tidegate removal) will improve recreational fishing opportunities	CSS Georgia archeological data recovery; provide increased cultural and education opportunities; cumulative incidental benefits of increased dissolved oxygen; restored upstream fish passage; increased striped bass stocking; increased submerged structures (resulting from Tidegate removal) will improve recreational fishing opportunities	CSS Georgia archeological data recovery; provide increased cultural and education opportunities; cumulative incidental benefits of increased dissolved oxygen; restored upstream fish passage; increased striped bass stocking; increased submerged structures (resulting from Tidegate removal) will improve recreational fishing opportunities	CSS Georgia archeological data recovery; provide increased cultural and education opportunities; cumulative incidental benefits of increased dissolved oxygen; restored upstream fish passage; increased striped bass stocking; increased submerged structures (resulting from Tidegate removal) will improve recreational fishing opportunities	CSS Georgia archeological data recovery; provide increased cultural and education opportunities; cumulative incidental benefits of increased dissolved oxygen; restored upstream fish passage; increased striped bass stocking; increased submerged structures (resulting from Tidegate removal) will improve recreational fishing opportunities

Table 11-3: Savannah Harbor Expansion – System of Accounts

Problem Statement: Container ship transportation at Savannah Harbor operates in an economically inefficient manner under existing and without project conditions.

Item	No Action	44 Foot Depth	45 Foot Depth	46 Foot Depth	47 Foot Depth	48 Foot Depth
D. Plan Evaluation						
1. Contributions to Planning Objectives						
a. Reduce Navigation Transportation Costs	The No Action Alternative does not reduce transportation costs	Reduces transportation costs by an average annual equivalent of $100,335,000	Reduces transportation costs by an average annual equivalent of $136,238,000	Reduces transportation costs by an average annual equivalent of $154,247,000	Reduces transportation costs by an average annual equivalent of $159,472,000 (at 4.125%)	Reduces transportation costs by an average annual equivalent of $159,953,000
		NA	NA	NA	Reduces transportation costs by an average annual equivalent of $213,144,000 (at 4.0%)	NA

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Problem Statement: Container ship transportation at Savannah Harbor operates in an economically inefficient manner under existing and without project conditions.

Item	No Action	44 Foot Depth	45 Foot Depth	46 Foot Depth	47 Foot Depth	48 Foot Depth
b. Integrate / Complement other related programs including DMMP and environmental programs	Operations comply with DMMP and environmental programs as funding allows	Fish by-pass supports NOAA anadromous fish passage program; incidental improvement to dissolved oxygen levels compliments EPA's TMDL. New material placement integrates with existing DMMP.	Fish by-pass supports NOAA anadromous fish passage program; acquisition of 1,643 acres of bottomland hardwoods supports Refuge expansion plan; incidental improvement to dissolved oxygen levels complements EPA's TMDL. New material placement integrates with existing DMMP	Fish by-pass supports NOAA anadromous fish passage program; acquisition of 2,128 acres of bottomland hardwoods supports Refuge expansion plan; incidental improvement to dissolved oxygen levels complements EPA's TMDL. New material placement integrates with existing DMMP	Fish by-pass supports NOAA anadromous fish passage program; acquisition of 2,245 acres of bottomland hardwoods supports Refuge expansion plan; incidental improvement to dissolved oxygen levels complements EPA's TMDL. New material placement integrates with existing DMMP	Fish by-pass supports NOAA anadromous fish passage program; acquisition of 2,683 acres of bottomland hardwoods supports Refuge expansion plan; incidental improvement to dissolved oxygen levels complements EPA's TMDL. New material placement integrates with existing DMMP

Table 11-3: Savannah Harbor Expansion – System of Accounts

Problem Statement: Container ship transportation at Savannah Harbor operates in an economically inefficient manner under existing and without project conditions.

Item	No Action	44 Foot Depth	45 Foot Depth	46 Foot Depth	47 Foot Depth	48 Foot Depth
2. Response to Planning Constraints						
Goal: Adhere to Maritime Safety Requirements	Vessels continue to operate under standard harbor safety guidelines	Plan complies with harbor safety guidelines. Meeting areas and turning basin modification increase margins of safety during channel transit.	Plan complies with harbor safety guidelines. Meeting areas and turning basin modification increase margins of safety during channel transit.	Plan complies with harbor safety guidelines. Meeting areas and turning basin modification increase margins of safety during channel transit.	Plan complies with harbor safety guidelines. Meeting areas and turning basin modification increase margins of safety during channel transit.	Plan complies with harbor safety guidelines. Meeting areas and turning basin modification increase margins of safety during channel transit.
Goal: No significant adverse impacts to the Upper Floridan Aquifer	Continued salinity increase due to withdrawals	No significant effect to aquifer or production wells	No significant effect to aquifer or production wells	No significant effect to aquifer or production wells	No significant effect to aquifer or production wells	No significant effect to aquifer or production wells

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Item	No Action	44 Foot Depth	45 Foot Depth	46 Foot Depth	47 Foot Depth	48 Foot Depth
Goal: No significant adverse impacts to cultural resources	CSS Georgia preservation as funds become available (currently not scheduled); Old Fort Jackson Shoreline hardened in 2004 and no bank erosion expected; Fort Pulaski continued bank erosion at unprotected areas	CSS Georgia archeological data recovery including excavating, conserving, and curating; no significant adverse impacts to river bank at Fort Pulaski	CSS Georgia archeological data recovery including excavating, conserving, and curating; no significant adverse impacts to river bank at Fort Pulaski	CSS Georgia archeological data recovery including excavating, conserving, and curating; no significant adverse impacts to river bank at Fort Pulaski	CSS Georgia archeological data recovery including excavating, conserving, and curating; no significant adverse impacts to river bank at Fort Pulaski	CSS Georgia archeological data recovery including excavating, conserving, and curating; no significant adverse impacts to river bank at Fort Pulaski

Table 11-3: Savannah Harbor Expansion – System of Accounts

Problem Statement: Container ship transportation at Savannah Harbor operates in an economically inefficient manner under existing and without project conditions.

Item	No Action	44 Foot Depth	45 Foot Depth	46 Foot Depth	47 Foot Depth	48 Foot Depth
Goal: Do not violate Environmental Restrictions on Dredging	The plan complies with environmental dredging restrictions.	Plan complies with environmental dredging restrictions.	Plan complies with environmental dredging restrictions.	Plan complies with environmental dredging restrictions.	Plan complies with environmental dredging restrictions.	Plan complies with environmental dredging restrictions.
Goal: Avoid adverse impacts to existing landside infrastructure along channel	No adverse impacts to existing landside infrastructure along channel	Plan avoids adverse impacts to landside infrastructure through channel design	Plan avoids adverse impacts to landside infrastructure through channel design	Plan avoids adverse impacts to landside infrastructure through channel design	Plan avoids adverse impacts to landside infrastructure through channel design	Plan avoids adverse impacts to landside infrastructure through channel design

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Item	No Action	44 Foot Depth	45 Foot Depth	46 Foot Depth	47 Foot Depth	48 Foot Depth
Goal: No adverse impact to Georgia DNR Striped bass recovery program	GADNR continues to operate Striped bass recovery program	Plan maintains effectiveness of GADNR Striped bass recovery program by supplementing program budget to offset habitat loss.	Plan maintains effectiveness of GADNR Striped bass recovery program by supplementing program budget to offset habitat loss.	Plan maintains effectiveness of GADNR Striped bass recovery program by supplementing program budget to offset habitat loss.	Plan maintains effectiveness of GADNR Striped bass recovery program by supplementing program budget to offset habitat loss.	Plan maintains effectiveness of GADNR Striped bass recovery program by supplementing program budget to offset habitat loss.
Goal: No adverse impacts to Shortnose sturgeon	No Sturgeon upstream passage to historic spawning area above New Savannah Bluff Lock and Dam, Continue existing population levels and trends	Plan restores access to historic spawning area.	Plan restores access to historic spawning area.	Plan restores access to historic spawning area.	Plan restores access to historic spawning area.	Plan restores access to historic spawning area.
Goal: No net adverse effect on dissolved oxygen	Continued low dissolved oxygen levels during Summer months	Plan fully offsets decrease with incidental improvement	Plan fully offsets decrease with incidental improvement	Plan fully offsets decrease with incidental improvement	Plan fully offsets decrease with incidental improvement	Plan fully offsets decrease with incidental improvement

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Item	No Action	44 Foot Depth	45 Foot Depth	46 Foot Depth	47 Foot Depth	48 Foot Depth
3. Response to Evaluation Criteria						
a. Acceptability	The no action plan would continue to be acceptable to state and local entities as compliant with existing laws, regulations, and policies. This plan is the least satisfactory plan to the local maritime community.	This plan would continue to be acceptable to state and local entities as compliant with existing laws, regulations, and policies. This plan provides minimal satisfaction to the local maritime community.	This plan would continue to be acceptable to state and local entities as compliant with existing laws, regulations, and policies. This plan provides moderate satisfaction to the local maritime community.	This plan would continue to be acceptable to state and local entities as compliant with existing laws, regulations, and policies. This plan provides somewhat more satisfaction to the local maritime community than the 45-foot plan.	This plan would continue to be acceptable to state and local entities as compliant with existing laws, regulations, and policies. This plan provides nearly the most satisfaction to the local maritime community.	This plan would continue to be acceptable to state and local entities as compliant with existing laws, regulations, and policies. This plan provides the most satisfaction to the local maritime community.

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Item	No Action	44 Foot Depth	45 Foot Depth	46 Foot Depth	47 Foot Depth	48 Foot Depth
b. Completeness	The plan's effects will continue to be realized into the future based on the continuance of historical trends in the maritime industry.	The plan's effects are somewhat reliant on completion of the Panama Canal Expansion.	The plan's effects are moderately reliant on completion of the Panama Canal Expansion.	The plan's effects are strongly reliant on completion of the Panama Canal Expansion.	The plan's effects are strongly reliant on completion of the Panama Canal Expansion.	The plan's effects are strongly reliant on completion of the Panama Canal Expansion.
c. Effectiveness	The no action plan does not contribute to navigation-related planning objectives.	This plan minimally contributes to navigation-related planning objectives. The plan significantly contributes to the integration objective.	This plan moderately contributes to navigation-related planning objectives. The plan significantly contributes to the integration objective.	This plan substantially contributes to navigation-related planning objectives. The plan significantly contributes to the integration objective.	This plan strongly contributes to navigation-related planning objectives. The plan significantly contributes to the integration objective.	This plan makes the most significant contribution to all planning objectives.

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Item	No Action	44 Foot Depth	45 Foot Depth	46 Foot Depth	47 Foot Depth	48 Foot Depth
d. Efficiency	The no action plan is the least efficient plan because of the additional transportation cost burden it will impose on the nation.	Although this plan has the lowest financial cost of the alternatives, it is only minimally efficient because it does not fully meet navigation-related planning objectives.	This plan is only moderately efficient because there would remain a residual transportation cost burden to the nation.	This plan is somewhat efficient, but it does not reduce transportation costs as much as deeper alternatives.	This plan is the most efficient in that it meets all planning objectives in the least costly manner and provides the greatest net benefit.	This plan is highly efficient, and it provides the greatest total transportation cost savings, but it does not provide the greatest net benefit.
e. Reversibility	The no action plan may be reversed by reducing maintenance dredging.	The navigation-related components of this plan may be reversed by altering the maintenance dredging regime. Mitigation-related components of the plan are largely irreversible.	The navigation-related components of this plan may be reversed by altering the maintenance dredging regime. Mitigation-related components of the plan are largely irreversible.	The navigation-related components of this plan may be reversed by altering the maintenance dredging regime. Mitigation-related components of the plan are largely irreversible.	The navigation-related components of this plan may be reversed by altering the maintenance dredging regime. Mitigation-related components of the plan are largely irreversible.	The navigation-related components of this plan may be reversed by altering the maintenance dredging regime. Mitigation-related components of the plan are largely irreversible.

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Item	No Action	44 Foot Depth	45 Foot Depth	46 Foot Depth	47 Foot Depth	48 Foot Depth
a. Implementation Responsibility	Existing implementation responsibilities are expected to continue.	Implementation of this plan requires responsible actions by the federal government and the non-federal partner in a manner similar to existing conditions. There are no new roles or responsibilities for federal, state, or local agencies.	Implementation of this plan requires responsible actions by the federal government and the non-federal partner in a manner similar to existing conditions. There are no new roles or responsibilities for federal, state, or local agencies.	Implementation of this plan requires responsible actions by the federal government and the non-federal partner in a manner similar to existing conditions. There are no new roles or responsibilities for federal, state, or local agencies.	Implementation of this plan requires responsible actions by the federal government and the non-federal partner in a manner similar to existing conditions. There are no new roles or responsibilities for federal, state, or local agencies.	Implementation of this plan requires responsible actions by the federal government and the non-federal partner in a manner similar to existing conditions. There are no new roles or responsibilities for federal, state, or local agencies.
E. Risk Evaluation						
1. Risk and Vulnerabilities						
a. Investment Risk	Minimal risk to return on investment of maintenance funds since those expenses are periodically justified.	This plan includes the lowest risk to the return on construction funds investment because the existing fleet and existing trade levels would provide some level of return.	This plan includes a very low risk to the return on the investment of construction funds because the return is somewhat based on completion of the Panama Canal Expansion and a minor fleet shift.	This plan includes a low risk to the return on the investment of construction funds because the return is somewhat based on completion of the Panama Canal Expansion and a minor fleet shift.	This plan includes a low risk to the return on the investment of construction funds because the return is somewhat based on completion of the Panama Canal Expansion and a minor fleet shift.	This plan includes a low risk to the return on the investment of construction funds because the return is somewhat based on completion of the Panama Canal Expansion and a minor fleet shift.

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Item	No Action	44 Foot Depth	45 Foot Depth	46 Foot Depth	47 Foot Depth	48 Foot Depth
b. Reliability	The no action plan requires continuance of existing periodic maintenance dredging to maintain reliability	This plan requires a negligible increase in existing maintenance dredging levels to maintain reliability	This plan requires a slight increase in existing maintenance dredging levels to maintain reliability	This plan requires a very small increase in existing maintenance dredging levels to maintain reliability	This plan requires a small increase in existing maintenance dredging levels to maintain reliability	This plan requires a minor increase in existing maintenance dredging levels to maintain reliability
c. Relative Sea-level rise	The no action plan may be modified in the future to account for effects of sea-level rise	The effects of a range of sea-level rise scenarios were included plan development	The effects of a range of sea-level rise scenarios were included plan development	The effects of a range of sea-level rise scenarios were included plan development	The effects of a range of sea-level rise scenarios were included plan development	The effects of a range of sea-level rise scenarios were included plan development
d. Risk of Ecosystem Damage	Existing conditions and trends are projected to continue	Post-construction monitoring will be conducted to verify predictions and assumptions for chlorides, aquifer impacts, and dissolved oxygen.	Post-construction monitoring will be conducted to verify predictions and assumptions for chlorides, aquifer impacts, and dissolved oxygen.	Post-construction monitoring will be conducted to verify predictions and assumptions for chlorides, aquifer impacts, and dissolved oxygen.	Post-construction monitoring will be conducted to verify predictions and assumptions for chlorides, aquifer impacts, and dissolved oxygen.	Post-construction monitoring will be conducted to verify predictions and assumptions for chlorides, aquifer impacts, and dissolved oxygen.

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Item	No Action	44 Foot Depth	45 Foot Depth	46 Foot Depth	47 Foot Depth	48 Foot Depth
e. Risk of Life and Safety	Existing levels of safety are projected to continue into the future.	Meeting areas and turning basin modification increase margins of safety during channel transit.	Meeting areas and turning basin modification increase margins of safety during channel transit.	Meeting areas and turning basin modification increase margins of safety during channel transit.	Meeting areas and turning basin modification increase margins of safety during channel transit.	Meeting areas and turning basin modification increase margins of safety during channel transit.

12 Uncertainty Considerations

Uncertainties are evaluated for economic benefits, costs, environmental impacts, mitigation effects, and sea-level change.

12.1 Economic Analysis Uncertainty

12.1.1 Jasper County Terminal Sensitivity Analysis

In this analysis of navigation improvements to Savannah Harbor, a proposed future Jasper County Terminal is not included as a without or with-project condition due to the high level of uncertainty concerning the proposed terminal (Section 5.2 US East Coast and Gulf Coast Port Configurations and Capacities). Nonetheless, a series of sensitivity analyses were conducted to identify the potential impact that a Jasper County terminal might have on the justification and recommendation of a proposed channel deepening to the Garden City Terminal.

Terminal Development Uncertainty

The JPO has estimated that Phase I of the terminal would become operational by 2025, with 3 berths, having a total capacity of 500,000 TEUs, turning basin, utility, road and rail access and supporting infrastructure on 1,500 acres in Jasper County, SC. Additional phases would be brought on line as needed to meet market demands. The terminal would eventually have 10 berths and a capacity of 7M TEUs. The estimated cost of the terminal and connecting land transportation corridors would be around $4B. However, there is a high degree of uncertainty regarding the development of a container terminal in Jasper County. There is some doubt about whether a terminal will be constructed, and if it is constructed, the timing of construction, the exact location where the terminal might be built and how it would operate. Although a draft Intergovernmental Agreement has been published and the states are continuing to work in a collaborative manner, numerous uncertainties still exist regarding the development of a new terminal at Jasper County. A terminal design has not been developed nor have permits been obtained or even sought for construction. Other unknowns include the terminal development costs, the number of ship berths that would be available, the amount of storage capacity, accessibility for rail and truck, and ultimate throughput capacity. In addition, impacts to Corps operations and maintenance of the existing Federal Savannah River channel are not known, nor are the impacts to the existing Dredged Material Management Plan for the harbor and the required environmental uses of these disposal areas. The areas serve not only as dredged material disposal sites but also as habitat for critical avian species.

In such situations of great uncertainty, Federal regulations at 40 C.F.R. 1502.22 call for an evaluation based what might be considered "reasonably foreseeable significant adverse environmental impacts." Because of the uncertainty surrounding virtually all aspects of a potential Jasper terminal, an evaluation at the reconnaissance level was

conducted, including quantitative evaluations in some areas and qualitative descriptions in others.

Scenario Evaluations

In order to properly address uncertainties related to a potential Jasper County terminal development, a set of three scenarios was evaluated. A range of options was included under each scenario. The purpose of these scenarios is to provide decision makers with a sense for the range of possible impacts, economic and environmental, on a determination of the feasibility of deepening the channel to Garden City if a Jasper County terminal is developed. Scenario One assumes that no terminal will be constructed at Jasper County during the period of analysis. This is the base case for the Savannah Harbor Expansion Project study and is considered the "most likely" future without project condition. Scenarios Two and Three are incremental evaluations intended to determine if construction of the channel segment between a proposed Jasper terminal and the existing Garden City Terminal is economically justified under the assumption that the terminal is constructed in Jasper County.

Scenario Two presents a "reasonable high impact" scenario. This scenario identifies the maximum potential impact to the Savannah Harbor Expansion Project that could reasonably be expected as a result of a proposed Jasper terminal development. This scenario assumes that a large 6.5 million TEU container facility would be constructed on DMCA 12A & 12B, the most upstream terminal development site under consideration.

Scenario Three is a "mid-range" scenario that will enable decision-makers to put into context the level of risk and uncertainty in the decision-making process. Scenario Three represents the District's best guess regarding potential impacts if a terminal were to develop at Jasper County. This scenario assumes a 2.6 million TEU facility would be constructed on DMCA 14A & 14B, which is located downstream from DMCA 12A & 12B site.

The location and capacity assumptions adopted for these scenarios are based on information contained in a preliminary siting report prepared for the Georgia and South Carolina Port Authorities in July 2007 and in "An Update on the Jasper Ocean Terminal", March 11, 2011 also prepared for the Georgia and South Carolina Ports Authorities, which is the most current information available at the time of this writing.

The updated Jasper Ocean Terminal Report estimates that there will be an eight year permitting process from 2012 to the end of 2019 followed by two years of final design, 2020 through 2022 and three years to construct. The earliest project on-line date would be early 2026 according to the Update on the Ocean Terminal. These scenarios assume that SHEP channel deepening project would be completed in 2017 and Garden City is expected to reach its capacity of 6.5 million TEU's in 2030, four years after the projected on-line date of Jasper's Ocean Terminal. Under these scenarios, no economic benefits accrue until the channel is completed. Construction

costs that occur in the future are discounted to the beginning of the period of analysis to insure consistent comparisons of the scenarios.

The extent to which estimated channel deepening benefits may be allocated between the Garden City and Jasper County terminals is also unknown. For the purposes of this analysis three benefit allocations will be analyzed:

- 25% to Jasper County and 75% to Garden City;
- 50% to Jasper County and 50% to Garden City; and
- 75% to Jasper County and 25% to Garden City.

The same 50-year period of analysis, beginning in the year 2017 and ending in the year 2066, is used for all the scenarios. The current Federal discount rate of 4-1/8% is used. The analysis is based on the construction of the 47' deep channel. Note: Benefits are updated to 2012 values in Section 14, Selected Plan.

Cost Estimate

Cost estimates have been provided for each scenario described above. It is assumed that the non-Federal sponsor (GaDOT) will be responsible for making the Federal Government whole with regard to any negative impacts that development of a proposed Jasper County Terminal would have on the Corps ability to dispose of dredged material. It is recognized that there is uncertainty regarding the details associated with this assumption. Changes in construction, operation and maintenance costs may occur due to the construction of a proposed Jasper County Terminal. However, because of the extremely high level of uncertainty regarding future disposal locations, it is only possible to provide costs at a rough order of magnitude (ROM) level of detail. For this analysis, the financial costs of construction are adjusted to reflect economic costs, which include interest during construction, assuming a three-year construction period.

Environmental effects do not occur linearly in the Savannah River estuary. Different resources would be impacted to varying degrees depending on the location of the proposed terminal. Valuable environmental resources that could be impacted under one scenario may not be impacted at all in another scenario. Mitigation costs for the scenarios are based on a proportion of the total mitigation costs estimated for the deepening from the ocean to the Garden City Terminal.

The site proposed in Scenario Two (Site 12A/12B) is mutually exclusive with components of the harbor deepening alternatives that are being considered. The new terminal would be located adjacent to the Sediment Basin, which would be filled as one of the mitigation features proposed for deepening up to the Garden City Terminal. These two actions could not occur as presently envisioned. In this scenario, a Jasper County terminal would be constructed prior to deepening from this location up to the Garden City Terminal. With that approach, the mitigation plan for deepening to the Garden City Terminal would need to be modified. The extent of those changes would

require substantial hydrodynamic modeling and are beyond the scope of this reconnaissance-level evaluation.

Mitigation costs for this scenario are based on a proportion of the total mitigation believed to be necessary to deepen from the ocean to the Garden City Terminal. For this scenario, those proportions are as follows, with these mitigation requirements being for the reach of the harbor between a Jasper County Terminal and the Garden City Terminal:

Dissolved Oxygen	60 %
Wetlands (salinity intrusion)	25 %
Shortnose sturgeon	80 %
Striped bass	50 %
Chlorides	100 %

The site proposed in Scenario Three (Site 14A/14B) is further downstream than the site in Scenario Two, so fewer impacts would be expected to the freshwater portions of the estuary. Mitigation costs for this scenario are based on a proportion of the total mitigation believed to be necessary to deepen from the ocean to the Garden City Terminal. For this scenario, those proportions are as follows, with these mitigation requirements being for the reach of the harbor between a Jasper County Terminal and the Garden City Terminal:

Dissolved Oxygen	100 %
Wetlands (salinity intrusion)	100 %
Shortnose sturgeon	100 %
Striped bass	100 %
Chlorides	100 %

Environmental impacts for both scenarios do not include impacts which would result from construction of a new container terminal in Jasper County, improvements to the transportation system that would be required to serve the new terminal, or actions required to make the Federal Government whole to release the dredged sediment disposal easement on the property that would allow the site to be used for a terminal. Those impacts could be substantial, but they are outside the scope of this evaluation.

Economic Analysis

It is anticipated that the greatest impact of the proposed terminal on economic benefits will be related to the increased throughput capacity that it provides to the region. This impact would be felt primarily during the later years of the period of analysis when commodity shipments are expected to increase to the point where the region could usefully employ additional terminal capacity.

It is anticipated that a proposed Jasper County Terminal will have relatively minor impacts on water and landside transportation costs, and that the landside transportation cost of shipping a container through a Jasper County Terminal may be somewhat

higher than the landside transportation cost associated with shipping a container through Garden City Terminal. It is not known if the development of a proposed Jasper County Terminal will affect forecasted commodity growth or the vessel/fleet mix, except to the extent that the additional capacity afforded by the terminal will provide opportunities to ship additional goods later in the period of analysis. For this "reasonable high impact" scenario, it is assumed that the majority of the commerce moving through the Jasper County Terminal will be transferred from commerce that would otherwise have moved through the Garden City Terminal and there will be no additional increase in the commodity forecast or the vessel/fleet mix. Detailed incremental analysis of tidal delays and meeting areas that would normally be done for a feasibility level evaluation has not been conducted for these reconnaissance level evaluations.

Scenario Results

Under all scenarios, construction of the channel increment from a proposed Jasper County terminal to the Garden City terminal is well justified. The large terminal located at Site 12A/12B actually would have less impact on incremental justification than the moderately sized terminal located at Site 14A/14B, because the channel increment between Site 12A/12B and Garden City is 2.84 miles shorter and the incremental costs, including mitigation costs, to go from Site 12A/12B to Garden City are much less than the costs to go from Site 14A/14B to Garden City. Timing of construction will have little impact to justification because Garden City is forecast to reach its 6.5M TEU capacity in 2030, four years after the projected construction of Jasper Ocean Terminal. As expected, the larger the distribution of benefits to Garden City, the greater is the economic justification for construction of the channel increment. Overall, justification of the channel increment between a Jasper County terminal and the Garden City terminal is not particularly sensitive to development of a terminal at Jasper County.

Tables 12-1 and 12-2 provide the results of the economic sensitivity analyses.

Table 12-1: Jasper County Terminal Sensitivity Analysis - 1

Incremental Analysis
Scenario Two - Reasonable High Impact
Assumes Development of Site 12A/12B, 6.5 Million TEU Capacity

Scenario Two Detail Description	Average Annual Incremental Benefits	Average Annual Incremental Costs	B/C Ratio
Jasper Co. 2026, 75% Benefits to Garden City	$111,510,000	$11,698,000	9.53 -to-1
Jasper Co. 2026, 50% Benefits to Garden City	$74,340,000	$11,698,000	6.35 -to-1
Jasper Co. 2026, 25% Benefits to Garden City	$37,170,000	$11,698,000	3.18 -to-1

Table 12-2: Jasper County Terminal Sensitivity Analysis - 2

Incremental Analysis
Scenario Three - Mid Range Impact
Assumes Development of Site 14 A/14B, 2.6 Million TEU Capacity

Scenario Three Detail Description	Average Annual Incremental Benefits	Average Annual Incremental Costs	B/C Ratio
Jasper Co. 2026, 75% Benefits to Garden City	$86,236,000	$19,658,000	4.39 -to-1
Jasper Co. 2026, 50% Benefits to Garden City	$57,491,000	$19,658,000	2.92 -to-1
Jasper Co. 2026, 25% Benefits to Garden City	$29,694,000	$19,658,000	1.51 -to-1

12.1.2 Alternative Sensitivity Analyses

Seventeen sensitivity analyses were conducted for the transportation cost savings model (Table 12-3). These sensitivity analyses are grouped as: sensitivities to the commodity forecasts, sensitivities to vessel availability and loadings, and other sensitivities. The following is a listing of the sensitivity analyses:

Sensitivities to Commodity Forecasts

1. Increase annual commodity growth by 1%
2. Increase annual commodity growth by 3%
3. Decrease annual commodity growth by 1%
4. Decrease annual commodity growth by 3%
5. No growth in commodity forecast

Sensitivities to Vessel Availability and Loadings

6. Historical Sub-Panamax share of Capacity Calling
7. Reduce future Sub-Panamax share of Capacity Calling
8. Increase amount of Savannah Cargo carried on Post-Panamax Vessels
9. Full deployment of Post-Panamax Vessels in Without (42 ft) Project Condition
10. Reduce Post-Panamax Vessel Calls by 25%
11. Deployment of Post-Panamax Vessels by Unit Costs
12. Increase Post-Panamax Vessel Loading beyond Maximum Practicable Capacity

13. Reduce PPX ! Replacement of PPX2 Vessels, Use historical Sub-Panamax share of capacity calling, and Deploy PPX Vessels by unit costs

Other Sensitivities

14. Increase Cargo density
15. Increase Savannah Share of Trade Route Cargo by 25%
16. Decrease Savannah Share of Trade Route Cargo by 25%
17. Draft Report Values – for comparison purposes

All sensitivity analyses result in positive benefits, including Sensitivity 5 (no growth in tonnage and TEUs imported and exported at Savannah). Benefits are maximized at a channel depth of 47 feet for all but Sensitivity 12, which shows maximum benefits at -48 feet. Sensitivity 12 demonstrates that there are two factors which could lead to maximization of benefits for most all sensitivities at 48 feet: (1) a reaction by carriers to take advantage of the larger tide window afforded by the 48-foot alternative by carrying more overall cargo when calling at Savannah, and/or (2) larger PPX2 vessels than the 47.6 feet design draft vessel used in this analysis. Another conjecture can be made regarding what factors and circumstances which could result in plan optimization at channel depths less than -47 feet. Such circumstances could include fewer PPX2 vessels deployed on the heavier cargo trade routes (RTW, ECUS MED, ECUS EU GULF PEN, FE SUEZ ECUS, and FE ECUS MED) which could lead to optimization at 46-foot channel depth. Additionally, in conducting these sensitivity analyses, one can conjecture that port rotation matters. When Savannah is a first or early port of call on the East Coast United States leg, vessels generally arrive with lighter cargo, thus sailing at shallower drafts (i.e., imports tend to be lighter than exports). Conversely, when Savannah is the last or near the end of the ECUS portion of their itinerary, they tend to carry proportionally more of the heavier export cargo and thus tend to sail deeper and make greater use of available channel depths.

In summary, the overall results of the sensitivity analyses confirm that improvements to Savannah Harbor are economically beneficial. The results of these sensitivity analyses also provide insight as to what conditions and circumstances would have to occur to change project benefits.

Table 12-3: Transportation Cost Model Sensitivity Analyses AAEQ Cost Savings

	-44 feet	-45 feet	-46 feet	-47 feet	-48 feet
Baseline					
Total Savings	$ 98,210,000	$133,150,000	$150,370,000	$155,040,000	$155,040,000
Incremental Savings	$ 98,210,000	$34,940,000	$ 17,220,000	$ 4,680,000	$0
Sensitivity 1					
Total Savings	$117,060,000	$158,490,000	$178,290,000	$184,340,000	$184,340,000
Incremental Savings	$117,060,000	$41,430,000	$19,800,000	$6,050,000	$0
Sensitivity 2					
Total Savings	$164,090,000	$222,280,000	$250,090,000	$258,560,000	$258,560,000
Incremental Savings	$164,090,000	$58,190,000	$27,800,000	$8,480,000	$0
Sensitivity 3					
Total Savings	$ 93,580,000	$126,390,000	$142,290,000	$147,470,000	$147,470,000
Incremental Savings	$93,580,000	$32,810,000	$15,900,000	$5,180,000	$0
Sensitivity 4					
Total Savings	$62,860,000	$84,840,000	$95,500,000	$98,970,000	$98,970,000
Incremental Savings	$62,860,000	$21,990,000	$10,660,000	$3,470,000	$0
Sensitivity 5					
Total Savings	$37,430,000	$50,640,000	$57,060,000	$59,250,000	$59,250,000
Incremental Savings	$37,430,000	$13,200,000	$6,430,000	$2,190,000	$0
Sensitivity 6					
Total Savings	$100,000,000	$135,410,000	$152,730,000	$157,200,000	$157,200,000
Incremental Savings	$100,000,000	$35,410,000	$17,310,000	$4,470,000	$0
Sensitivity 7					
Total Savings	$96,580,000	$131,090,000	$148,230,000	$153,090,000	$153,090,000
Incremental Savings	$96,580,000	$34,510,000	$17,140,000	$4,870,000	$0
Sensitivity 8					
Total Savings	$102,980,000	$135,000,000	$151,160,000	$155,440,000	$155,440,000
Incremental Savings	$102,980,000	$32,020,000	$16,160,000	$4,280,000	$0
Sensitivity 9					
Total Savings	$105,920,000	$140,860,000	$158,080,000	$162,760,000	$162,760,000
Incremental Savings	$105,920,000	$34,940,000	$17,220,000	$ 4,680,000	$0
Sensitivity 10					
Total Savings	$81,300,000	$112,960,000	$130,020,000	$135,050,000	$135,050,000
Incremental Savings	$81,300,000	$31,660,000	$17,060,000	$5,020,000	$0
Sensitivity 11					
Total Savings	$95,470,000	$128,170,000	$144,850,000	$149,530,000	$149,530,000
Incremental Savings	$95,470,000	$32,700,000	$16,680,000	$4,680,000	$0
Sensitivity 12					
Total Savings	$98,210,000	$143,480,000	$172,010,000	$183,080,000	$187,420,000
Incremental Savings	$98,210,000	$45,280,000	$28,530,000	$11,070,000	$4,340,000
Sensitivity 13					
Total Savings	$132,630,000	$175,480,000	$193,050,000	$198,370,000	$198,370,000
Incremental Savings	$132,630,000	$42,850,000	$17,570,000	$5,320,000	$0
Sensitivity 14					
Total Savings	$99,750,000	$149,630,000	$185,090,000	$212,620,000	$212,620,000

Table 12-3: Transportation Cost Model Sensitivity Analyses AAEQ Cost Savings

	-44 feet	-45 feet	-46 feet	-47 feet	-48 feet
Baseline					
Total Savings	$ 98,210,000	$133,150,000	$150,370,000	$155,040,000	$155,040,000
Incremental Savings	$ 98,210,000	$34,940,000	$ 17,220,000	$ 4,680,000	$0
Incremental Savings	$99,750,000	$49,880,000	$35,460,000	$27,520,000	$0
Sensitivity 15					
Total Savings	$122,760,000	$166,430,000	$187,960,000	$193,810,000	$193,810,000
Incremental Savings	$122,760,000	$43,670,000	$21,530,000	$5,850,000	$0
Sensitivity 16					
Total Savings	$73,660,000	$99,860,000	$112,770,000	$116,280,000	$116,280,000
Incremental Savings	$73,660,000	$26,200,000	$12,920,000	$3,510,000	$0
Sensitivity 17					
Total Savings	$93,010,000	$122,350,000	$134,930,000	$139,150,000	$139,150,000
Incremental Savings	$93,010,000	$29,340,000	$12,580,000	$4,220,000	$0

Cargo Forecast Sensitivity

Sensitivity 1: One-Percent Increase In Annual Commodity Growth Rate

When adjusting the commodity growth rate upwards by 1 percent, the project benefits increase by approximately 19 percent. However, this increase in benefits would also require that the Garden City Terminal's capacity increase from 6.5 million TEUs in 2030 to 7.8 million TEUs, a condition which the Corps believes could not occur.

Sensitivity 2: Three-Percent Increase In Annual Commodity Growth Rate

When adjusting the commodity growth rate upwards by 3 percent, project benefits increase by 67 percent. However, this increase in benefits would also require that the Garden City Terminal's capacity increase from 6.5 million TEUs in 2030 to 11.4 million TEUs, a condition which the Corps believes could not occur.

Sensitivity 3: One-Percent Decrease In Annual Commodity Growth Rate

A decrease in the commodity growth rate by 1 percent reduces project benefits by 5 percent. However, the port's TEU capacity of 6.5 million TEUs is not achieved until 2037, but benefits are only computed through 2035, indicating that there are some additional benefits, which have not been quantified.

Sensitivity 4: Three-Percent Decrease In Annual Commodity Growth Rate

The model adjusted by decreasing the commodity growth rate by 3 percent per year with the minimum annual growth limited to zero growth. A negative growth rate is not used in this sensitivity analysis. A decrease in the commodity growth rate by 3 percent reduces project benefits by 36 percent. However, the port's TEU capacity of 6.5 million TEUs is not achieved until well beyond 2035, but benefits are only computed through 2035, indicating that there are some additional benefits, which have not been quantified.

Sensitivity 5: No Growth In The Commodity Forecast

In the no-growth sensitivity analysis commodity tonnage is held at baseline year-2010 values throughout the 50-year study period. The no-growth assumption reduces project benefits by 62 percent.

Vessel Availability and Loading

Sensitivity 6: Maintenance of Historical Sub-Panamax Share of Cargo

The baseline transportation cost savings analysis assumes a 33% drop in the Sub-Panamax share for cargo from the historical amount. Under the assumption of a historical Sub-Panamax share, the project benefits increase slightly because of a less efficient without project condition. Vessel calls by Sub-Panamax vessels increase under this sensitivity analysis and vessel calls by Panamax vessels are lower than that of the baseline condition.

Sensitivity 7: Reduction in Future Sub-Panamax Share of Cargo

The baseline transportation cost savings analysis assumes a 33% drop in the Sub-Panamax share for cargo from the historical amount. Under this sensitivity analysis, there is a 65% reduction in the Sub-Panamax share for cargo from the historical amount. Project benefits decrease slightly (2%) under this scenario because the analysis assumes that some Post-Panamax vessels will shift to less benefitting routes.

Sensitivity 8: Five-Percent Increase in Savannah Post-Panamax Vessel Capacity

The baseline analysis assumes that the future share of Savannah cargo carried on Post-Panamax vessels would comprise the same percent of the estimated maximum practicable capacity as observed in the 2005/07 data for Panamax and Post-Panamax vessels. This sensitivity analysis reflects the potential that carriers may reduce the number of ports on a rotation. This sensitivity analysis results in increases in annual benefits of about 5 and 1 percent respectively for channel depths of -44 and -45 feet while no change in benefits for depths of 46 feet and greater.

Sensitivity 9: Full Deployment of Post-Panamax Vessels in the Without-Project Condition

The baseline condition assumed that 50 percent of the "unconstrained" PPX2 vessels would call in the without project (-42 foot) condition. This sensitivity analysis assumes that essentially the same number of PPX 2 vessels would call Savannah Harbor in a -42 foot channel as would call in a -47- or -48-foot channel, but carry less cargo due to the channel constraints. Average annual benefits are about 5 to 8 percent higher than the baseline. Benefits generally increase under this sensitivity analysis because of the inefficient use of Post-Panamax vessels in the without-project condition.

Sensitivity 10: Twenty-five Percent reduction in Post Panamax Vessel Calls
Under a 25% reduction in the number of Post Panamax calls, benefits are significantly lower than the baseline condition, given the reduced pool of Post Panamax vessels to provide gains in efficiency. Average annual benefits would be about 13 to 17 percent lower than the baseline.

Sensitivity 11: Deployment of Post-Panamax Vessels by Unit Costs
This sensitivity analysis employs the same basic assumptions as were presented in a previous draft of the Economics Appendix and GRR (December 2010). The primary assumption for this sensitivity analysis is that PPX 2 vessels would deploy in accordance a strict unit cost comparison by trade route. Average annual benefits are about 3 to 4 percent lower than the baseline, and there is no change in incremental benefits between -46 and -47 feet.

Sensitivity 12: Increase Post-Panamax Vessel Loading Beyond Baseline Maximum Practicable Loading Estimates
This sensitivity analysis assumes that vessels would load more deeply, in response to a deeper channel, than estimated by the baseline maximum practicable loading analysis. The result is a shift of overall sailing draft distributions with deeper channels. Average annual benefits are the same at 44 feet but begin to increase substantially at -45 feet, when the effects of the increased loading assumption begin to take effect. The incremental benefit from -47 to -48 feet is more than $4 million in this sensitivity analysis. This sensitivity analysis also reflects, at least in a general sense, the effects on project benefits and channel depth optimization that would likely occur if vessels with drafts greater than -48 ft called on Savannah on a regular basis..

Sensitivity 13: Reduce PPX1 Replacement of PPX2 Vessels, Use Historical Sub-Panamax Cargo Share, and Deploy Post-Panamax Vessels by Unit Costs
This sensitivity analysis employs some basic assumptions that were used during development of the transportation cost savings model. First, it assumes the deployment by unit cost depths as presented in Sensitivity 11 and presented in the draft report. Secondly, it assumes the historic Sub-Panamax share of capacity calling as presented in Sensitivity 6. And finally, it assumes that when PPX2 vessels do not call on a particular route due to channel constrants, they will be replaced on a vessel for vessel basis rather than a capacity for capacity basis as included in the baseline condition. These were all assumptions used prior to refinements that have evolved throughout the SHEP study as more information became available. Annual benefits and vessel calls increase substantially over the baseline ranging from 28 to 35 percent greater.

Other Sensitivity Analyses
Sensitivity 14: Increase Cargo Density
This sensitivity analysis is based on the assumption that cargo density, i.e., tonnage per container, may increase in the future as shippers look for ways to cut costs by increasing packing efficiency. Under this sensitivity analysis the TEU forecast decreases slightly and the port's TEU capacity is not achieved until 2031, one year

after the baseline result. Average annual benefits increase from 2 to 37 percent with the greater increases occurring at greater depths.

Sensitivity 15: Increase Savannah's Share of Trade Route Cargo by 25%
The base line estimate of benefits used 2005 and 2007 vessel calls, Savannah cargo and empty containers, and sailing draft information combined with the Load Factor Analysis to estimate the amount of vessel capacity utilized when vessels called at Savannah Harbor. While a number of variables in the baseline analysis were updated from 2005/07 by incorporating information from 2008 and 2010, sailing drafts were not analyzed for these years, therefore newer estimates of total cargo carried has not been revised. The amount of Savannah cargo carried as a percent of total cargo carried could vary considerably. For this sensitivity analysis, it was assumed that the amount of Savannah cargo carried relative to total cargo is 25% greater than observed and calculated from the 2005 and 2007 estimates with the result that benefits are 25 percent greater than baseline.

Sensitivity 16: Decrease Savannah's Share of Trade Route Cargo by 25%
For this sensitivity analysis, the estimated amount of Savannah cargo relative to total cargo was decreased by 25%. The purpose of this analysis is the same as described in Sensitivity 15; Savannah's cargo share is a highly uncertain factor in the benefits analysis. This sensitivity analysis results in annual benefits and incremental benefits decreasing by 25 percent from the base line.

Sensitivity 17: November 2010 Draft Report Values
Sensitivity 17 is presented primarily for comparison purposes. The average annual benefits are 5 to 10 percent lower than the current baseline in this final report; however, there are offsetting assumptions, some of which increase benefits and others which decrease benefits. While the overall commodity forecast tonnage is lower in the this report than in the November 2010 Draft Report, the forecast number of TEUs is higher due to more empty containers and changes in cargo weights that resulted from incorporating 2008 – 2010 actual shipments at Savannah. Also, the new Post-Panamax vessel call forecast resulted in an increase in the number of PPX 2 vessels in the early years of the analysis period. Additionally, a 2017 base year is used in the final report baseline compared to a 2015 year base year in the draft report, resulting in higher early year benefits. The discount rate of 4.125 percent for FY 2011, as compared to the 4.375 percent discount rate used in the November 2010 Draft Report, likewise results in an upward adjustment of benefits. And finally, including deployment of PPX 2 vessels in the without project condition, as is occurring presently, results in an increase in benefits.

12.2 Cost Risk Analysis

A Cost Risk Analysis is a systematic and comprehensive method to evaluate uncertainty and risks that may affect the estimated project costs. Risks were characterized by the magnitude of possible uncertainties and the probability of occurrence for each item or event. In compliance with Engineer Regulation 1110-2-

1302 Civil Works Cost Engineering, dated September 15, 2008, the Corps performed a formal risk analysis to establish project contingencies by identifying and measuring the cost and schedule impact of project uncertainties with respect to the estimated project cost. The Cost Risk Analysis for this project was conducted by the Corps' Cost Engineering Center of Expertise at Walla Walla District. Details of the analysis can be found in the Engineering Appendix.

The Corps' Cost Engineering Center of Expertise recommends a contingency value of 25% based on an 80% confidence level, as per USACE Civil Works guidance. The contingency amount for the Selected Plan accounts for cost and schedule growth potential due to risk analyzed in the baseline cost estimate of 47-foot design depth. Schedule slippage risk is calculated at 1 to 2 years. The Cost and Schedule Risk Model is based on 1.5-year risk slippage. The 25% contingency has been applied to all project costs.

12.3 Environmental Impact and Mitigation Uncertainty

Consideration was given to uncertainties that exist in the ability to predict the impacts from the proposed harbor deepening alternatives. Uncertainties occur when knowledge is incomplete. In the case of this project, there are uncertainties in such things as the accuracy of the model predictions and the biological response to physical parameters. The major risks for an environmental analysis are (1) that the predicted level of impacts understates the actual impacts that will occur, and (2) that such understatement would alter a decision-maker's conclusions on whether the project should be constructed.

The Corps reviewed the Uncertainty Analysis that was prepared by Kinetics Analysis Corporation (KAC) in 2005 on the hydrodynamic, salinity, and water quality models. That analysis was conducted toward the end of the model development process and evaluated the ability of those models to accurately predict the observed data. A model is typically developed to represent the observed field data, and its ability to duplicate that data is often used to assess its accuracy and the reliability of its predictions. A copy of KAC's analysis can be found in the Engineering Appendix. KAC evaluated the model's ability to duplicate the field data for salinity, dissolved oxygen, river discharge, and tidal phase. River discharge and tidal phase are useful in evaluating how a model is constructed but are not discussed here because they do not aid in evaluating the two risks mentioned earlier.

KAC discussed model errors at four locations – the I-95 Bridge, Lucknow Canal, the USFWS Dock, and at Houlihan Bridge. We believe that only two of those locations are pertinent to the present discussion of risk and uncertainty. Salinity levels are too low at I-95 to be meaningful. All values reported by KAC are below those that would result in impacts to vegetation or fish habitat. The Lucknow Canal Station is located very close and upstream of the USFWS Dock, so the USFWS Dock provides a better site at which to evaluate the model for salinity.

12.3.1 Uncertainty in Salinity Predictions

KAC found the model to generally predict salinity levels too high at the Houlihan Bridge and the USFWS Dock. KAC found the model to predict salinity too high along the entire gradient from 1 to 15 ppt. KAC evaluated the model using two river flow periods, so they produced multiple evaluations of the model's reliability for the same location, depending on flow. At the Houlihan Bridge, the errors typically range from 0.5 to 1 ppt when the observed salinity measured 2 ppt. At the USFWS Dock, the errors typically range from 0.25 to 0.6 ppt when the observed salinity measured 1 ppt and from 1.1 to 1.6 ppt when the observed salinity measured 2 ppt.

KAC also developed error bounds for the model's salinity predictions. At the Houlihan Bridge, they found that for salinity levels around 1 ppt, the model had between a 70 and 85 percent chance of over-predicting salinity, when predicting at and below the 1 ppt level. At the USFWS Dock, they found that for salinity levels around 0.5 ppt, the model had an 83 to 85 percent chance of over-predicting salinity. At that location, there is a 5 percent chance that the predictions would be between 0.12 and 0.25 ppt too low (0.19 ppt average error). There is roughly a 5 percent chance that the model's predictions would be 0.19 ppt too low when predicting values at that low level (0.5 ppt).

12.3.2 Risk with Salinity Predictions

As discussed above, the hydrodynamic model has roughly an 80 percent chance of over-predicting salinity levels at low salinity levels, thus leading to an over-prediction of salinity-induced impacts. Therefore, the model is considered to present little risk for decision-makers evaluating salinity impacts to wetlands. However, some risk still exists. At the upper 95 percent confidence level, the model could be from 0.25 to 1.6 ppt too low when salinity is predicted to be less than 2 ppt. To acknowledge this risk, USACE proposes to expand the wetland mitigation that would be implemented, but only if post-project monitoring determines that such expanded mitigation is warranted.

12.3.3 Uncertainty in Dissolved Oxygen Predictions

KAC found the model to generally predict dissolved oxygen levels too low at the Houlihan Bridge and the USFWS Dock. Those two stations are the most downstream locations considered by KAC and are, therefore, the closest to the area of the harbor which typically experiences D.O. problems in the summer. In general, KAC found the model to under-predict dissolved oxygen along the gradient of D.O. from 1 to 8 mg/l. At the Houlihan Bridge, the errors typically range from 0.025 to 0.075 mg/l across that range depending on river flow. At the USFWS Dock, the errors typically range from 0.01 to 0.02 mg/l when the observed D.O. measured less than 1.6 mg/l (upper extent of KAC's analysis on D.O. at this Station). At the Lucknow Canal, KAC found the errors to range up to 0.01 mg/l when the observed D.O. measured less than 0.7 mg/l. Those errors are quite small and within the general range of reliability of field and laboratory measurements.

12.3.4 Risk with Dissolved Oxygen Predictions

The fact that the model under-predicts dissolved oxygen by quite small amounts indicates that the model should be a good predictor of dissolved oxygen-related impacts. The model's errors in predicting dissolved oxygen levels present little risk for decision-makers. No adjustment to the predictions or mitigation procedure appears to be warranted in response to the risk of error in the models' predictions.

12.3.5 Uncertainty in Biological Responses

There is considerable uncertainty in the biological responses to changes in the physical environment. These changes are greatest at the individual organism level and are less at the species and ecosystem levels. There are no known ways to quantify the uncertainties inherent in the impact predictions made during the evaluation of this project. Biologic responses typically vary around a norm and the variation of an individual from that norm is not of primary concern in this evaluation. This analysis is concerned with the response of the biologic communities that reside in and depend on the harbor to provide habitat for some portion of their life. The Interagency Coordination Teams developed procedures that they believe capture the important biologic criteria that could be affected by this project for certain critical natural resources. The criteria are a matter of professional judgment and were intended to describe good habitat conditions for those species. Field studies identified individual organisms residing in areas of the harbor that are outside what the evaluation criteria would indicate provide good habitat. That individual variability indicates that some individuals are likely to find more of the harbor to provide acceptable habitat or be able to accept marginal habitat for short periods of time. However, in the same manner, to those individuals with a narrower range of acceptability than the norm, the harbor may provide less acceptable habitat that the calculations indicate. The effect of this range in individual behavior is unknown but is not believed to be of concern since we are primarily interested in the response of the entire similar biologic community rather than individuals.

There is some uncertainty that the biologic parameters used to define acceptable habitat are incorrect. If the parameters are incorrect or incomplete and the values selected for those parameters are wrong, the extent of acceptable habitats would be in error. This possibility was reduced through the interagency nature by which the parameters were identified. The natural resource agencies provided representatives to the Interagency Coordination Teams based on an individual's experience and familiarity with similar construction projects. The Interagency Teams first identified which species they believe to be most critical in the harbor or best represent important guilds or communities. They then identified those species most likely to be impacted by the changes expected from a harbor deepening. The teams then reviewed professional literature to identify parameters that had been found in the past to differentiate acceptable habitat from unacceptable for those species. This collaborative and deliberate approach minimized the uncertainty in the species evaluated, the biologic parameters selected to define acceptable habitat, and the values

selected for those parameters to differentiate between acceptable and unacceptable habitats.

12.3.6 Risk in Biological Responses

As discussed above, there is uncertainty about the responses of individual organisms to the changes that would occur as a result of the proposed project. However, the risk that accompanies that uncertainty is low because we are generally concerned about impacts at the community level.

Since biologic communities respond to the sum of the influences bearing upon them, there is uncertainty with how the impacts of this project would combine with other ecological factors that may stress a community. The impact process included several alternate conditions along with the basic set of conditions for which the resource agencies requested this project be evaluated. These alternate conditions included such things as alternate river flows for fishery, wetland, and dissolved oxygen impacts, and two variations of sea-level rise for wetland impacts. These alternate conditions were included as sensitivity tests to the basic impact evaluation. The sensitivity tests provide information on how the project would function under environmental conditions that are outside the norm. Their inclusion in the overall analysis substantially reduces the risk that the project would produce impacts that would occur at unacceptable levels, even under uncommon circumstances.

12.4 Risk in Sea-Level Change Assumptions

Table 15-2 of the Engineering Appendix outlines details on risk and uncertainty for possible sea level changes in Savannah Harbor. Analysis and rates are based on EC 1165-2-212, *Sea-level Change Considerations for Civil Works Programs*, dated October 1, 2011. Three alternative rates of sea-level rise were computed, and the "low" rate was selected for use as the most likely future condition. For mitigation features, the base year sea-level rise, at the completion of construction, was used. This ensures that the project fully mitigates for impacts produced over the entire period of analysis.

Areas considered where uncertainty of sea-level rise estimates may have impacts are: dredging, mitigation structural features, freshwater wetland loss mitigation, and upstream chlorides at the City of Savannah water supply intake.

The dredging scenarios include new work dredging, maintenance dredging of the deepened channel, and mitigation dredging of McCoys Cut and Middle and Back Rivers. No impact from sea-level rise uncertainty is anticipated because the authorized dredging depths are relative to the Mean Lower Low Water (MLLW) datum. As sea level changes, the MLLW datum will be adjusted periodically, thus additional depth from sea-level rise will fill in with sediment. Therefore, there is very low risk associated with sea-level rise and dredging - whether new work, maintenance, or mitigation.

Structural features such as sills or plugs also carry minimal risk from sea-level rise uncertainty. They are designed to function over a wide variation of tidal stage, and the sea-level rise uncertainty is small compared to the tidal range. It is possible that a structure's effectiveness could be reduced slightly with greater than projected sea-level rise rates, but this could be readily addressed through adaptive management of the mitigation features.

Sea-level rise uncertainty results in a minor level of risk. A different rate of sea-level rise could affect the purchase of mitigation wetlands and the mitigation for chloride impacts to the City of Savannah Abercorn Creek water supply intake. A higher rate of sea-level rise than that assumed would result in a lesser need for mitigation. This is due to the without-project condition, which also includes sea-level rise, impacting the same freshwater wetlands that are projected to be impacted by the harbor deepening project. The mitigation based on the recommended sea-level rise assumptions result in the lowest risk to the resources impacted by the project. That is, the sea-level rise uncertainty could result in more mitigation lands being acquired than are actually necessary, which is preferable to the alternative of assuming too much sea-level rise and then finding that less sea-level rise resulted in unmitigated ecosystem damage from a harbor deepening project. Similarly, if sea-level rise is greater than assumed, then impacts from the project on the water supply intake would be reduced. That is not to say that chlorides would not impact the intake, but that the cause of the chloride increase would be sea-level rise rather than harbor deepening. The risk, then, is that the project may have over-mitigated.

13 Public Involvement, Review, and Consultation

13.1 Public Involvement Program

This study was conducted as a partnership between the USACE Savannah District, as the lead Federal agency, representatives of three other Federal agencies that need to approve the project (EPA Region 4, NMFS-Southeast Regional Office, and the USFWS-Southeast Region), and the Georgia Ports Authority (for their shipping expertise). Representatives from the Cooperating Agencies met on a regular basis to reach decisions on technical work to be conducted and review results of evaluations.

Savannah District coordinated technical aspects of the project with technical staff of Federal and State resource agencies through a series of Interagency Coordination Teams. The Savannah District generally developed those groups around specific natural resources, as follows:

- Wetlands;
- Water Quality;
- Fisheries;

- Sediment Placement; and
- Groundwater.

The agencies involved in the technical aspect of project-related studies were those with approval or certification authority. Agencies included the SC Department of Health and Environmental Control and the GA Department of Natural Resources because of their review of the Project's effects on water quality and coastal zone consistency. The intent of that coordination was to obtain incremental approval of the technical work conducted on the project. Through this approach, the Corps attempted to (1) use predictive tools that the agencies agreed are appropriate, (2) use those tools in the manner the agencies specified, and (3) produce output formats the agencies stated were needed for them to identify impacts to each resource.

The results of impact evaluation modeling runs and other analyses were shared with the interagency teams as they became available. After the agencies had a chance to review the information, the Corps shared the results with the public. The public coordination was usually accomplished through the SEG, further discussed below. One of the original purposes of the SEG was to develop a consensus mitigation plan for USACE and GPA consideration. Therefore, USACE shared the results of the technical studies with this group as they became available.

In response to the Draft EIS on the Feasibility Report in 1997, many concerns were raised by State and Federal agencies and the interested public regarding the economic and environmental evaluation. After a series of meetings among GPA and State and Federal agencies, an agreement was reached that the EIS for the 1997 Feasibility Report would be considered a Tier I EIS with another EIS to be prepared during the design phase of the project. As part of the Final EIS preparation, GPA and the agencies would form an SEG to advise GPA on appropriate environmental issues and to identify studies necessary to address those issues. During the process of obtaining Congressional approval in the Water Resources Development Act of 1999, the composition of the SEG was expanded to include the interested public.

The first meeting of the SEG was held on January 12, 1999. During that meeting, participants identified 49 issues of interest, some of which were procedural for operating the SEG and others were specific to the proposed project. Meetings were held monthly until July 2000. After that date, the meetings have been held bi-monthly and occasionally tri-monthly. To date, 70 full SEG meetings have been held. For the first several meetings, the facilitator published meeting minutes which were subject to review and approval by the full SEG. Subsequently, verbatim taped transcripts were made and eventually transcribed transcripts were made by a contract court reporter. All minutes, taped and transcribed records, and other project material can be found on the Savannah Harbor Expansion Project web site, http://www.sav-harbor.com.

Fifty-nine people attended the first SEG meeting and attendance at subsequent meetings has been generally in the range of 40 to 50 people. Attendance records can also found on the web site. The SEG developed operating guidelines and formed itself into various committees to oversee different aspects of the project. The SEG recommended 21 areas of additional investigation that resulted in 31 additional studies. The results of the various studies were presented to the SEG as they became available. The SEG accepted the results and acknowledged the individual studies as being complete. All study results are included in the GRR and EIS evaluations. Copies of the study recommendation, scopes of work and final reports of each of the areas of study can be found on the harbor deepening web site.

In addition to the SEG, the Corps used other methods to ensure the entire public was aware of the GRR and EIS activities. This began with the NEPA scoping meeting held in 2002. The District prepared and distributed brochures that described the environmental field work that was being conducted; discussed the project at local professional and community groups such as the American Society of Civil Engineers. The hydrodynamic modeling approach, wetland impact evaluation approach, and the project in general has been the subject of presentations at the Georgia Water Resources Conference in 2001, 2003, 2005, and 2007. Interim plan formulation results (Formulation of Alternatives report) were distributed for public comment in 2005.

The Georgia Ports Authority conducted a demonstration project during the summer of 2007 of the dissolved oxygen injection system that was being considered in the project. The full-scale system was operated within sight of City Hall for a period of about six-weeks. GPA arranged for representatives of natural resource agencies and the general public to tour the facility at specified times and the demonstration project was covered on the front page of the local newspaper.

13.2 USACE Environmental Operating Principles

The Savannah District is committed to implementing the USACE environmental operating principles. The following discussion presents the implementation of these principles in the study and planning process for the Savannah Harbor deepening:

1. Strive to achieve environmental sustainability. An environment maintained in a healthy, diverse, and sustainable condition is necessary to support life.

The project considered the sustainability of both the existing deep-draft navigation project in Savannah and the natural resources located within the estuary. The proposed harbor deepening would allow the port to serve its customers in a more cost effective manner by reducing the cost of transporting goods through the port while assuring the sustainability of the Savannah National Wildlife Refuge. The Corps considered the long-term needs of the harbor for sediment placement sites and found the existing sites to be adequate for the life of the project. The mitigation plans incorporate flow-rerouting features, which will provide benefits with low long-term

maintenance requirements. Several of the mitigation features were specifically designed to minimize long term O&M costs, to ensure their sustainability. Continued operation of the oxygen injection systems over the long term will ensure the project's effects are managed and sustainable. The project also includes mitigation for Shortnose sturgeon, Striped bass, water supply, cultural resources, and wetlands to also ensure sustainability.

2. Recognize the interdependence of life and the physical environment. Proactively consider environmental consequences of Corps programs and act accordingly in all appropriate circumstances. Coordination with environmental agencies and their inclusion as part of the Project Development Team (PDT).

The project PDT worked closely with environmental agencies, both State and Federal, to review proposed project requirements and how those requirements will impact the environment and what can be done to mitigate or prevent this from happening.

3. Seek balance and synergy among human development activities and natural systems by designing economic and environmental solutions that support and reinforce one another.

The project has been designed to allow sustainability for both mankind and the natural environments. The mitigation plan constitutes approximately half of project costs.

4. Continue to accept corporate responsibility and accountability under the law for activities and decisions under our control that impact human health and welfare and the continued viability of natural systems.

The District acknowledged differences between itself and the Savannah National Wildlife Refuge in the responsibility for maintenance of some project mitigation features. The Corps and the Refuge signed a Memorandum of Agreement in 2009 that defines the responsibilities of the agencies in the future. In 2011, the Corps completed rehabilitation of the portion of the water control system located on the Refuge, restoring those structures to their original condition. That rehabilitation will enable the USFWS to operate the system that allows them to manage freshwater within the Refuge impoundments in a safer and more cost-effective manner.

5. Seek ways and means to access and mitigate cumulative impacts to the environment; bring systems approaches to the full life cycle of our processes and work.

The Corps considered cumulative impacts in its assessment of the ecological and social value of resources that the project would impact. The project features were designed recognizing the present and expected future status of specific environmental resources, how those resources function in the estuary, and how those resources are influenced by man's activities.

6. Build and share an integrated scientific, economic and social knowledge base that supports a greater understanding of the environment and impacts of our work.

The Savannah Harbor estuary is a complicated natural environment that has been altered by the activities of man since the 1700's. In order to study the impacts of a project which further alters the natural ecosystem, comprehensive planning and design of technical data gathering and interpretation is required. This has been accomplished on the SHEP with little spared in terms of cost or personnel resources. The adoption of stakeholder input through Stakeholder Evaluation Group meetings resulted in numerous studies that were undertaken to insure that every possible impact from the additional project depth was investigated.

7. Respect the views of individual and groups interested in Corps activities; listen to them actively, and learn their perspective in the search to find innovative win-win solutions to the Nation's problems that also protect and enhance the environment.

One major way in which the Corps sought the views of the public was through its 12-year participation in the Stakeholders Evaluation Group, a body which GPA formed to provide the public with a means to receive project information and provide their concerns and suggestions about the project. The group provided its views regarding possible studies to be performed and possible mitigation measures.

13.3 Application of USACE Campaign Plan

I. Engineering Sustainable Water Resources.
Deliver enduring and essential water resource solutions through collaboration with partners and stakeholders. USACE will deliver enduring and essential water resources solutions. The Corps will collaborate with partners and stakeholders to find holistic and sustainable solutions.

1. Employ integrated, comprehensive and systems-based approach

The Savannah Harbor estuary is a complicated natural environment that has been altered by the activities of man since the 1700's. To study the impacts of a project which further alters the natural ecosystem, comprehensive planning, technical analysis and interpretation were required. This was accomplished on the Savannah Harbor Expansion Project with little spared in terms of cost or personnel resources. The Corps conducted the evaluation in a cooperative manner with the regional offices of critical federal agencies (EPA, USFWS, and NOAA Fisheries). The Corps also established and used Interagency Coordination Teams to discuss potential project effects on important natural resources. The Corps sought the views of local stakeholders through a Stakeholder Evaluation Group that was organized by the Georgia Ports Authority. As a result of input from the natural resource agencies and the Stakeholder Evaluation Group, the Corps conducted numerous studies to insure that all potential project impacts were identified and evaluated.

The project team used a systems approach in its assessments of environmental and economic effects. In the systems approach, the project's physical impacts were modeled to identify resulting changes in the chemical and biological characteristics of the estuarine system. The expected effects of a potential feature were identified across all the natural resources in the estuary.

From an economic perspective, the team assessed the effects of a project in terms of the international system of containerized cargo transport. The systems approach to channel deepening in Savannah accounted for depths and capacities at other ports, deepening of the Panama Canal, and incorporated evaluation of a broad range of alternatives, including improvements at locations other than Savannah.

2. Employ risk-based concepts in planning, design, construction, operations, and major maintenance

The planning of the project, the incorporation of design elements and the consideration of future contingencies to account for risk during the construction and operations and maintenance phase was accomplished as the project was developed. Investigation of the Floridan Aquifer is a prime example of the risk-based approach to determining what impacts further deepening would have on the harbor and its environs. The same applies to hurricane surge studies, bank erosion and stability investigations, coastal erosion investigations, and the myriad model runs conducted to determine possible detrimental impacts to natural resources within the estuary. A risk and uncertainty analysis was performed for the critical investigations performed during the study. The risk and uncertainty analysis for the construction consisted of (1) an in-depth cost estimating effort to account for unknowns such as dredge plant availability, production estimates, material variations and disposal area availability, and (2) inclusion in the project of a monitoring and adaptive management plan to ensure the expected project impacts are not exceeded and the mitigation features perform as intended. An important example of the risk-based analysis of long term O&M was the determination that proposed changes to the current configuration of the harbor will require an increase in O&M funding.

3. Continuously reassess and update policy for program development, planning guidance, design, and construction standards

Through the years of this project's planning and formulation, numerous policy changes have been determined to apply to this project, including application of the 12 Actions for Change. Cost Estimating Risk Analyses, Agency Technical Review and Independent External Peer Review of all documents, and consideration of sea-level rise, are examples where updated policy has been incorporated to provide Congress with confidence in the US Army Corps of Engineers' work.

4. Employ dynamic independent review

Every work product on this report has been reviewed in-house before being released by the Project Delivery Team and either has been subjected to both internal and external peer review. Most products have been researched and developed outside the Savannah District, lending even more credence to the independent nature of the study's components. The Regional Project Delivery Team consisted of Mobile, Charleston, Wilmington, Omaha, Philadelphia, and San Francisco Districts; the Engineer Research and Development Center in Vicksburg; the Cost Center of Expertise in Walla Walla; the Deep Draft Navigation Center of Expertise in Mobile; and the Institute for Water Resources in Fort Belvoir. The Federal Cooperating Agencies, the US Fish and Wildlife Service, the National Marine Fisheries Service and the US Environmental Protection Agency, were also deeply involved in the review process. The Corps developed the project plans in an iterative design/review/redesign manner with interagency coordination teams (including the States of Georgia and South Carolina) to ensure the plans would meet the needs of the natural resource agencies that would be asked to provide environmental clearances for the project.

5. Employ adaptive planning and engineering systems

The very nature of this project required the application of adaptive management in the engineering and environmental arenas. The project includes monitoring (before, during and after construction) and adaptive management (10 years after construction) to ensure the expected project impacts are not exceeded and the mitigation features perform as intended. This includes detailed data collection efforts prior to, during, and after construction. Adaptive management in the form of alterations to the monitoring plan and modification of the mitigation features is included to insure that degradation of environmental resources is prevented over the long term.

6. Focus on sustainability

The project considered the sustainability of both the existing deep-draft navigation project in Savannah and the natural resources located within the estuary. The proposed harbor deepening would allow the port to serve its customers in a more cost effective manner by reducing the cost of transporting goods through the port while assuring the sustainability of the Savannah National Wildlife Refuge. The Corps considered the long-term needs of the harbor for sediment placement sites and found the existing sites to be adequate for the life of the project. The mitigation plans incorporate flow-rerouting features, which will provide benefits with low long-term maintenance requirements. Several of the mitigation features were specifically designed to minimize long term O&M costs, to ensure their sustainability. Continued operation of the oxygen injection systems over the long term will ensure the project's effects are managed and sustainable. The project also includes mitigation for Shortnose sturgeon, Striped bass, water supply, cultural resources, and wetlands to also ensure sustainability.

7. Review and inspect completed works

The monitoring and adaptive management plan is a major component of the project. The Corps will monitor the project's effects for 10 years after construction is complete. It will also perform adaptive management to ensure the mitigation features perform as intended. A limited monitoring program – including annual inspection of the mitigation features -- will be performed for the life of the project to ensure the mitigation features continue to perform as intended.

8. Assess and modify organizational behavior

The Savannah District conducted this study in a regional manner to better use Corps talents and expertise. Ship simulation was performed by the Corps' Engineer Research and Development Center in Vicksburg, MS. The economic analysis was performed by the Corps' Deep-Draft Navigation Center of Expertise in Mobile, AL. Cost estimating work was performed by the Wilmington District in Wilmington, NC. The Agency Technical Review was conducted to provide a review by Corps experts who did not participate in development of the project by Corps employees outside the South Atlantic Division. An Independent External Peer Review was conducted by experts in various fields from the private sector.

II. Delivering Effective, Resilient, Sustainable Solutions.
Deliver innovative, resilient, sustainable solutions to the Armed Forces and the Nation. USACE will deliver innovative, resilient, sustainable solutions to the Armed Forces and the Nation. We will use innovative tools to efficiently and effectively, deliver high quality facilities. We will improve reliability and resiliency of critical infrastructure and reduce risks related to water resources and other DOD infrastructure.

9. Effectively communicate risk

Risk and uncertainty was routinely communicated within the Corps of Engineers, and to its customers and the public. Communication outlets included the Stakeholder Evaluation Group meetings, periodic meetings of five Interagency Coordination Teams, one-on-one meetings with affected municipalities, the local newspaper, project web sites and numerous briefings by the District Commander and his staff to civic organizations.

10. Establish public involvement risk reduction strategies

The major risk reduction strategy involving the general public consisted of three major components: (1) scoping of the issues to be considered during the course of the study, (2) participation in the Stakeholder Evaluation Group (a group sponsored by the Georgia Ports Authority as a means for the public to receive project information, and provide concerns and suggestions to the Georgia Ports Authority), and (3) public review of the Draft GRR and Draft EIS.

III. Recruit and Retain Strong Teams.
Build and cultivate a competent, disciplined, and resilient team equipped to deliver high quality solutions. USACE will build and cultivate a competent, disciplined, and resilient team equipped to deliver high quality solutions. We will strengthen critical core technical competencies. We will communicate strategically with employees, stakeholders and the public. We will improve our efficiency and effectiveness by increasing the use of standardized processes.

11. Manage and enhance technical expertise and professionalism

Through a regional approach, Savannah District was able to obtain the talents and skills of technical experts located both within and outside the District. This approach afforded unparalleled professional development opportunities for Corps personnel. The collaborative manner in which the District conducted the study also provided multiple opportunities for its technical experts to interact with scientists from sister state and federal agencies, such as when they jointly determined the means of identifying project impacts and evaluating measures to reduce and mitigate those impacts.

12. Invest in research

The project expended considerable expense in researching the potential impacts of the project and potential mitigation features. State-of-the-art techniques were employed in several technical areas – aquifer impact assessment, wetland monitoring, fishery monitoring, coastal engineering, hydrogeology explorations along the Savannah River, hydrodynamic modeling of estuarine systems, sediment characterization, and predicted chloride levels at the City of Savannah's water intake. These investigations substantially increased the body of knowledge for how the Savannah River estuary functions. This knowledge has already been used by others in their research efforts to enhance the sustainability of development along the coastal plain.

13.4 Scoping and Draft EIS

A Notice of Intent (NOI) was published in the Federal Register on January 22, 2002 announcing the Savannah District, USACE intended to prepare a Draft Environmental Impact Statement (DEIS) for the Savannah Harbor Expansion Project Feasibility Study. (Within the NOI, the public and agencies were notified that a scoping meeting would be conducted for the proposed project. On February 21, 2002, a scoping meeting was held for the proposed action at the Savannah International Trade and Convention Center. Additionally, on April 12, 2002, a NEPA scoping meeting was convened. GPA received 178 comments as a result of the meeting which can be found on the SHEP web site: http://www.sav-harbor.com/public%20information.htm. All comments and pertinent correspondence and scoping documents are included in the Environmental Appendix: Scoping Documents and Correspondence.

A Notice of Availability of the DEIS was published in the Federal Register on November 15, 2010 for 45-day period and advertised in local newspapers in both Georgia and South Carolina. In response to several requests, the District extended the review and comment period an additional 15 days until January 25, 2011 to provide the agencies and the public additional time to review the document. In addition, copies of the DEIS were made available at public libraries, and the documents were posted on the Savannah District website. A public information meeting on the project was also held at the Savannah Civic Center on December 15, 2010. Participants were provided detailed information on the project and its associated mitigation plan and provided the opportunity to ask questions and submit oral or written comments.

For the Final EIS, a Notice of Availability will be published in the Federal Register and advertised in local newspapers. The Final EIS will also be made available in public libraries and on the Savannah District website.

13.5 Agency and Public Coordination

Coordination with Federal, State, and local agencies has been extensive during the course of the SHEP nearly 13-year study. Savannah District engaged representatives of the U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, National Park Service, US Geological Survey, National Marine Fisheries Service, US Navy, Georgia Department of Natural Resources, South Carolina Department of Health and Environmental Control, the South Carolina Department of Natural Resources, Georgia Ports Authority, Georgia Department of Transportation, and City of Savannah to aid in evaluating the project alternatives. The public's views were sought through initial scoping meetings, periodic newsletters, and regular coordination with the Stakeholders Evaluation Group, a group that the Georgia Ports Authority formed to provide a forum for interested citizens to meet and discuss the project.

Cultural resources investigations and reconnaissance were coordinated with the Georgia and South Carolina Division of Archives and History, Underwater Archaeology Unit, and with the Georgia and South Carolina State Historic Preservation Officers, pursuant to the Abandoned Shipwreck Act of 1987 and the National Historic Preservation Act of 1966, as amended. The State Historic Preservation Offices (SHPO) have reviewed reports that have been prepared that assess the condition of cultural and historic resources that could be impacted by the proposed project. A Programmatic Agreement has been developed that describes the actions the Corps would take to comply with the National Historic Preservation Act. That Agreement is included as Appendix G of the Final EIS. Savannah District would undertake further coordination with the SHPOs as further investigations are conducted.

The Final EIS contains Savannah District's Consistency Determination with the Georgia Coastal Management Program. The determination was provided to the GA DNR Coastal Resources Division, which administers the Georgia CZM Program, for review and concurrence, in compliance with the Coastal Zone Management Act (CZMA), 16 U.S.C. 1451 et seq., as amended, as part of GA DNR-CRD's review of

the Draft EIS. GA DNR-CRD stated that in general the project complied with GA's Coastal Management Program.

The Final EIS contains Savannah District's Consistency Determination with the South Carolina Coastal Management Program. The determination was provided to the Office of Ocean and Coastal Resource Management of the SC DHEC, which administers the South Carolina CZM Program, for review and concurrence, in compliance with the Coastal Zone Management Act (CZMA), 16 U.S.C. 1451 et seq., as amended, as part of their review of the Draft EIS. SC DHEC initially disagreed with the Corps determination; however, upon the Corps providing additional information, SC DHEC removed their objection to the Corps determination that the project is fully consistent with the enforceable policies of the South Carolina Coastal Management Program.

The Final EIS contains Savannah District's Section 404(b)(1) Evaluation on the selected plan. That evaluation was provided to the GA DNR-EPD and SC DHEC, which administer the Section 401 water quality certification programs in their states under the authority of the Clean Water Act. The water quality certifications from Georgia and South Carolina are included in Appendix Z of the Final EIS.

Most of the entrance channel sediments would be deposited in the Savannah ODMDS. Transport and deposition of sediments into the ODMDS requires approval from Environmental Protection Agency Region 4, who administers the Section 103 ocean disposal program in the southeast under the Marine Protection, Research, and Sanctuaries Act. EPA previously approved the transport and deposition of maintenance sediments from the entrance channel into the ODMDS. Sediment testing of the new work entrance channel sediments did not identify any contaminants of concern that would preclude use of the ODMDS. Based on both historic sampling results and information obtained for this project, Savannah District believes that the new work sediments would be suitable for deposition in the ODMDS. The District will provide a Section 103 Evaluation to EPA Region 4 for review and approval prior to use of the Savannah ODMDS.

Consultation under Section 7(c) of the Endangered Species Act of 1973, as amended, was performed with the US Department of the Interior, USFWS and the US Department of Commerce, NMFS. The Biological Assessment (BA) addressing these issues is included in Appendix B of the Final EIS. Appendix Z of the Final EIS contains the USFWS concurrence of the Corps' BA. NOAA Fisheries Service prepared a Biological Opinion, which is included in Appendix Z.

The Corps coordinated with the federal and state natural resource agencies as required under the Fish and Wildlife Coordination Act, as amended (16 U.S.C. 661, et seq.). A Draft Coordination Act Report provided by the USFWS was included in the November 2008 Draft EIS. Appendix E of the Final EIS contains the Final Coordination Act Report, as well as the Corps' response to the recommendations included in that report.

13.6 Summary of Comments on November 2010 Draft GRR and Draft EIS

Upon distribution of the Draft EIS (DEIS) and Draft GRR on November 15, 2010, the Savannah District received over 1,100 written letters, e-mails, and dictated responses from Federal and state agencies, environmental groups, civic organizations, and private citizens. The comment letters and the Corps' responses are included as Appendix A to the Final EIS.

The majority of the commenters (684) provided general statements supporting the harbor deepening project. The remainder of the commenters submitted comments related to the environmental impacts, the economic analyses, and engineering studies associated with the proposed project. The comments contained in the letters were generally grouped into three broad categories (despite some overlap) as follows: Environmental (1,247), Economics (356), and Engineering (258). A summary of the comments by subject area including the 684 comments in support of the project is provided below in Figure 13-1.

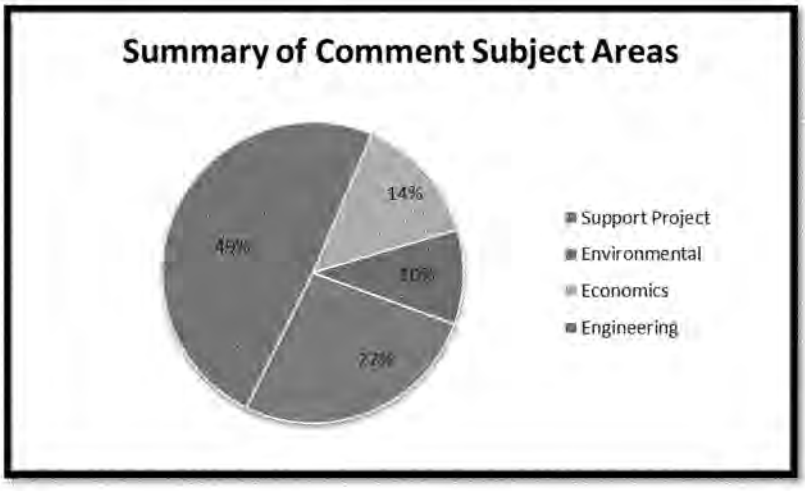


Figure 13-1: Summary of Comment Subject Areas

The majority of the comments were related to the environmental analyses and predicted impacts associated with the proposed project. In general, the environmental comments focused on two major issues: the proposed monitoring and adaptive management plan and the impacts to endangered species, specifically the Shortnose sturgeon. The District received comments from all the Federal Cooperating Agencies (Department of Interior (DOI), Department of Commerce (DOC), and the Environmental Protection Agency (EPA)) regarding the post-construction monitoring

period. Both the DOI and EPA requested that the monitoring period be extended to as much as 10 years. The Federal Cooperating Agencies and the State resource agencies, GA DNR-EPD in particular, requested additional elements be included in the monitoring plan to ensure the actual impacts of the project do not exceed those expected for a particular resource.

Several resource agencies expressed concern that a 5-year monitoring period may be too short to adequately test the performance of the mitigation features. Some of the mitigation features are designed to address impacts that only become evident during low river flows. River flows are entirely dependent upon climate conditions, and it is possible to go through a 5-year monitoring period without experiencing low flows that would test the performance of the mitigation features. The risk of not observing significant low-flow data during a 10-year monitoring period is greatly reduced. Historic records from the Savannah River at the Clyo streamflow gage indicate that 5 years of above-average flows are not uncommon, but even during so-called "wet decades" there have always been a few years of below normal flow.

To address these concerns, the Corps added elements to the monitoring plan and lengthened the monitoring period for some elements to as much as 10 years. Elements added to the plan include determination of the freshwater interface, addition of a wetland monitoring site, expanded monitoring of MCDAs effluent, and additional biological monitoring in the MCDAs. The Corps believes the adaptive management plan, as proposed, would allow for any necessary changes to the project should the environmental impacts exceed what is predicted or mitigation features do not function as intended.

A number of commenters expressed concern about funding assurance for both the construction and operation and maintenance of the proposed mitigation features and any adaptive management features. To address their concerns, the State of Georgia has indicated that it would place its share of the adaptive management funding in an escrow account so funds would be available if/when needed. The District intends to obtain its share of the adaptive management costs at the same time as the funds for the dredging work are obtained. By obtaining the funds as the construction progresses, they would be available to make adjustments to the project's mitigation if/when needed. In this way, all the funds identified in the final project documents for adaptive management would be obtained by the time the dredging is complete. With regard to operation and maintenance of the mitigation features, the Corps' highest budget priority is given to funding requests for operation of mitigation features.

In addition to the monitoring plan, a large number of comments, particularly from the DOC, were concerned with the proposed mitigation for impacts to Shortnose sturgeon habitat. A mitigation feature proposed in the DEIS to compensate for adverse impacts to Shortnose sturgeon habitat was construction and operation of a horseshoe rock ramp fish bypass around the New Savannah Bluff Lock and Dam near Augusta, Georgia. In their comments, the DOC indicated that the proposed design was inadequate because the percentage of river flow passing through the structure (5%) did not provide

adequate assurance that Shortnose sturgeon could find or use the structure. Based on these comments, the Corps held a fish passage workshop and invited representatives from the Federal and State natural resource agencies, fishway engineers, and academic experts to review the design. As a result of the input provided at the workshop and a follow-up site visit arranged by NMFS, the Corps revised the rock ramp design to accommodate 100% of the river flow a majority of the spring spawning season, while not increasing flooding upstream and maintaining an acceptable pool level.

Both the GA DNR-CRD and the City of Tybee Island submitted comments regarding the proposed beneficial use of dredged materials, i.e. nearshore placement of new work sediments from the entrance channel. GA DNR-CRD's initial finding was that the SHEP is generally consistent with the enforceable provisions of the Georgia Coastal Management Program. However, certain changes were requested regarding the dredged sediment placement plan, viz., the State expressed concern about the proposed deposition in the nearshore sites and the two offshore [fish enhancement] sites. In light of GA DNR-CRD and the City of Tybee Island's concerns about the quality of the sediments, the Corps revised the dredged sediment placement plan and now intends to deposit all sediments from the entrance channel in either the Ocean Dredged Material Disposal Site or approved upland confined sediment placement sites. Consequently, proposed dredged sediment placement areas: Site MLW 200, Site MLW 500, ERDC Nearshore, Site 2, Site 2 Extension, and Sites 3, 4, 5, 6, 11, and 12, were deleted from the proposed action, and the Corps would not deposit new work sediments in those locations as part of the Savannah Harbor Expansion Project.

The City of Savannah submitted comments concerning the potential impacts of increased chlorides to their water supply intake on Abercorn Creek. As a result of their comments, the Corps, Georgia Ports Authority, and the City of Savannah closely coordinated to perform additional impact analyses. The analyses indicated that during drought conditions and high tide, the increased chloride concentrations would cause an increase in lead corrosion and disinfection byproducts, both of which are regulated by the EPA, at the City's municipal and industrial plant. Based on the outcome of the updated studies, the Corps has added a raw water storage impoundment to mitigate for these expected impacts.

A number of comments were also submitted concerning to the engineering and design of the channel, in particular the Ocean Bar Channel (entrance channel) and channel extension. Respondents were concerned that the channel design presented in the Draft documents was not adequate to allow safe transit of the larger ships expected to call after the harbor is deepened. The preliminary channel design was determined using the Corps of Engineers' design standards and procedures outlined in EM-1110-2-1613, Hydraulic Design of Deep Draft Navigation Projects. In accordance with ER-1110-2-1403, final channel dimensions and navigation requirements were developed using the Corps state-of-the-art ship simulator with input from the Savannah Harbor Pilots Association (SHPA).

The use of ship simulators to establish final design parameters for deep draft navigation channels is the standard practice worldwide and ensures that channels are safe and economical and result in minimal environmental impact and long term maintenance requirements. The use of ship simulators also provides the Savannah Harbor Pilots that work the channel on a daily basis with the opportunity to provide input into the design and ensure the navigability and safety of the channel. The ship simulation study verified that the channel could be deepened and widened at three bends to maintain two-way traffic capability for the design vessel and a smaller vessel. Two meeting areas are also included to provide for meeting of two design vessels.

Currently, the Savannah Harbor Pilots safely bring in vessels with a minimum of 4 feet of underkeel clearance. The Corps expects this practice to continue with the deepened channel. The vertical motion study, which included the channel extension out to a maximum of Station -98+600B, showed that the pilots can safely navigate the design vessel through the deepened Ocean Bar Channel at a ship speed of 14 knots or less. Documentation for both the ship simulation and vertical motion studies can be found in Engineering Appendix Supplemental Materials.

With respect to economics, most respondents commented or asked questions about how deepening the harbor is economically justified if the cargo volume growth rate remains the same in both the with- and without- project conditions. As indicated by the commodity forecast discussed in Section 5 of the GRR, under both the without- and with-project conditions, the District expects the Garden City Terminal to reach its build-out capacity near 2030 when the total number of TEUs processed reaches 6.5 million. The Corps anticipates that without deepening, more vessels would be required to transport a given volume of cargo, when compared to the with-project condition in which vessels could load more completely (thereby requiring fewer vessels).

No increase in cargo is expected to occur as a result of the proposed harbor deepening. As a result, the number of containers that transit the areas that surround the port would not change as a result of a deeper harbor. The project's economic benefits accrue from the use of larger, more cost-effective container ships, not an increase in the number of containers moving through the port. These transportation cost savings are predicted to result in an average net benefit of over $170 million annually to the Nation.

14 Selected Plan

The current Savannah Harbor Expansion Project authorization in Section 101(b)(9) of the Water Resources Development Act of 1999 authorized a deep-draft navigation project up to a depth of -48 feet subject to further evaluation and concurrence by the Secretaries of the Army, Commerce and Interior, and the Administrator of the Environmental Protection Agency (EPA). Given the unique authorization of this project, any final recommendation of a preferred plan must meet the requirements of

the legislation. Therefore, the final General Reevaluation Report (GRR) considered depths alternatives between -42 and -48 feet (impacts/benefits).

The Selected Plan is the NED plan of -47 feet because it maximizes net benefits at an average annual equivalent of $174 million (FY 2012 price levels and discount rate of 4.00%). The Selected Plan complies with Army policy, the Water Resources Development Act of 1999 authorization, and is supported by the non-Federal cost share sponsor.

The Selected Plan includes navigation improvements to the existing Savannah Harbor Navigation Project and mitigation that extends into the upper harbor beyond the extent of the navigation improvements. Several features of the existing Navigation Project would continue and would not be affected by the present improvements.

The navigation components of the Selected Plan consist of:

- 47-foot deepening alternative, which includes channel bend wideners, oceanward extension of the entrance channel, and expansion of the Kings Island Turning Basin;
- Long Island Meeting Area at 47-feet; and
- Oglethorpe Meeting Area at 47-feet.

The Plan includes an extensive natural resource mitigation plan, which is described in Section 14.2.

The Selected Plan costs and benefits were updated in December 2011 to reflect FY 2012 price levels and the FY 2012 Federal discount rate of 4.00% for Corps projects (Economic Guidance Memorandum 12-01). The benefit update includes incorporation of the most recent vessel operating costs (Economic Guidance Memorandum 11-05).

The FY 2012 Project First Cost is $652,000,000 (Table 14-1). The Selected Plan FY 2012 annual average equivalent cost (including annual maintenance) is $39,000,000. The Selected Plan FY 2012 average annual equivalent benefits are $213,000,000, which result in average annual equivalent net benefits of $174,000,000 and a benefit-to-cost ratio of 5.5. The project was authorized in Section 101(b)(9) of WRDA 1999 to be carried out at a total cost of $230,174,000. When escalated to October 2011 price levels in accordance with the procedure set out in ER 1105-2-100, Appendix G, implementing Section 902 of WRDA 1986, the authorized total project cost amounts to $469,000,000. The current estimated Project First Cost of $652,000,000 exceeds that amount by more than 20 percent, necessitating a statutory modification to the project to increase its authorized total cost.

Table 14-1: Selected Plan (47-Foot Deepening) Economic Highlights

Description	Total Cost
FY11 (At Oct 2010 Levels)	
M-CACES Cost Estimate	$604,000,000
M-CACES w/o Nav Aids & Non-Fed Berth Dredging	$596,000,000
PED Sunk Costs	$ 41,000,000
Project First Cost	$636,000,000
FY12 (At Oct 2011 Levels)	
Project First Cost	$652,000,000
Project First Cost with Other Associated Costs	$660,000,000
Interest During Construction	$ 49,000,000
Total Project Investment Cost	$709,000,000
Average Annual Cost	$ 34,000,000
Annual O&M Cost	$ 5,000,000
Total Average Annual Cost	$ 39,000,000
Average Annual Benefits	$213,000,000
Average Annual Net Benefits	$174,000,000
BCR (4.0% Discount Rate)	5.5
BCR (7.0% Discount Rate)	3.8
Inflated to Midpoint of Construction	$750,000,000

Other Associated Costs: Navigation Aids & Non-Federal Berth Dredging
Note: Totals may be affected by rounding.

The existing condition and Selected Plan widths by channel ranges (Table 14-2) and existing condition and Selected Plan controlling depths, advance maintenance dredging depths, and total dredging depths by channel ranges (Table 14-3) are presented below.

Table 14-2: Existing and Selected Plan Widths (feet)

Range Name	Station Limits Lower	Station Limits Upper	Existing Project Width	Recommended Project Width
S8	97+680B [A]	60+000B	*Not Applicable*	570
Tybee	60+000B	40+522B	600	570
0A	40+522B	38+186B	800	770
Bloody Point	38+186B	23+475B	600	570
1A	23+475B	20+832B	800	858 [B]
Jones Island	20+832B	16+142B	700	758 [B]
2A	16+142B	13+771B	800	861 [B]
Tybee Knoll Cut	13+771B	1+380B	500	470
4	1+380B	1+552	Varies	Varies
New Channel	1+552	9+526	500	470
6	9+526	11+385	600	600
Long Island Crossing	11+385	24+920	500	470
Long Isl. Meeting Lane[1]	*13+000*	*23+000*	*Not Applicable*	*570*
8	24+920	27+317	800	770
Lower Flats	27+317	31+037	600	661 [B]
10 through 12	31+037	36+948	600 to 700	735 to 835 [C]
Upper Flats	36+948	40+437	550	535
14	40+437	41+693	500 to 700	485 to 685
Bight Channel	41+693	49+489	700	700
Ft. Jackson Channel	49+489	53+127	Varies	Varies [C]
21	53+127	54+481	600	661 [B]
Oglethorpe	54+481	61+405	500	485
Oglethorpe Meeting Lane[2]	*54+080*	*60+700*	*Not Applicable*	*585*
23	61+405	63+277	Varies	Varies
24 through 25	63+277	69+734	500	467
26	69+734	71+128	600	585
City Front Channel	71+128	76+537	500	470
28	76+537	77+283	550	535
Marsh Island Channel	77+283	87+642	500	470
32	87+642	90+701	Varies	Varies
33 through 35	90+701	93+933	500	470
34	93+933	95+378	500	446
35	95+378	97+543	500	434
Kings Is. Turning Basin	97+543	103+000	Varies	Varies [B]
Whitehall Channel	103+000	105+500	400	400
Port Wentworth Channel	105+500	112+500	200	200

Notes:
[1] Includes 1,000-foot transition, [2] Includes 500-foot transition
[A] Existing project starts at 60+000B, recommended project requires 38,600 linear feet of channel extension to 97+6800B
[B] Width expansion on north side of channel only
[C] Width expansion on south side of channel only

Table 14-3: Existing and Selected Plan Depths (feet below MLLW)

Station Limits		Existing Project Depths			Selected Project Depths		
Lower	Upper	Auth. Depth	Adv. Maint	Total Depth	Auth. Depth	Adv. Maint	Total Depth
-97+680B	-60+000B	*	*	*	49	0	49
-60+000B	-14+000B	44	0	44	49	0	49
-14+000B	+24+000	42	2	44	47	2	49
+24+000	+35+000	42	4	46	47	4	51
+35+000	+37-000	42	6	48	47	6	53
+37-000	+70+000	42	4	46	47	4	51
+70+000	+102+000	42	2	44	47	2	49
+102+000	+103+000	42	0	42	47	0	47
Kings Island Turning Basin		42	8	50	47	8	55
+103+000	+105+500	36	2	38	36	2	38
+105+500	+112+500	30	2	32	30	2	32

*Stations -98+600B to -60+000B are not currently part of the Savannah Harbor Navigation Project.
Up to an additional 2-feet of volume is paid as Allowable Overdepth.

14.1 Environmental Effects

Chapter 8: Alternative Plan Evaluation: Environmental Impacts describes the project environmental impacts of the alternative plans and describes the methods used to assess those impacts. The expected environmental effects of the Selected Plan (with mitigation features) are shown in Table 14-4. A discussion of the mitigation plan and mitigation planning effort follows.

Table 14-4: Environmental Effects of the Selected Plan

Resource or Resource Element	Mitigated Impact
Salinity	Moves farther up the estuary
Freshwater Wetlands Conversion	-223 acres
Brackish Marsh Conversion	+964 acres
Salt Marsh Conversion	-740 acres
Brackish Marsh Loss	15.68 acres
Dissolved Oxygen	Minor incidental improvement
Fisheries	Change in Acceptable Habitat
- Striped bass spawning	- 14 %
- Striped bass eggs	- 11 %
- Striped bass larvae	- 5 %
- American shad (Jan)	0 %
- American shad (May)	0 %
- American shad (Aug)	0 %
- Shortnose sturgeon adult (January)	- 7 %
- Shortnose sturgeon adult (August)	+ 6 %
- Shortnose sturgeon juvenile (January)	- 8 %
- Southern flounder	+57 %
Chlorides in Abercorn Creek	Periodic increases
Chlorides at City's M&I Water Treatment Plant	No significant effects
Drinking Water Aquifer	No discernible impacts
Hurricane Surge	Minor, max increase of 0.8 feet
Beach Erosion	Minor; within accuracy of evaluation
Bank Erosion Due to Ship Traffic	No measurable addition to ongoing erosion
Shoaling	Minimal upstream shift
Velocity	Theoretical reduction, but not measurable

14.2 Mitigation Details

The natural resource mitigation plan consists of the following components:

- Constructing and operating flow re-routing features in and near the Savannah National Wildlife Refuge to reduce salinity impacts to tidal freshwater and brackish wetlands;
- Acquiring bottomland hardwoods/freshwater wetlands (223 acres) to compensate for salinity increases to tidal freshwater wetlands. The acquired lands would become part of the Savannah National Wildlife Refuge and be managed by the USFWS;
- Restoring marsh at former Disposal Area 1S;

- Constructing and operating an oxygen injection system to remove the incremental effects of this harbor deepening project;
- Constructing and operating a fish bypass channel at the New Savannah Bluff Lock and Dam to compensate for impacts to Shortnose sturgeon habitats;
- Funding an existing Striped bass stocking program to compensate for adverse impacts to Striped bass spawning and nursery habitats within the estuary;
- Constructing a raw water impoundment to supply the City of Savannah water treatment plant intake with water during periods of high chloride concentration; and
- Implementing adaptive management features if post-construction monitoring shows them to be needed. Those features consist of removing the Tidegate sill, enlarging the diversion structure at the mouth of McCoys Cut, a diversion structure at the junction of Middle and Back Rivers, and acquisition of up to another 10 percent of freshwater wetland acreage to compensate for wetland impacts. Implementation of any or all of these features may not be needed, but the project would include funding sufficient to implement all of them. Which of these features would be implemented would depend on the findings of the monitoring.

Other mitigation features include:

- Construction of a recreational boat ramp on Hutchinson Island, and
- Removal and curation of the CSS *Georgia*.

Corps guidance (ER 1105-2-100, Appendix C) states: "Monitoring is appropriate for all mitigation actions to insure that those actions have achieved the objective. The level of monitoring should be consistent with the magnitude of the project and the degree of risk and uncertainty with the probable success of the mitigation." Section 2039 of WRDA 2007 states that post-construction monitoring "shall continue until such time as the Secretary determines that the criteria for ecosystem restoration success will be met." It goes on to say that "For a period of 10 years from completion of construction of a project (or a component of a project) for ecosystem restoration, the Secretary shall consider the cost of carrying out the monitoring as a project cost. If the monitoring plan under subsection (b) requires monitoring beyond the 10-year period, the cost of monitoring shall be a non-Federal responsibility." As a result, post-construction monitoring of up to 10 years can be considered a cost-shared project cost.

Monitoring would be conducted to ensure that (1) the impacts described in the EIS are not exceeded, and (2) the mitigation plans described in this document function as intended. The following list provides an overview of the monitoring that would be performed:

- Multi-phase monitoring program (Pre-Construction, During Construction, and Post-Construction).
- Post-Construction monitoring includes the following:
    - Continuous data recorders
    - Intensive biological monitoring
    - Model assessments
    - Bathymetry surveys
    - Freshwater interface determination
    - Chloride monitoring
    - Groundwater monitoring
    - Monitor 12 marsh sites
    - Monitoring of marsh restoration site
    - Shortnose sturgeon-harbor monitoring
    - Shortnose sturgeon-New Savannah Bluff Lock and Dam monitoring
    - Fish distribution monitoring along marshes
    - Impact assessment review
    - Bird use of confined disposal facilities monitoring
    - Monitoring of dredged material containment area effluents (dewatering)
    - Avian field counts
    - Terrestrial field counts
    - Vegetation sampling
    - Vegetation removal
    - Bird tissue analysis
    - Sampling exposed Miocene layer for Cadmium
    - Striped bass habitat monitoring
    - Oversight and Reporting.

The Post-Construction Monitoring activities would be performed for different durations, some extending up to 10 years. Some Post-Construction Monitoring activities would be performed if initial monitoring indicates they are warranted.

14.2.1 Mitigation Costs

Table 14-5 presents the estimated costs of mitigation for the Selected NED Plan in FY 2012 price levels. The State of Georgia has indicated that it would place its share of the Adaptive Management costs in an escrow account so they would be available if/when needed. The Savannah District intends to obtain its share of the Adaptive Management costs at the same time as the funds for the dredging work are obtained. By obtaining the funds as the construction progresses, they would be available to make adjustments to the project's mitigation if/when needed. In this way, all the funds identified in the final project documents for Adaptive Management would be obtained by the time the dredging is complete.

Table 14-5: Selected NED Plan Mitigation Costs

Mitigation Plan Element	Total Cost
Real Estate	$ 18,445,625
Dissolved Oxygen	$ 70,803,750
CSS Georgia	$ 13,914,375
McCoys Cut Modifications	$ 13,437,024
Rifle Cut Modifications	$ 828,914
Tidegate & Embankment	$ 21,545,225
Sediment Basin Modifications	$ 29,392,561
Fish Passage	$ 29,577,470
Boat Ramp	$ 624,953
Salt Marsh Restoration	$ 17,594,949
Striped Bass	$ 3,300,000
Monitoring and Adaptive Mgt	$ 60,195,000
Chlorides	$ 25,187,500
Total	$ 304,847,345

14.3 Plan Construction

The initial construction will be to raise dikes to have adequate capacity for dredged material disposal quantities. Construction of Dissolved Oxygen systems, raw water storage impoundment, and removal of the CSS *Georgia* will be concurrent with raising of the dikes.

The Ocean Bar Channel contract was assumed to begin November 2013 and disposal will be in the ODMDS. The Ocean Bar is assumed to be constructed with both hopper dredges and/or hydraulic cutterhead pipeline dredges. Either pipeline (filling dump scows and tug hauled) and/or the hopper dredges would place material in the ODMDS.

For the Outer Ocean Bar, cutterhead pipeline dredges (filling dump scows and tug hauled to the ODMDS for disposal) would not be restricted to work only during the winter dredging season. Hopper dredges would be allowed to work during the months of December 15 thru March 31.

The Inner Harbor contractor was assumed to place dredged material into existing confined disposal areas 13, 14A, 14B and Jones Oyster Island. The Inner Harbor contractor would be required to avoid upstream of Station 63+000 during the period April 1 – May 15 to avoid impacts to Striped bass fishery resources. Dredging the Inner Harbor between June 1 and September 30 may also be impacted if dissolved oxygen levels fall below 4 to 5 ppm.

Several areas to be dredged within the Inner Harbor contain cadmium-laden sediments. Material from these areas would be placed in disposal areas 14A and/or 14B. These sediments will then be covered with non-cadmium dredged materials. Construction sequence will be important to dredge cadmium-laden sediments first and then cover with non-cadmium dredged sediments.

There will be limited debris removal in both contracts made necessary because of sinkers and other miscellaneous debris which may have accumulated since the last deepening.

Disposal of 12 to 15 million cubic yards of material from the Inner Harbor, Stations +4+000 to +103+000 would be into existing Confined Disposal Facilities labeled 13A, 14A, 14B, and Jones/Oysterbed Island.

Disposal of 11 to 13 million cubic yards of material from the Outer Harbor Bar Stations +4+000 to -97+680B would be into the existing EPA-approved ODMDS.

The Fish Passage at the New Savannah Bluff lock and dam will be constructed by excavating around the end of the dam and placement of rock ramp rip rap and weir stone. The contract time period was assumed to be 700 calendar days. There will be no downstream in-water construction during the months of February through May.

Rip rap features for the Diversion Structure at McCoy's Cut; Closure of lower Arm at McCoy's Cut; Rifle Cut closure; and the stone weir at Sediment Basin broad berm were assumed to be constructed by loading rip rap onto material barges from docks and hauled by tug to the individual sites. Rip rap will be dumped and/or placed using barge mounted cranes with rock boxes or buckets. The contract time period assumed for these contracts are listed below:

- Diversion Structure at McCoy's Cut (includes 140 LF sheetpile) – 150 calendar days;
- Western Lower Arm at McCoy's Cut – 150 calendar days;
- Rifle Cut closure (Rip rap + Fill) – 150 calendar days; and
- Broad Berm – 420 calendar days.

Deepening excavation for McCoy's Cut, Middle and Little Back River channels was assumed to be by barge mounted clamshell/shovels loading material into hopper barges. Hopper barges will then be tugged to the existing confined disposal sites and unloaded or pumped out into the disposal areas. The contract time period assumed for this contract is 510 calendar days.

Suitable fill material for Rifle Cut closure was assumed to come from within existing confined dredge disposal areas. The material to be suitable must be mostly sand. Material would be excavated from the existing disposal areas and loaded into hopper barges for transport. Hopper barges would be transported by tug and then unloaded/pumped out at the construction fill site.

Removal of Tidegate Abutments and Piers – It was assumed the 15 concrete piers, walkways, and abutments will be broken down by blasting/mechanical methods. Concrete pieces would be loaded by barge mounted cranes onto material barges and/or land for stockpiling and removal from the site. Removal of earthen abutments/embankments, existing rip rap, stacked gates, conduit hardware, lighting, handrails and utilities are also required. The contract time period was assumed to be 365 calendar days.

Tidegate embankments (approximately 1,000,000 cubic yards) are to be excavated to widen the river. Suitable embankment (sandy) material may be excavated by barge mounted equipment and placed into the nearby Broad Berm fill. One half of material (525,000 cubic yards) was assumed to be placed onto flat or confined hopper barges and then unloaded by dumping or pump-out into the Broad Berm. Turbidity limits cannot be exceeded when performing this work. The remaining unsuitable material from embankments was assumed to be pumped or dredged into the existing confined disposal facilities. The contract time period was assumed to be 540 calendar days.

Broad Berm fill material, 1,200,000 cubic yards, was assumed to come from either/or Tidegate embankment removal or existing confined dredge disposal areas. It was assumed suitable material in the disposal areas would be excavated from the existing disposal areas and loaded into hopper barges for transport. Hopper barges would be transported by tug and then unloaded/pumped out at the construction fill site areas. Small portable pipeline cutterhead dredges may also be used in the disposal areas or at the Tidegate location to pump suitable material into the fill area.

Marsh Restoration at Area 1S (Onslow Island) – Areas designated to be restored must be cleared and grubbed. It was assumed that an entrance channel will be excavated from Middle River into the island area using barge mounted crane clamshell/shovels and material loaded into hopper barges. Hopper barges will be towed to the existing confined disposal areas and unloaded/pumped out. The entrance channel excavation will continue into the interior of the island and remove approximately 425,000 cubic yards of material with disposal into the existing DMCAs. Land equipment will then backfill the excavated area and grade to elevation +7.6 MLLW. Suitable material may

be used to fill Broad Berm near existing sedimentation basin. The contract time period was assumed to be 540 calendar days.

A new public access boat ramp will be constructed on the North side of Hutchinson Island (at the site where the Tidegate embankment abutment is removed). The public access Boat Ramp includes a two-lane concrete boat ramp with floating dock, 20 space trailer parking, handicap-accessible and single car parking spaces. The contract time period was assumed to be 365 calendar days.

The oxygen injection systems will be land based at two locations to supply oxygen for three injection sites, with water being withdrawn from the river, super-saturated with oxygen, and returned to the river. The sites will require development of access roads, concrete platform for work areas and to support Speece cones, intake/discharge piping systems, electrical service, perimeter fencing and 11 to 13 Speece cones per site. The contract time period was assumed to be 365 calendar days for each location.

A raw water storage impoundment will be constructed of earthen embankment with HDPE liner, mechanical mixing system, four pump stations rated at 21 MGD each, and a powered activated carbon treatment system will be included in the construction. The contract time period was assumed to be 365 calendar days.

Overall, the average dredging production (18,000 to 21,000 cy/day) and unit costs appear reasonable when compared to historical information for production and pricing (adjusted to October 2010). Contingencies for construction were estimated at 25% for this level of design and detail to represent unanticipated conditions or uncertainties not known at the time the estimate was developed. This includes uncertainties relating to multiple year mobilization/de-mobilization, fuel price fluctuations, competitive bid environment situations, and representative contingency to carry forward during construction.

Construction of the Selected Plan would commence as soon as all the approvals are obtained and funds are obtained to begin construction. Pre-construction monitoring may commence in Fiscal Year 2012 during the Pre-Engineering and Design phase. If sufficient funds are made available to construct the project in an efficient manner, the deeper channel could be operational in October 2016. Post-construction monitoring and adaptive management, including monitoring of adaptive actions which may be necessary, would be conducted through Fiscal Year 2029. Figure 14-1 presents the project's preliminary construction schedule.

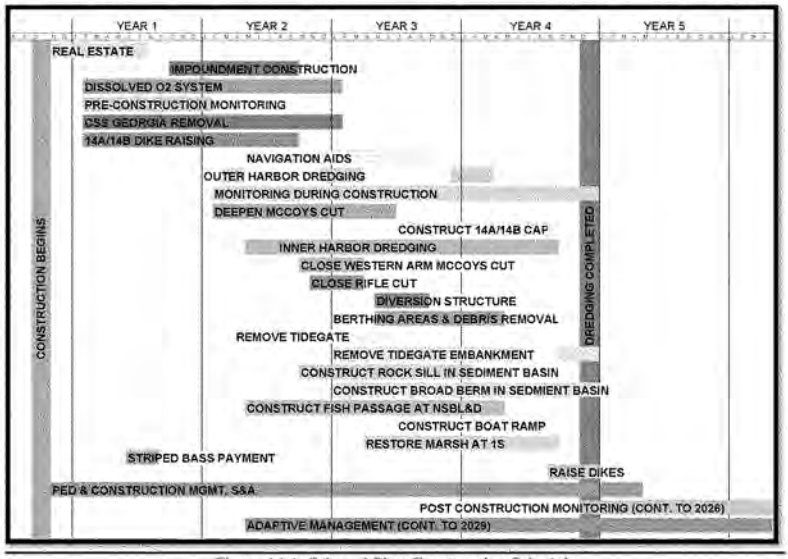


Figure 14-1: Selected Plan Construction Schedule

14.4 Operation and Maintenance

Currently, Savannah District annually receives approximately $13 million for O&M dredging and maintenance of the upland disposal areas. This does not include funds for dike raising, dike maintenance, and mosquito control. With these funds, the center two quadrants of the Federal channel are kept clear. However, under current and without-project conditions, with the Sediment Basin operational, if the entire channel prism were to be maintained the cost would be $22,204,230 (Oct 2007 price levels), an increase of approximately $9.2 million (59%) over the present O&M funding. This information is based on a Sedimentation Analysis done on the Savannah Harbor Expansion Project in June 2007. As a part of the Selected Plan, Sediment Basin modifications will result in the sediment currently being captured in the Sediment Basin (~1,932,000 cubic yards) being deposited in the navigation channel mainly in the range from Stations 24+000 to 70+000. This will result in an increase of O&M dredging and maintenance costs attributable to the project of $2,730,0300 in FY 2012 price levels. A total of $50,300 (FY12) in additional O&M dredging maintenance is attributed to the Bar Channel. Overall, an increase of $2,780,600 (FY12) is expected in dredging maintenance costs attributable to the Selected Plan to maintain the existing level of service (clearing the center two quadrants of the channel).

The annual operating costs for the on-site oxygen generation systems are $1,236,800 (FY12). The costs for operating the oxygen injection systems are based on their continued operation for a period of 180 days per year. Operational costs are projected to be uniform throughout that 180-day period. Adjustments should be made to those operating costs if the systems would be operated for shorter or longer durations. Variations in dissolved oxygen discharges could be made to respond to changes in the harbor's dissolved oxygen regime. Such changes could be identified through operational hydrodynamic/water quality modeling. Also included in the annual O&M costs are the replacement costs for the Speece Cone and intake and discharge lines at 40-year intervals; and replacement of the oxygen flow control, oxygen generator and side stream pump at 20-year intervals.

Additional operations and maintenance costs in FY 2012 price levels include:

- Maintenance dredging at McCoys Cut on a 10-year cycle at an average annual cost of $116,500;
- Annual debris removal at the New Savannah Bluff Lock & Dam fish passage at an average annual cost of $51,100;
- Annual maintenance of CSS *Georgia* artifacts at an annual cost of $20,400;
- Long-term monitoring to ensure performance of mitigation features at an average annual cost of $437,700.

14.4.1 Advance Maintenance

The increase in inner harbor shoaling due to the closing of the sediment basin will change operations and maintenance dredging requirements. With the increase in shoaling, dredges used for maintenance will have to be in the 24- to 30-inch size cutterhead as opposed to the 18-inch cutterhead currently in use. This increase in cutterhead size will alleviate the need for additional advance maintenance in the areas experiencing increased shoaling due to closing of the sediment basin. Therefore, assuming that the existing level of service is maintained, the current inner harbor advance maintenance program is adequate to provide the authorized inner harbor depth.

15 Plan Implementation Requirements

This chapter defines implementation responsibilities necessary to insure that the Selected Plan's goals and objectives are achieved. Included are discussions of the division of plan responsibilities between Federal and non-Federal interests, institutional requirements, cost sharing and analysis of non-Federal sponsor's financial capability.

15.1 Section 902 Cost Limitation

In August 1998, the GPA submitted the final Savannah Harbor Expansion Feasibility Study Report and Final Tier I EIS to the Assistant Secretary of the Army (Civil Works). Based on these documents, Congress conditionally authorized the SHEP to deepen the harbor by as much as six feet in Section 101(b)(9) of Public Law 106-53, the Water Resources Development Act(WRDA) of 1999. The authorization depends upon (1) completion of an EIS that evaluates depth alternatives from 42 through 48 feet; (2) approval of the selected plan by the Secretaries of Interior, Commerce, Army, and the Administrator of the Environmental Protection Agency and agreement that the mitigation plan adequately addresses the potential environmental impacts of the project; and (3) implementation of mitigation steps before or concurrent with construction of the project.

In accordance with Public Law 99-662, WRDA 86, Section 204(b) the Corps and GPA executed a Memorandum of Agreement (MOA) in April 2000. This MOA allowed the GPA to fund the Corps for technical support in the preparation of the GRR and EIS, with GPA taking the lead. Included in the Section 204(b) MOA was a provision that there was no promise for credit or reimbursement of GPA's cost for preparation of the GRR/EIS should the project be constructed. In July 2001, a Memorandum of Understanding (MOU) was executed between the Department of the Army, GPA, the EPA, Department of Commerce and the Department of the interior which designated the Corps as the lead Federal agency in preparing the EIS, the other three agencies as "Federal Cooperating Agencies," and the GPA as a "State Cooperating Agency" with specialized expertise in shipping. This agreement essentially removed the GPA as the project lead, but with the Section 204(b) agreement, they were still responsible for the bulk of the costs of technical support. Since 2001, Congressionally-appropriated

Federal funding has been used to prepare governmental decisions and reviews. There are no local cooperation agreements for the SHEP construction phase at this time. However, the Georgia Department of Transportation (GDOT) and the GPA entered into a November 15, 2007 Memorandum of Agreement specifying how any SHEP non-Federal funding would be addressed between these organizations. In addition, the GDOT provided a letter of intent to be the non-Federal cost share sponsor, dated July 18, 2010.

The selected channel deepening alternative of -47 feet is in the same location shown in the 1998 Feasibility Report, with subsequent design refinements including a channel extension from the existing -42 foot project terminus at Station -60+000B to Station -97+680B to ensure the channel meets deep water. The deepening would generally occur on the existing channel footprint. The SHEP incorporates approximately 40 miles of channel improvements consisting of:

- Maintaining existing side slopes and bottom width no less than 450 feet;
- Improving the bend wideners identified in the Ship Simulation Study;
- Constructing the Oglethorpe and Long Island meeting lanes;
- Continuing the existing advance maintenance features;
- Constructing and/or relocating Aids to Navigation as required;
- Deepening Container Berths 4 through 7 at the GPA facility; and
- Incrementally increase dredged material disposal area capacity.

The SHEP project has received Federal funds allocation through FY2012 as shown in Table 15-1:

Table 15-1: SHEP Federal Funding Allocation

Fiscal Year	Construction	Investigation	Total
FY 2000	$0	$163,000	$163,000
FY 2001	$0	$177,000	$177,000
FY 2002	$0	$540,000	$540,000
FY 2003	$0	$648,000	$648,000
FY 2004	$483,000	$534,000	$1,017,000
FY 2005	$0	$883,000	$883,000
FY 2006	$0	$880,000	$880,000
FY 2007	$0	$1,194,000	$1,194,000
FY 2008	$0	$796,000	$796,000
FY 2009	$1,970,000*	$400,000	$2,370,000
FY 2010	$3,299,000*	$0	$3,299,000
FY 2011	$2,994,000	$0	$2,994,000
FY 2012	$588,000	$0	$588,000
Total	$9,334,000	$6,215,000	$15,548,000

*Includes American Recovery and Reinvestment Act Construction Funds

GPA-funded efforts since project authorization would be eligible for crediting under existing policy as the result of special legislation contained in Public Law 108-7, Division D: Energy and Water Development Appropriations Resolutions, 2003 – Title I: Department of Defense – Civil, Section 119. That section states that the Secretary of the Army, acting through the Chief of Engineers, is authorized to credit toward the non-Federal share of the cost of the Savannah Harbor Expansion Project, authorized by section 101(b)(9) of the Water Resources Development Act of 1999, an amount equal to the Federal share of the costs incurred by the non-Federal interests subsequent to project authorization to the extent that the Secretary determines that such costs were necessary to ensure compliance with the conditions of the project authorization. Based on an evaluation of the invoices provided by GPA, Savannah District concluded that $23,441,730 of GPA's expenditures through June 2011 can be creditable as project costs.

The project was authorized in Section 101(b)(9) of WRDA 1999 to be carried out at a total cost of $230,174,000, substantially in accordance with a Chief of Engineer's Report to be completed no later than December 31, 1999. The Chief's Report was signed on October 21, 1999. When escalated to October 2011 price levels in accordance with the procedure set out in ER 1105-2-100, Appendix G, implementing Section 902 of WRDA 1986, the authorized total project cost amounts to $469 million. The current estimated first cost of $652 million exceeds that amount by more than 20 percent, necessitating a statutory modification to the project to increase its authorized total cost as shown in the enclosed Section 902 Limit worksheets (Tables G-1 through G-4).

The following tables (Tables 15-2 through 15-5) and narrative discuss the changes in project costs and benefits since receipt of the WRDA 1999 authorization. Supplemental Tables G-1 through G-4 (from ER 1105-2-100 Appendix G) present the cost increase computations.

Table 15-2: SHEP Project Costs History

WBS	Feature	Authorized Costs WRDA 1999 (-48 ft)	Authorized Project Costs Updated to FY11 Price Levels	Selected NED FY11 Plan Costs (-47 ft)	Last Presented WRDA 2010 (FY 11)
01	Real Estate				
	12 - RE Nav.	$960,000	$1,809,000	$160,000	$3,631,000
	06 - RE Fish & Wildlife	$1,225,000	$2,308,000	$18,446,000	$12,698,000
06	Fish & Wildlife	$79,612,000	$149,990,000	$212,316,000	$189,833,000
12	Nav, Ports & Harbors	$114,686,000	$216,068,000	$253,754,000	$271,938,000
18	Cultural Resources	$14,348,000	$27,032,000	$13,914,000	$13,914,000
30	Planning & Engr Design	$8,400,000	$15,826,000	$27,258,000	$11,068,000
31	Const Management	3,844,000	$7,242,000	$73,824,000*	$11,068,000
12	Aids to Navigation	$811,000	$1,528,000	$5,025,000	$5,025,000
	Interest During Construction	$6,287,000	$11,845,000	$48,682,000	$51,494,000
	Total**	$230,174,000	$433,648,000	$653,379,000	$570,669,000
	FY 2012 Project First Cost***	NA	NA	$651,857,000	NA

*Includes $60,195,000 in Mitigation Monitoring and Adaptive Management;
**Includes the Associated Costs of Non-Federal Berth Dredging and Aids to Navigation
***Includes PED Sunk Cost but not the Associated Costs of Non-Federal Berth Dredging and Aids to Navigation or Interest During Construction

Dredging: The 1998 Feasibility Report cost included $114.7M for a dredging to the 48-foot depth. Since project authorization, considerable engineering analysis has been conducted. Dredging costs have increased to account for the handling of new work materials containing naturally enriched cadmium, a seaward extension of the entrance channel, the addition of two meeting areas and the compliance with additional environmental requirements. The Selected Plan cost estimate includes $257.3M for dredging to the 47-foot depth.

Mitigation Real Estate: Since project authorization, considerable environmental analyses have been conducted, such as chloride, aquifer, hydrodynamic, and dissolved oxygen modeling, to more clearly identify all environmental impacts while coordinating with the other cooperating Federal agencies. Mitigation plan costs have increased to mitigate for the impacts these additional analyses have identified. Principal among those, modeling has showed the project impacts would include the loss of freshwater tidal marsh. A total of 0.6% of Authorized Project Costs are for real estate required for mitigation while 2.8% of Current Project Costs are for real estate required for mitigation (separable real estate costs were not identified in the $46M

chloride mitigation water line relocation estimate provided by the City of Savannah and used by the Georgia Ports Authority in the 1998 Feasibility Report). For the purposes of this cost comparison, real estate costs could not be identified in the 1998 Feasibility Report, so they are assumed to be zero in that report. Real estate costs have increased from $400 per acre in the Corps' initial estimates to approximately $7,800 per acre at this time, including administration and contingency.

Construction Management: Since project authorization, construction management costs have increased to incorporate more intensive contract management required to meet increased environmental requirements, quality assurance and better assure the avoidance of claims from $3.8M to $13.6M. In addition, a $60.2M Mitigation Monitoring and Adaptive Management feature cost has been added under this Work Breakdown Structure, Code of Accounts.

Aids To Navigation: Since project authorization, considerable analysis of the needs of channel users has been conducted. The Aids to Navigation costs have increased from $0.8M to $5.0M to incorporate a seaward extension of the entrance channel and two meeting areas.

The following is a comparison of features between the authorized plan and the Selected Plan beyond the level of detail shown in the above table:

Chlorides: The 1998 Feasibility Report cost included $46M for a water intake line relocation as mitigation for impacts to the City of Savannah's Abercorn Creek Municipal and Industrial water intake. The Selected Plan now includes a $25.2M raw water storage impoundment as mitigation for this impact.

Endangered Species: The 1998 Feasibility Report included a habitat improvement feature which was to be constructed in the lower harbor as mitigation for impacts to the endangered Shortnose sturgeon. The Selected Plan now includes a $29.6M fish passage as mitigation for these impacts. The 1998 Feasibility Report does not show the cost for this individual feature so a cost comparison is not possible.

Dissolved Oxygen: The 1998 Feasibility Report cost included a $24M Oxygen injection system as mitigation for impacts to Dissolved Oxygen. The Selected Plan now includes a $70.8M Oxygen injection system as mitigation for these impacts.

Wetland Impacts: The 1998 Feasibility Report cost included the acquisition of 3,000 acres of mostly freshwater wetland for incorporation into the Savannah National Wildlife Refuge and the restoration of 85 acres of marsh as mitigation for wetland impacts. The Selected Plan now includes the acquisition of 2245 acres of mostly freshwater marsh for incorporation into the Savannah National Wildlife Refuge and restoration of 40 acres of marsh as mitigation for these impacts. The 1998 Feasibility Report does not show the costs for these individual features so a cost comparison is not possible.

Flow Re-Routing: The 1998 Feasibility Report included flow re-routing measures as mitigation for salinity impacts. The Selected Plan now includes different flow re-routing measures for $56.8M as mitigation for these impacts. The 1998 Feasibility Report does not show the costs for these individual features so a cost comparison is not possible.

Striped Bass: The 1998 Feasibility Report did not include any mitigation for impacts to the Striped bass. The selected Plan now includes providing $3.3M to the Georgia Department of Natural Resources for these impacts.

Recreational Boating: The 1998 Feasibility Report did not include any mitigation for impacts to recreational boating. The selected Plan now includes $0.6M for the construction of a boat ramp for these impacts.

Old Fort Jackson Shoreline Protection: The 1998 Feasibility Report cost included bank protection to protect Old Fort Jackson, a War of 1812 and Civil War era fort. However, since that time bank protection was constructed to protect the fort and this work is no longer necessary. The 1998 Feasibility Report does not show the costs for this individual feature so a cost comparison is not possible.

Monitoring And Adaptive Management: The 1998 Feasibility Report did not include a Monitoring and Adaptive Management component. The Selected Plan now includes a $60.2M Monitoring and Adaptive Management plan.

Contingency: The 1998 Feasibility Report contingencies varied by expense and averaged 16%. The Selected Plan now includes a contingency of 25% across all project costs.

The Selected 47-foot NED Plan construction costs were provided to Congress on June 30, 2010 in response to a Senate request for an updated authorized total project cost for consideration in WRDA 2010. Those costs differ from the final costs included in this document as they were draft and were refined during the review process.

Table 15-3: SHEP Project Average Annual Costs and Benefits History

	Annual Costs	Annual Benefits	Net Annual Benefits (FY12)
Authorized (August 1999)	$17,582,000	$52,742,000	$35,160,000
Last Reported WRDA Fact Sheet (30 June 2010)	$32,790,000	$148,732,000	$115,942,000
Selected - 47-foot NED Plan (FY12)	$38,897,000	$213,144,000	$174,227,000

Benefits for the project's 1999 authorization documents were calculated for three categories using the FY 1999 Federal discount rate of 7.125 percent.

Vessel Operation Costs: Vessel operating costs were developed for each draft category with benefits accruing through the operation of larger more efficient vessels

Tide Delay Costs: Costs were determined for constrained vessels subject to tidal delays and considered how long they would be delayed and in-port operating costs impacts under both the with and without project conditions.

Ship Beam/Channel Width Delay Costs: Benefits were accrued through a model that estimated situations where two or more vessels would not have sufficient clearance to meet or pass in some sections of the channel.

Since project authorization, additional economic analysis has been conducted. Benefits were calculated using three different methods and using the FY 2012 Federal discount rate of 4.00 percent;

Transportation Cost Savings: Channel deepening reduces transportation cost by allowing a more efficient future fleet mix. As the Savannah Harbor channel is deepened, the reliability of the channel depth increases. The increased reliability is expected to encourage carriers to assign more of their large vessels to Savannah route

services. These benefits were calculated using the Transportation Cost Savings Model.

Meeting Area and Tide Delay Benefits: Meeting area and tide delay benefits were determined based on the reduction in transit time required to navigate Savannah Harbor as a result of channel modifications, which reduce congestion within the harbor. These benefits included those attributed to reduced delays to accommodate Liquid Natural Gas vessel movements. These benefits were calculated using the HarborSym model.

The BCR at the time of authorization was 3:1 and calculated using the FY 1999 federal discount rate of 7.125 percent. BCR for the Selected -47-foot NED Plan is 5.5 calculated using the FY 2012 federal discount rate of 4.00 percent.

Table 15-4: SHEP Project Cost Comparison (1999 Authorized Plan and Selected Plan)

Feature	Authorized	Authorized %	Selected 47-Foot Plan	Selected 47-Foot Plan %
Real Estate				
RE Nav. Ports & Harbors	$960,000	0.4%	$160,000	0.03%
RE Fish & Wildlife	$1,225,000	0.5%	$18,445,625	3%
Fish & Wildlife	**$79,612,000	34.6%	*$272,511,000	45%
Nav, Ports & Harbors	$114,686,000	49.8%	$253,754,000	42%
Cultural Resources	$14,348,000	6.2%	$13,914,000	2.3%
Planning & Engr Design	$8,400,000	3.6%	$27,258,000	4.5%
Const Management	3,844,000	1.7%	*$13,629,000	2.25%
Aids to Navigation	$811,000	0.4%	$5,025,000	0.8%

*For purposes of this comparison, $60,195,000 in Mitigation Monitoring and Adaptive Management is included under Fish & Wildlife and not Construction Management costs.

** Separable real estate costs were not identified in the $46,000,000 chloride mitigation water line relocation estimate provided by the City of Savannah and used by the Georgia Ports Authority in the 1998 Feasibility Report. That level of detail was not included in that report. For the purposes of this cost comparison, real estate costs are assumed to be zero for the 1998 Feasibility Report cost. Real Estate costs for chloride mitigation are included in the Selected Plan.

The total cost of the project was expected to be $230.2 million, of which approximately 41 percent was for mitigation-related features, including cultural resources. The amount identified to be spent on mitigation has grown from 1999 to 2010, but the relationship of those costs to the total project cost has not changed substantially. When viewed from the total project perspective, the percentage allocated for mitigation has not risen substantially more than any other type of project cost and the mitigation plan proposed in this report addresses most of the same natural resources. Mitigation for impacts to two additional resources are included in the 2010 plan (Striped Bass and Recreational Boaters), and mitigation for one resource was

reduced in cost (water quality at City of Savannah's Abercorn Creek Water Intake). Extensive additional interagency collaboration that has occurred since 1999 has resulted in greater definition and agreement on the extent of the environmental impacts and the specific measures proposed to address those impacts.

Table 15-5: SHEP Project Cost Sharing Comparison
(1999 Authorized Plan and Selected NED Plan)

	1999 Authorization		Selected Plan	
Item	**Federal**	**Non-Federal**	**Federal**	**Non-Federal**
General Navigation Features	$86,800,000	$39,600,000	$442,366,000	$195,103,000
LERR	$100,000	$2,100,000	$0	$163,000
Aids to Navigation	$810,000	$0	$5,148,000	$0
Dredge non-Federal Berths	$0	$450,000	$0	$2,647,000
Historic Preservation Mitigation & Data Recovery	$11,000,000	$3,400,000	$11,276,000	$2,948,000
Additional Funding Requirements (10% of GNF)		$17,000,000	-$65,169,000	$65,169,000
Totals	$98,800,000	$63,000,000	$393,621,000	$266,030,000

Table G-1 (ER 1105-2-100 Appendix G)								
CWCCIS Index(s)								
			Index	Yearly Inflat Rate	Cumul Inflat Rate	Cumul rate to Begin FY	One Half rate of Infl FY	Tot Allow Inflat for FY
Item	(b)	(c)	(d)	(e)	(f)	(h)	(i)	(j)
Date of Price Level		FY 98						
Authorized Estimate		227,989	455.42		1			
First Fiscal year		FY 99		0.066268		1	1.033134	1.033134
1st Qtr, 2nd yr	FY 00		485.6		1.066268			
Second Fiscal year		FY 00		0.054757		1.066268	1.027379	1.095461
1st Qtr, 3rd yr	FY 01		512.19		1.124654			
Third Fiscal year		37165		-0.03958		1.124654	0.980212	1.1024
1st Qtr, 4th yr	FY 02		491.92		1.080146			
Fourth Fiscal year		FY 02		0.068588		1.080146	1.034294	1.117189
1st Qtr, 5th yr	FY 03		525.66		1.154231			
Fifth Fiscal year		FY 03		0.021991		1.154231	1.010996	1.166923
1st Qtr, 6th yr	FY 04		537.22		1.179614			
Sixth Fiscal year		FY 04		0.103328		1.179614	1.051664	1.240558
1st Qtr, 7th yr	FY 05		592.73		1.301502			
Seventh Fiscal year		FY 05		0.095828		1.301502	1.047914	1.363862
1st Qtr, 8th yr	FY 06		649.53		1.426222			
Eighth Fiscal year		FY 06		0.066309		1.426222	1.033155	1.473508
1st Qtr, 9th yr	FY 07		692.6		1.520794			
Nineth Fiscal year		FY 07		0.066503		1.520794	1.033252	1.571363
1st Qtr, 10th yr	FY 08		738.66		1.621931			
Tenth Fiscal year		FY 08		-0.06161		1.621931	0.969194	1.571967
1st Qtr, 11th yr	FY 09		693.15		1.522002			
Eleventh Fiscal year		FY 09		0.060088		1.522002	1.030044	1.567729
1st Qtr, 12th yr	FY 10		734.8		1.613456			
Twelfth Fiscal year		FY 10		0.000517		1.613456	1.000259	1.613873
1st Qtr, 13th yr	FY 11		735.18		1.61429			
Thirteenth Fiscal year		FY 11		0.123589		1.61429	1.061794	1.714044
1st Qtr, 14th yr	FY 12		826.04		1.813798			

Table G-2 (ER 1105-2-100 Appendix G)								
CPI Index(s)								
			Index	Yearly Inflat Rate	Cumul Inflat Rate	Cumul rate to Begin FY	One Half rate of Infl FY	Allow Inflat for FY
Item	(b)	(c)	(d)	(e)	(f)	(h)	(i)	(j)
Date of Price Level		10/1/1998						
Authorized Estimate		2,185	161.000		1			
First Fiscal year		FY 99		0.02236		1	1.01118	1.01118
1st Qtr, 2nd yr	FY 00		164.600		1.02236			
Second Fiscal year		FY 00		0.02916		1.02236	1.01458	1.03727
1st Qtr, 3rd yr	FY 01		169.400		1.05217			
Third Fiscal year		FY 01		0.03896		1.05217	1.01948	1.07267
1st Qtr, 4th yr	FY 02		176.000		1.09317			
Fourth Fiscal year		FY 02		0.03295		1.09317	1.01648	1.11118
1st Qtr, 5th yr	FY 03		181.800		1.12919			
Fifth Fiscal year		FY 03		0.022		1.12919	1.011	1.14161
1st Qtr, 6th yr	FY 04		185.800		1.15404			
Sixth Fiscal year		FY 04		0.02045		1.15404	1.01023	1.16584
1st Qtr, 7th yr	FY 05		189.600		1.17764			
Seventh Fiscal year		FY 05		0.0269		1.17764	1.01345	1.19348
1st Qtr, 8th yr	FY 06		194.700		1.20932			
Eighth Fiscal year		FY 06		0.05085		1.20932	1.02542	1.24006
1st Qtr, 9th yr	FY 07		204.600		1.27081			
Nineth Fiscal year		FY 07		0.04212		1.27081	1.02106	1.29757
1st Qtr, 10th yr	FY 08		213.217		1.32433			
Tenth Fiscal year		FY 08		0.03781		1.32433	1.01891	1.34937
1st Qtr, 11th yr	FY 09		221.279		1.3744			
Eleventh Fiscal year		FY 09		0.01224		1.3744	1.00612	1.38281
1st Qtr, 12th yr	FY 10		223.987		1.39122			
Twelfth Fiscal year		FY 10		0.14137		1.39122	1.07068	1.48956
1st Qtr, 13th yr	FY 11		255.651		1.58789			
Thirteenth Fiscal year		FY 11		-1		1.58789	0.5	0.79395
1st Qtr, 14th yr	FY 12		0.000		0			

Table G-3 (ER 1105-2-100 Appendix G)									
Authorized Cost Increase Computation									
FY	Current Project Cost			Current Sched (%)		Authorized Cost Sch		th Cost Inflat	
	Total	Constr	R.E.	Constr	R.E.	Constr	R.E.	Constr	R.E.
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
FY 00	$163.00	$163.00	$0	0.027	0.00	$62.05	$0.00	$74.59	$0.00
FY 01	$177.00	$177.00	$0	0.030	0.00	$67.38	$0.00	$81.51	$0.00
FY 02	$540.00	$540.00	$0	0.090	0.00	$205.57	$0.00	$252.00	$0.00
FY 03	$648.00	$648.00	$0	0.108	0.00	$246.68	$0.00	$315.86	$0.00
FY 04	$1,017.01	$1,017.01	$0	0.170	0.00	$387.16	$0.00	$527.02	$0.00
FY 05	$882.50	$882.50	$0	0.147	0.00	$335.96	$0.00	$502.77	$0.00
FY 06	$880.00	$880.00	$0	0.147	0.00	$335.00	$0.00	$541.65	$0.00
FY 07	$1,194.00	$1,194.00	$0	0.199	0.00	$454.54	$0.00	$783.72	$0.00
FY 08	$796.00	$796.00	$0	0.133	0.00	$303.03	$0.00	$522.68	$0.00
FY 09	$2,370.00	$2,370.00	$0	0.396	0.00	$902.23	$0.00	$1,552.03	$0.00
FY 10	$3,379.00	$3,379.00	$0	0.564	0.00	$1,286.34	$0.00	$2,075.99	$0.00
FY 11	$2,993.00	$2,993.00	$0	0.500	0.00	$1,139.39	$0	$1,952.97	$0.00
Balance to complet	$602,860	$583,849	$19,011	97.489	100.00	$222,263	$2,185	$403,141	$0
Total	$617,900	$598,889	$19,011	100.00	100.00	$227,989	$2,185	$411,867	$0

Table G-4 (ER 1105-2-100 Appendix G)			
MAXIMUM COST INCLUDING INFLATION THROUGH CONSTRUCTION			
FY 12		Thousands Dollars (000's)	
Line 1			
a.	Current Project estimate at current price levels:		$617,900
b.	Current project estimate, inflated through construction:		$703,087
c.	Ratio: Line 1b / line 1a		1.1379
d.	Authorized cost at current price levels:		$411,867
	(Column (h) plus (i) from table G-3)		
e.	Authorized cost, inflated through construction:		$468,649
	(Line c x Line d)		
Line 2	Cost of modifications required by law:		$0
Line 3	20 percent of authorized cost:		$46,035
	.20 x (table G-3, columns (f) + (g))		
Line 4	Maximum cost limited by section 902:		$514,684
	Line 1e + line 2 + line 3		

15.2 Cost Sharing

The costs for the Selected NED Plan will be shared in accordance with Section 101 of the WRDA 1986 and cost shared as a General Navigation Feature. The Recommended Plan requires a blended cost sharing structure as there are two cost sharing depth increments involved. Channel depths from -21 feet to -45 MLLW feet are cost shared 25 percent non-Federal and 75 percent Federal. Any depth greater than -45 feet MLLW is cost shared 50 percent non-Federal and 50 percent Federal. An additional 10 percent of the total costs of General Navigation Features, which includes dredged material disposal construction costs, will be repaid by the non-Federal sponsor over a period not to exceed 30-years. Sponsor costs for lands, easements, right-of-ways, and relocations, except utilities, are credited against the 10% cash contribution. For the purposes of allocating the cost by depth consistent with Planning Guidance Letter 62, the following costs are assigned to each depth zone in the same proportion that dredging costs are assigned to each zone (61% for depth alternatives of -45 feet MLLW and less; 39% for depth alternatives greater than -45 feet MLLW):

- Mobilization and Demobilization costs;
- Preconstruction Engineering and Design; and
- Supervision and Administration.

The costs listed above are not creditable against the additional 10% cash over 30 years.

The non-Federal sponsor will provide all Lands, Easements, Right-of-ways, and Relocations (LERR). The LERR for construction, operation, maintenance, and rehabilitation to mitigate damages to fish and wildlife will be cost shared to the same extent as General Navigation Features. Cost sharing for the Selected NED Plan is presented in Table 15-6. Explanatory notes are provided in Table 15-7. Costs are presented in FY 2012 price levels.

Table 15-6: Savannah Harbor Expansion Cost Allocation for the Selected NED 47-Foot Plan (FY12 Price Levels)

				COST SHARE ALLOCATION FOR 47-FOOT ALTERNATIVE			
			Total Costs	Federal Costs	Fed %	Non-Federal Costs	Non-Fed %
1	**Basic Project (w/o Mitigation)**						
A	**Construction - Navigation Only**						
	1.a.1	Dredged Material 42 to 45 = 13,860,800 cy	$124,547,788 (61%)	$93,410,841	75%	$31,136,947	25%
	1.a.2	Dredged Material 45 to 47 = 8,861,219 cy	$79,623,486 (39%)	$39,811,743	50%	$39,811,743	50%
	1.a.3	Dredging Mobilization (42 to 45)	$18,514,124.19 (61%)	$13,885,593	75%	$4,628,531	25%
	1.a.4	Dredging Mobilizattion (45 to 47)	$11,836,092.25 (39%)	$5,918,046	50%	$5,918,046	50%
	1.a.5	Disposal Area Capacity (42 to 45)	$15,086,947	$11,315,210	75%	$3,771,737	25%
	1.a.6	Disposal Area Capacity (45 to 47)	$5,548,463	$2,774,232	50%	$2,774,232	50%
	1.a.7	Debris Removal - 1/	$2,161,653	$1,621,239	75%	$540,413	25%
B	**SUBTOTAL: 47-Foot Alternative**		$257,318,552	$168,736,904		$8,581,648	
	1.b.1	Incremental Subtotal (42 to 45)	$160,310,511				
	1.b.2	Incremental Subtotal (42 to 47)	$97,008,041				

			COST SHARE ALLOCATION FOR 47-FOOT ALTERNATIVE			
			Federal Costs	Fed %	Non-Federal Costs	Non-Fed %
2	**Fish and Wildlife Mitigation**					
2a	Construction (42 to 45)	$206,527,461	$154,895,595	75%	$51,631,865	25%
2.b	Construction (45 to 47)	$9,857,524	$4,928,762	50%	$4,928,762	50%
2.c	Monitoring & Adapt Mgt (42 to 45)	$61,026,008	$45,769,506	75%	$15,256,502	25%
2.d	Monitoring & Adapt Mgt (45 to 47)	$383,843	$191,922	50%	$191,922	50%
2.e	Mitigation Properties (42 to 45)	$15,703,915	$11,777,937	75%	$3,925,979	25%
2.f	Mitigation Properties (45 to 47)	$3,113,978	$1,556,989	50%	$1,556,989	50%
2.g	Utility Relocation	$0	$0		$0	
2.h	CSS Georgia Preservation (1% of Fed GNF)	$14,224,278	$2,431,500	100%	$0	0%
2.i	CSS Georgia Preservation Remainder of $14,224,278	$11,792,778	$8,844,584	75%	$2,948,195	25%
2.j	**SUBTOTAL: 47-Foot Alternative**	$310,837,007	$230,924,344		$79,912,663	
	2.j.1 Incremental sub-total (42 to 45)	$297,481,662				
	2.j.2Incremental sub-total (45 to 47)	$13,355,345				

			COST SHARE ALLOCATION FOR 47-FOOT ALTERNATIVE			
			Federal Costs	Fed %	Non-Federal Costs	Non-Fed %
3	**Erosion or Shoaling Prevention**					
3.a	Construction -1/					
3.b	LERR		$0.00		$0.00	
3.c	Utility Relocation		$0.00		$0.00	
3.d	SUBTOTAL: 47-Foot Alternative	$0.00	$0.00		$0.00	
4	**Other Costs**					
4.a	PED Sunk Costs	$41,827,459				
4.b	Planning, Engineering, & Design	$27,807,939				
4.c	Construction Supervision & Administration	$13,903,970				
4.d	SUBTOTAL: 47-Foot Alternative	$83,539,368				
	4.d.1 Incremental sub-total (42 to 45)	(61%) $50,959,014	$38,219,261	75%	$12,739,754	25%
	4.d.2Incremental sub-total (45 to 47)	(39%) $32,578,999	$16,289,499	50%	$16,289,499	50%
5	TOTAL GNF for NED 47-Foot Alternative	$651,693,573	$453,642,458		$198,051,115	
6	LERR credited -1/	$163,229		0%	$163,229	100%
7	**PROJECT FIRST COST**	**$651,856,802**	**$453,642,458**	**69.59%**	**$198,214,344**	**30.41%**
8	Other Associated Costs					
8.a	Berthing Areas (42 to 45)	$2,460,083	$0	0%	$2,460,083	100%
8.b	Berthing Areas (45 to 47)	$186,727	$0	0%	$186,727	100%
8.c	Navigation Aids	$5,148,011	$5,148,011	100%	$0	0%
8.d	Sponsor's 10% of GNF Payback over 30 years	$65,169,357	-$65,169,357		$65,169,357	
8.e	Utility Relocation	$0	$0		$0	
9		$659,651,622	$393,621,112	59.67%	$266,030,510	40.33%

Note: Table assumes the non-Federal sponsor will be credited $23,000,000 of the sunk costs for providing funds during PED.

Table 15-7: Cost Sharing Explanations	
Explanatory Notes	
1/'All are required for the new work REGARDLESS OF THE NED alternative selected and will not vary by depth. Therefore all costs will be shared at the rate for the first depth alternative (i.e. 44 foot) that they would be incurred or 75% Federal/25% non-Federal	
2/Historic Preservation costs are shared as follows: 100% Federal up to 1% of the Federal General Navigation Feature costs. Any remaining balance will require a HQUSACE waiver for cost sharing. The CSS Georgia would need to be removed for any depth alternative. Therefore, the NED alternative rate of 50% Federal/50% Non-Federal is not applicable to the cost share amount. The rate for the first depth alternative that the CSS Georgia must be removed is the 44-foot alternative. Therefore, the cost share of 75% Federal/25% non-Federal has been used for the amount exceeding 1% of the Federal GNF Costs of the Selected Plan.	
Historic Preservation cost allocation (total amount)	$14,224,278
1% of Federal GNF is 100% Federal cost	$2,431,500
Balance to cost share	$11,792,778
The Federal interest extends only to GNF (General Navigation Features): primary access channels, anchorages, turning basins, locks and dams, harbor areas, jetties and breakwaters	
Non-Federal sponsor may plan, design and construct navigation projects and be reimbursed with the Federal share. NOTE: Use of this authority requires advance approval and close coordination with HQUSACE	
Per Section 203 of WRDA 1986, for authorized projects, the Secretary shall credit toward the non-Federal share of the cost of construction of such project an amount equal to the portion of the cost of developing such study	
Non-Federal sponsors must:	
Provide, at their expense, all ancillary shore side harbor facilities such as docks, terminal and transfer facilities, berthing areas, and local access channels	
Provide all Lands Easements Right of way Relocations and Disposal for construction and maintenance	
For providing depths from 20 feet to 45 feet below mllw, the Non-Federal sponsor pays 25% of the GNF	
For providing depths beyond 45 feet below mllw, the Non-Federal sponsor pays 50% of the GNF	
Provide cash contributions toward the costs for construction of the GNF of the project, which includes the costs of constructing land-based and aquatic dredged material disposal facilities, paid during construction	
Hold and save the U.S. free from damages due to the construction, operation and maintenance dredging	
Contribute 50% of the incremental costs for maintenance dredging associated with project depths in excess of 45 feet	
For all depths, provide an additional cash contribution equal to 10% of GNF, which includes dredged material disposal construction costs. These costs may be paid over a period not exceeding 30 years	
The sponsor's costs for LERR, except utilities, are credited against the additional cash contribution	

15.3 Financial Analysis of Non-Federal Sponsor's Capabilities

A financial analysis is required for any plan being considered for USACE implementation that involves non-Federal cost sharing. The purpose of the financial analysis is to ensure that the non-Federal sponsor understands the financial commitment involved and has reasonable plans for meeting that commitment. The financial analysis includes the non-Federal sponsor's statement of financial capability, the non-Federal sponsor's financing plan, and an assessment of the sponsor's financial capability.

A self-certification of financial capability signed by the Chief Financial Officer of the non-Federal Sponsor is required. The Self-Certification documentation is provided as an attachment to this report.

15.4 Land Requirements

Land requirements for the NED -47-foot alternative plan include: (1) acquiring channel improvement/sloughing easements over approximately 6.6 acres of land necessary for the deepening phase of the project for channel wideners; (2) the execution of a Special Use Permit between the non-Federal Project Sponsor and the US Fish and Wildlife Service (USFWS) covering approximately 48 acres of land required for the construction of mitigations features proposed within the boundaries of the Savannah National Wildlife Refuge; (3) acquiring freshwater wetlands in fee simple (which would be deeded to the Savannah National Wildlife Refuge) whose value equals the land needed to expand the Kings Island Turning Basin within the Savannah National Wildlife Refuge; (4) acquiring approximately 2,245 acres of land in fee simple necessary for mitigation purposes to offset impacts to wetlands; (5) acquiring two additional properties, one 5.5 acres and one 3 acres, which will be acquired in fee simple by the non-Federal Project Sponsor for the construction of Dissolved Oxygen Injection Systems; (6) acquiring approximately 7 acres in fee simple for the construction of the fish bypass channel along with the acquisition of a perpetual road easement over approximately 6 acres for access to the proposed channel to be constructed on Federally and privately owned lands located at the New Savannah Bluff Lock and Dam in North Augusta, Aiken County, South Carolina and; (7) acquiring approximately 35 acres of land in fee simple for the construction of a raw water storage impoundment to mitigate for chloride impacts on the City of Savannah's municipal and industrial water intake on Abercorn Creek. The wetland mitigation lands and lands equal in value to lands at the Kings Island Turning Basin will be acquired in fee simple by the non-Federal Project Sponsor and deeded to the USFWS to become part of the Savannah National Wildlife Refuge. The Dissolved Oxygen facilities will be constructed and maintained by the Corps. The chloride mitigation lands will be acquired in fee simple by the non-Federal Project Sponsor and deeded to the City of Savannah after construction for operation and maintenance by the City.

15.5 Non-Federal Sponsor's Responsibilities

The non-Federal sponsor would be responsible for the following actions:

a. Provide, during the period of construction, a cash contribution equal to the following percentages of the total cost of construction of the general navigation features:

i. Twenty-five percent of the costs attributable to dredging to a depth in excess of 20 feet, but not in excess of 45 feet; plus

ii. Fifty percent of the costs attributable to dredging to a depth in excess of 45 feet;

b. Provide 50 percent of the excess cost of operation and maintenance of the project over that cost which the Federal Government determines would be incurred for operation and maintenance for depths deeper than 45 feet;

c. Pay with interest, over a period not to exceed 30 years following completion of the period of construction of the project, up to an additional 10 percent of the total cost of construction of general navigation features. The value of LERRs, with the exception of utility relocations, provided by the Sponsor for the general navigation features, described below, may be credited toward this required payment. The owner of a utility requiring relocation as part of an improvement deeper than 45 feet below MLW must fund 50% of the cost;

If the amount of credit equals or exceeds 10 percent of the total cost of construction of the general navigation features, the Sponsor shall not be required to make any contribution under this paragraph, nor shall it be entitled to any refund for the value of LERRs and deep-draft utility relocations in excess of 10 percent of the total cost of construction of the general navigation features;

d. Provide all LERRs and perform or ensure the performance of all relocations and deep-draft utility relocations determined by the Federal Government to be necessary for the construction, operation, maintenance, repair, replacement, and rehabilitation of the general navigation features (including all lands, easements, and rights of way, relocations, and deep-draft utility relocations necessary for the dredged material disposal facilities);

e. Provide, operate, maintain, repair, replace, and rehabilitate, at its own expense, the local service facilities in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government;

f. Accomplish all removals determined necessary by the Federal Government other than those removals specifically assigned to the Federal Government;

g. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the Sponsor owns or controls for access to the project for the purpose of operating, maintaining, repairing, replacing, and rehabilitating the general navigation features;

h. Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, replacement, and rehabilitation of the project, any betterments, and the local service facilities, except for damages due to the fault or negligence of the United States or its contractors;

i. Keep, and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents, and other evidence is required, to the extent and in such detail as will properly reflect total cost of construction of the general navigation features, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and local governments at 32 CFR, Section 33.20;

j. Perform, or cause to be performed, any investigations for hazardous substances as are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601-9675, that may exist in, on, or under lands, easements, or rights of way that the Federal Government determines to be necessary for construction, operation, maintenance, repair, replacement, or rehabilitation of the general navigation features. However, for lands that the Government determines to be subject to the navigation servitude, only the Government shall perform such investigation unless the Federal Government provides the Sponsor with prior specific written direction, in which case, the Sponsor shall perform such investigations in accordance with such written direction;

k. Assume complete financial responsibility, as between the Federal Government and the Sponsor, for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights of way that the Federal Government determines to be necessary for the construction, operation, maintenance, repair, replacement, and rehabilitation of the project;

l. To the maximum extent practicable, perform its obligations in a manner that will not cause liability to arise under CERCLA;

m. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the Sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element;

n. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987, and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights of way, required for construction, operation, maintenance, repair, replacement, and rehabilitation of the general navigation features, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act;

o. Comply with all applicable Federal and State laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army." The State is also required to comply with all applicable Federal labor standards requirements including, but not limited to, the Davis-Bacon Act (40 USC 3144 *et seq.*), the Contract Work Hours and Safety Standards Act (40 USC 3701 *et seq.*), and the Copeland Anti-Kickback Act (40 USC 3145 *et seq.*);

p. Provide the non-Federal share that portion of the costs of mitigation and data recovery activities associated with historic preservation, that are in excess of 1 percent of the total amount authorized to be appropriated for the project, in accordance with the cost sharing provisions of the agreement;

q. Prevent obstructions of or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) which might reduce the ecosystem restoration, hinder its operation and maintenance, or interfere with its proper function, such as any new development on project lands or the addition of facilities which would degrade the benefits of the project; and

r. Do not use Federal funds to meet the Sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is authorized.

16 Conclusions

Savannah District conducted its evaluation of the Savannah Harbor Expansion Project with the collaboration of the Cooperating Agencies, which consisted of EPA Region IV, the USFWS Southeast Region, the NOAA Fisheries Service Southeast Region, and the Georgia Ports Authority. The District also sought and incorporated the views of other Federal and State agencies, the public, and the Stakeholders Evaluation Group on the scientific investigations and analyses to be conducted, the evaluation of the alternative depths and mitigation features, and the plan to be implemented.

Savannah Harbor is currently the second largest container port on the US east coast (by TEU volume) and the fourth largest container port in the Nation. However, it also currently has the shallowest controlling depth for a major container port.

The present 42-foot deep channel was designed to accommodate container ships with a maximum TEU capacity of 4,024 TEUs. At that time, the design vessel was the largest size containership that could pass through the Panama Canal.

The largest vessels presently calling at the Port are rated at more than 8,100 TEUs and are too wide and deep to pass through the Panama Canal. GPA and the State of Georgia have made major investments in landside infrastructure to accommodate increasingly larger vessels and burgeoning trade growth at the Port and the region it serves. Additional improvements are planned and funded.

The primary navigation problems identified relate to the inefficient operation of container ships resulting from insufficient channel depth. Operating costs for container ships calling at Savannah are increased because vessels must light load to navigate the 42-foot channel. Deeper-drafting vessels can use tides to provide additional water depth, but they must wait for the higher tides to occur, incurring additional operating costs from the time delays. Light loading and tidal delays will increase in the future as present harbor users increase their annual tonnage and as larger, more efficient ships replace older, smaller ones. These inefficiencies affect the cost of the Nation's international trade.

Several management measures were identified to address the navigation-related problems. These included operational (i.e., non-structural) measures, locally implemented structural measures, structural measures implemented at other ports, and structural modification of the existing 42-foot navigation channel. Management measures carried into detailed planning included channel deepening, turning basin expansion, bend widening, and meeting area construction. The alternative plans evaluated in detail included the No Action alternative (42-foot depth) and five channel deepening alternatives: 44-, 45-, 46-, 47-, and 48-foot channel depth.

Under without-project conditions, the ongoing expansion of the Elba Island LNG facility is expected to increase LNG vessel traffic by as much as 80%. Planned infrastructure improvements at the Garden City Terminal are expected to increase the TEU throughput capacity to 6.5 million TEUs before 2020. The number of TEUs transported through the port is expected to continue to grow. Vessel traffic at the Garden City Terminal is expected to approximately double by 2024.

The Corps evaluated a wide variety of potential project issues including salinity, dissolved oxygen, loss of wetlands, conversion of one marsh type to another, beach erosion, shoreline erosion, fisheries, benthos, endangered species, cultural and historic resources, sediment quality, groundwater, drinking water, hurricane surge, tidal amplitude, economics, air quality, environmental justice, noise, and cumulative impacts. State-of-the-art computer models were used to determine the level of effect that could be expected from implementation of the alternatives. The same models were used to evaluate ways to reduce those effects and develop mitigation plans. The project alternatives include features to avoid impacts, reduce impacts, and then replace of compensate for impacts that couldn't be avoided or reduced.

Project impacts would generally increase with the depth alternative considered (42, 43, 44, 45, 46, 47 to 48-foot depths). Similarly, the project benefits would also increase as the channel depth increases. Those benefits would consist of transportation cost savings produced when larger Post-Panamax vessels operate more efficiently and experience fewer tidal delays. Increases in the number of containers moving through the Port are expected in the future. However, no changes in that growth are expected to occur as a result of deepening the harbor. That expected growth of cargo would occur with or without a deepening project. The 47-foot depth alternative is identified as the National Economic Development (NED) Plan because it maximizes the net economic benefits that would be produced for the nation. The 47-foot depth alternative has a benefit-to-cost ratio of 5.5. The total project investment cost is estimated to be $709 million, which would save the Nation more than $213 million each year in transportations cost for waterborne commerce. The project would produce annual net benefits of $174 million. The annual cost to operate and maintain the Savannah Harbor Navigation Project would increase by $5.1 million.

Direct adverse impacts from the 47-foot depth alternative would occur to the following resources: 16 acres of brackish marsh, chloride levels at the City of Savannah's water intake, Striped Bass habitat, and Shortnose sturgeon habitat. Indirect impacts would occur to the following resources: conversion of 223 acres of tidal freshwater marsh to brackish marsh; and conversion of 740 acres of saltmarsh to brackish marsh.

With the mitigation, the following would occur: (1) Restoration of 40 acres of brackish marsh at Disposal Area 1S; (2) Minor increase in dissolved oxygen levels throughout the estuary; (3) No adverse effects to the City of Savannah's municipal and industrial water intake on Abercorn Creek; (4) Restoration of access for Shortnose sturgeon and other anadromous fish species to historic spawning areas at the Augusta Shoals through a fish bypass at the New Savannah Bluff Lock and Dam; (5) Increase in the number of Striped bass fingerlings stocked in the estuary; (6) Conversion of 223 acres of tidal freshwater marsh to brackish marsh; (7) Conversion of 740 acres of saltmarsh to brackish marsh; (8) Conversion of 964 acres of tidal freshwater marsh and saltmarsh to brackish marsh; (9) Recovery and preservation of the remains of the CSS *Georgia*; and (10) Construction of a public boat ramp on Hutchinson Island.

After consideration of the environmental impacts, the economic benefits, the views of the public, and the views of the Federal Cooperating Agencies, the 47-foot depth alternative is the Selected Plan because it is economically justified, it maximizes the net economic benefits to the Nation, it is environmentally sustainable, and in the best interest of the Nation.

The improvement to the existing deep-draft navigation project at Savannah Harbor (Savannah Harbor Navigation Project), which was authorized by Section 101(b)(9) of the Water Resources Development Act of 1999 should be implemented to deepen the existing 42-foot project to a 47-foot depth, with such modifications as in the discretion of the Secretary may be deemed advisable.

17 District Engineer's Recommendation

After considering the information provided in this document about the analyses that the Corps of Engineers conducted in collaboration with its partners to evaluate the proposed deepening of Savannah Harbor, after considering the comments that the public and natural resource agencies provided after their review of the draft reports, after considering that the non-Federal sponsor shall, prior to implementation, agree to perform the required items of cooperation, and after considering the views of the Cooperating Agencies, I recommend approval and implementation of the Selected Plan described in Section 14, with such modifications thereof as in the discretion of the Commander, HQUSACE, may be advisable.

The Selected Plan has a total project first cost of $652 million with an estimated Federal share of $454 million and an estimated non-Federal share of $198 million (prior to the sponsor's 10% payback of General Navigation Feature costs), a benefit to cost ratio of 5.5 to 1, and would save the Nation more than $213 million each year in transportation costs.

The Selected Plan is the 47-foot depth alternative with navigational improvements including channel deepening, constructing two meeting areas and three channel bend wideners, enlarging one turning basin, deepening berths, constructing advance maintenance features, and increasing capacities in dredged material containment areas. Mitigation for environmental impacts associated with the project include an oxygen injection system, various flow re-routing measures, a boat ramp, a fish bypass at the New Savannah Bluff Lock and Dam, funding a Striped bass restocking program, restoring brackish marsh, removing and curating the CSS *Georgia*, constructing a raw water storage impoundment, and monitoring and adaptive management. HQUSACE issued a policy review memorandum on 21 October 2011 recommending implementation of the mitigation plan, including those features not consistent with normal Corps policy, as outlined in the reports. On 28 November 2011, ASA(CW) issued a memorandum concurring with the HQUSACE recommendation. The Selected Plan is economically justified, environmentally sustainable, and in the best interest of the Nation.

The project was authorized in Section 101(b)(9) of WRDA 1999 to be carried out at a total cost of $230,174,000. When escalated to October 2011 price levels in accordance with the procedure set out in ER 1105-2-100, Appendix G, implementing Section 902 of WRDA 1986, the authorized total project cost amounts to $469 million. The current estimated first cost of $652 million exceeds that amount by more than 20 percent, necessitating a statutory modification to the project to increase its authorized total cost.

The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and implementation funding. However, prior to transmittal to the Congress, the sponsor, the States, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

JEFFREY M. HALL
Colonel, EN
Commanding

GENERAL RE-EVALUATION REPORT
APPENDIX A: ECONOMICS
SAVANNAH HARBOR EXPANSION PROJECT
Chatham County, Georgia and Jasper County, South Carolina

January 2012

US Army Corps of Engineers
Savannah District
South Atlantic Division

Table of Contents

Attachments x
1. INTRODUCTION 1
1.1. Document Layout 1
1.2. Study Purpose and Scope 1
1.3. Problems and Opportunities 2
2. EXISTING CONDITIONS 4
2.1. Economic Study Area (Hinterland) and Regional Distribution Centers 6
2.2. Facilities and Infrastructure 7
2.2.1. Garden City Terminal 7
2.2.2. Elba Island Natural Gas Facility 8
2.2.3. Ocean Terminal 8
2.2.4. Other Facilities 8
2.3. Container Services 9
2.4. Historical Commerce 12
2.5. Existing Fleet 14
2.5.1. Vessel Classes 14
2.5.2. Analysis of Vessel Calls by Prior and Post Port 15
2.5.3. Trade Balance 17
2.5.4. Historical Calls by Day of Week 17
2.5.5. Liner Services by Region 19
2.5.6. Vessel Deployment to North America 19
2.6. Shipping Operations 21
2.6.1. Underkeel Clearance 21
2.6.2. Tidal Range 22
2.6.3. Sailing Practices 23
2.7 Design Vessel 27
3. FUTURE CONDITIONS - WITHOUT AND WITH PROJECT 28
3.1. Garden City Terminal 28
3.2. Operations 29
3.3. Commodity Forecast 30
3.3.1. Baseline 30
3.3.2. Trade Forecast 32
3.3.2.1. Background 32

3.3.2.2. IHS Global Insight 33
3.3.3. SHEP Long Term Trade Forecast – Metric Tons 41
3.4. Vessel Fleet 43
3.4.1. World Fleet 43
3.4.2. Container Vessels Calling at Savannah 52
3.4.3. Initial Allocation of Post-Panamax Vessel Calls by Service 57
3.4.4. Load Factor Analysis and Unit Cost Estimation 60
3.4.5. Deployment by Channel Depth 67
3.5 Summary Information and Assumptions 74
4. TRANSPORTATION COST SAVINGS BENEFIT ANALYSIS 76
4.1. Estimated Share of World Fleet 80
4.2. Calculation of Transportation Costs 83
4.2.1. Voyage Cost by Vessel Class 83
4.2.2. Calculation of Distances for Each Route 83
4.2.3. Savannah Portion of the Total Route Service Distance and Share of Voyage Costs 85
4.3. Transportation Cost Savings Benefits by Project Depth 87
5. SENSITIVITY ANALYSES 88
5.1. Sensitivities to Commodity Forecast 89
5.1.1. Sensitivity 1: Increase Annual Commodity Growth by 1% 89
5.1.2. Sensitivity 2: Increase Annual Commodity Growth by 3% 92
5.1.3. Sensitivity 3: Decrease Annual Commodity Growth by 1% 94
5.1.4. Sensitivity 4: Decrease Annual Commodity Growth by 3% 96
5.1.5. Sensitivity 5: No Growth in Commodity Forecast 98
5.2. Sensitivities to Vessel Availability and Loadings 100
5.2.1. Sensitivity 6: Historical Sub-Panamax Share of Capacity Calling 100
5.2.2. Sensitivity 7: Reduce Future Sub-Panamax Share of Capacity Calling 103
5.2.3. Sensitivity 8: Increase Amount of Savannah Cargo Carried on Post-Panamax Vessels 105
5.2.4. Sensitivity 9: Full Deployment of Post-Panamax Vessels in Without (42 ft) Project Condition 107
5.2.5. Sensitivity 10: Reduce Post-Panamax Vessel Calls by 25% 109
5.2.6. Sensitivity 11: Deployment of Post-Panamax Vessels by Unit Costs 111
5.2.7. Sensitivity 12: Increase Post-Panamax Vessel Loading Beyond Maximum Practicable Loading 113

5.2.8. Sensitivity 13: Reduce PPX1 Replacement of PPX2 Vessels, Use Historical SPX Share of Capacity Calling, and Deployment of PPX by Unit Costs 116
5.3. Other Sensitivities 118
5.3.1. Sensitivity 14: Increase Cargo Density 118
5.3.2. Sensitivity 15: Increase Savannah Share of Trade Route Cargo by 25% 121
5.3.3. Sensitivity 16: Decrease Savannah Share of Trade Route Cargo by 25% 122
5.3.4. Sensitivity 17: December 2010 Draft Report Values 123
5.4. Sensitivity Summary 126
6. MEETING AREA AND TIDE DELAY ANALYSES 129
6.1. HarborSym Model 129
6.1.1. Inputs 129
6.1.2. Outputs 131
6.2. Savannah Harbor Expansion Project – Meeting Area Analysis 131
6.2.1. Meeting Area Alternatives 131
6.2.2. Vessel Call List 133
6.2.3. Sailing Draft Distribution 136
6.2.4. Vessel Operating Costs 145
6.2.5. Meeting Area Analysis – HarborSym Results 147
6.3. Savannah Harbor Expansion Project – Tide Delay Analysis 152
6.3.1. HarborSym Analysis – Tide Delay 153
6.3.2. Tide Delay - Annual Benefits 158
6.3.3. Tide Delay - Average Annual Benefits 158
6.4. Cumulative Benefits – Meeting Area and Tide Delay Benefits 159
6.5. Project NED Benefits Summary 159
6.5.1 Updated FY2012 Benefits for Recommended Plan 160
7.0 MULTIPORT ANALYSIS 162
7.1. Multiport Analysis – GEC Evaluation (Final Report dated July 2006) 162
7.2. Update 163
8. SOCIOECONOMIC AND REGIONAL ANALYSES 165
8.1. Socioeconomic Overview 165
8.1.1. Demographics 165
8.1.2. Employment 168
8.1.3. Households 169
8.1.4. Income 170
8.2. Regional Economic Development Analysis 171

8.2.1. Regional Analysis 171
8.2.2. Summary 172
8.2.3. Results of the Economic Impact Analysis 172

List of Tables

Table 1: Savannah Harbor Container Services 10
Table 2: Controlling Depths at US East Coast Ports 12
Table 3: Vessel Size Class Definitions 15
Table 4: Savannah Container Calls by Day of the Week 18
Table 5: Vessel Underkeel Clearance Requirements 22
Table 6: 2007 Panamax Vessel Transits – Sailing Draft 25
Table 7: 2007 Post-Panamax Vessel Transits - Sailing Draft 25
Table 8: 2007 Panamax and Post-Panamax Vessel Transits - Sailing Draft 26
Table 9: Historical Containerized Imports (metric tons) 31
Table 10: Historical Containerized Exports (metric tons) 32
Table 11: Commodity Forecast Baseline 32
Table 12: Trade Partner and World Region Groupings 34
Table 13: GI Reported Containerized Commodities - 2007 Imports 36
Table 14: GI's Savannah Harbor Containerized Trade Forecast – Imports (metric tons) 37
Table 15: GI's Savannah Harbor Containerized Import Metric Tons - Rate of Change 37
Table 16: GI Reported Containerized Commodities - 2007 Exports 38
Table 17: GI's Savannah Harbor Containerized Trade Forecast – Exports (metric tons) 39
Table 18: GI's Savannah Harbor Containerized Export Metric Tons - Rate of Change 39
Table 19: 2010 Containerized Imports and Exports Forecasts 40
Table 20: Savannah Harbor Containerized Imports and Exports- Rate of Change (2010 update) 41
Table 21: SHEP Containerized Trade Forecast - Import Metric Tons 41
Table 22: SHEP Containerized Trade Forecast - Export Metric Tons 42
Table 23: Average Container Box Weight and Empty Percentages by Service 42
Table 24: TEU Forecast for Selected Years 43
Table 25: World Feet by TEU Band - 2010 46
Table 26: Historical Vessel Calls at Savannah by TEU Band 2000-2010 54
Table 27: Historical Share of Nominal Vessel Capacity Calling Savannah by TEU Band 55
Table 28: Forecasted Post-Panamax Share of Vessel Capacity 55
Table 29 – World Fleet: Detailed View of 7.6 - 12.0 TEU Band 56
Table 30: Percentage of Sub-Panamax Vessel Capacity at Savannah ((Historically) 58
Table 31: Forecast Percentage of Sub-Panamax Vessel Capacity 58
Table 32: Route Percent Share of Forecast PX and PPX Tonnes 58
Table 33: Screen shot of vessel information taken from Lloyd's Registry of Vessels and used in the LFA 62
Table 34: Variables Used in LFA upon Model Calibration 63
Table 35: Vessel Capacity Utilization 66
Table 36: Maximum Practicable Sailing Draft (feet) by Project Depth Alternative 68
Table 37: Vessel Operating Costs for Three Vessel Classes 69
Table 38: Unit Cost in Tonnes per Thousand Miles 69

Table 39: FE (Panama) ECUS Vessel Calls by Class by Year (with 140% replacement ratio) 71
Table 40: ECUS MED Vessel Calls by Class by Year 71
Table 41: FE (Suez) ECUS Vessel Calls by Class by Year 72
Table 42: Average Metric Tons Carried per Call by Channel Depth - Imports 73
Table 43: Forecast Vessel Calls by Vessel Size Class, Channel Depth, and Year 74
Table 44: Savannah Share of Vessel Capacity Utilized by Route 77
Table 45: Maximum Practicable Capacity by Service Route - PPX1 - Metric Tons 77
Table 46: Maximum Practicable Capacity by Service Route - PPX2 - Metric Tons 78
Table 47: Average Tonnage Carried Per Call by Channel Depth - Imports 78
Table 48: Vessel Trips by Year, Vessel Class, and Channel Depth 80
Table 49: Historic Percent of World Fleet Calling Once Per Week on Savannah 81
Table 50: Percent of World Fleet Utilized on Average Calling Savannah Once Per Week ... 82
Table 51: Voyage Cost per 1000 Nautical Miles and Other Selected Statistics 83
Table 52: ECUS EU GULF PEN World Region Service - Individual Service Rotations 84
Table 53: ECUS EU GULF PEN World Region Service - Distance Calculation 85
Table 54: World Region Service - Total Trip Distance 85
Table 55: Percent of Vessel Cargo Allocated to Savannah 86
Table 56: Savannah Share of Voyage Cost 87
Table 57: AAE Transportation Cost Savings by Project Depth 88
Table 58: Incremental Transportation Cost Savings by Project Depth 88
Table 59: Sensitivity 1 – Increase Annual Commodity Growth by 1% - AAE Transportation Cost Savings 90
Table 60: Sensitivity 1 - Increase Annual Commodity Growth by 1% - Forecast Vessel Calls 91
Table 61: Sensitivity 2 – Increase Annual Commodity Growth by 3% - AAE Transportation Cost Savings 92
Table 62: Sensitivity 2 - Increase Annual Commodity Growth by 3% - Forecast Vessel Calls 93
Table 63: Sensitivity 3 – Decrease Annual Commodity Growth by 1% - AAE Transportation Cost Savings 94
Table 64: Sensitivity 3 - Decrease Annual Commodity Growth by 1% - Forecast Vessel Calls 95
Table 65: Sensitivity 4 – Decrease Annual Commodity Growth by 3% - AAE Transportation Cost Savings 96
Table 66: Sensitivity 4 - Decrease Annual Commodity Growth by 3% -Forecast Vessel Calls 97
Table 67: Sensitivity 5 – No Growth in Commodity Forecast - AAE Transportation Cost Savings 98
Table 68: Sensitivity 5 - No Growth in Commodity Forecast - Forecast Vessel Calls 99
Table 69: Sensitivity 6 – Historical SPX Share of Capacity Calling - AAE Transportation Cost Savings 101
Table 70: Sensitivity 6 - Historical SPX Share of Capacity Calling - Forecast Vessel Calls102
Table 71: Sensitivity 7 – Reduce Future SPX Share of Capacity Calling - AAE Transportation Cost Savings 103

Table 72: Sensitivity 7 - Reduce Future SPX Share of Capacity Calling - Forecast Vessel Calls 104
Table 73: Sensitivity 8 – Increase Amount of Savannah Cargo Carried on PPX Vessels - AAE Transportation Cost Savings 105
Table 74: Sensitivity 8 – Increase Amount of Savannah Cargo Carried on PPX Vessels - Forecast Vessel Calls 106
Table 75: Sensitivity 9 – Full Deployment of PPX Vessels in Without Project Condition - AAE Transportation Cost Savings 107
Table 76: Sensitivity 9 - Full Deployment of PPX Vessels in Without Project Condition - Forecast Vessel Calls 108
Table 77: Sensitivity 10 – Reduce PPX Vessel Calls by 25% - AAE Transportation Cost Savings 109
Table 78: Sensitivity 10 - Reduce PPX Vessel Calls by 25% - Forecast Vessel Calls 110
Table 79: Sensitivity 11 – Deployment of PPX Vessels by Unit Costs - AAE Transportation Cost Savings 111
Table 80: Sensitivity 11 - Deployment of PPX Vessels by Unit Costs - Forecast Vessel Calls 112
Table 81: Sensitivity 12 - Increase PPX Vessel Loading Beyond MPC - AAE Transportation Cost Savings 114
Table 82: Sensitivity 12 - Increase PPX Vessel Loading Beyond MPC - Forecast Vessel Calls 115
Table 83: Sensitivity 13 – Reduce PPX1 Replacement of PPX2 Vessels, Use Historical SPX Share of Capacity Calling, and Deployment of PPX by Unit Costs - AAE Transportation Cost Savings 116
Table 84: Sensitivity 13 - Reduce PPX1 Replacement of PPX2 Vessels, Use Historical SPX Share of Capacity Calling, and Deployment of PPX by Unit Costs - Forecast Vessel Calls 117
Table 85: Sensitivity 14 – Increase Cargo Density - AAE Transportation Cost Savings..... 119
Table 86: Sensitivity 14 - Increase Cargo Density - Forecast Vessel Calls..... 120
Table 87: Sensitivity 15 – Increase Savannah Share of Trade Route Cargo by 25% - AAE Transportation Cost Savings 122
Table 88: Sensitivity 16 – Decrease Savannah Share of Trade Route Cargo by 25% - AAE Transportation Cost Savings 123
Table 89: Sensitivity 17 – December 2010 Draft Report Values - AAE Transportation Cost Savings 124
Table 90: Sensitivity 17 - December 2010 Draft Report Values - Forecast Vessel Calls 125
Table 91: Sensitivity Summary Table – Net Benefits 127
Table 92: Sensitivity Summary – Net Incremental Benefits 128
Table 93: Containerized Vessel Fleet – 44-Foot Depth (2017-2030)..... 134
Table 94: Containerized Vessel Fleet – 45-Foot Depth (2017-2030)..... 134
Table 95: Containerized Vessel Fleet – 46-Foot Depth (2017-2030)..... 134
Table 96: Containerized Vessel Fleet – 47-Foot Depth (2017-2030)..... 134
Table 97: Containerized Vessel Fleet – 48-Foot Depth (2017-2030)..... 134
Table 98: LNG Vessel Fleet (bcm) (2017-2030)..... 135
Table 99: General Cargo Fleet – Annual Vessel Calls (2017-2030) 136
Table 100: Historical and Future Without Project Condition Sailing Draft Distribution – Panamax Vessel Class..... 137

Table 101: Carrier Reported Sailing Drafts at Savannah Harbor (2008-2009) – Panamax Vessel Class 137
Table 102: Carrier Reported Sailing Drafts at World Harbors with 45-Foot Terminal Depth – Panamax Vessel Class 138
Table 103: Panamax Vessel Class Sailing Draft Distributions 139
Table 104: Historical and Future Without Project Condition Sailing Draft Distribution – Generation 1 Post-Panamax Vessel Class 140
Table 105: Carrier Reported Sailing Draft Distribution (2008-2009) – Post-Panamax Generation 1 Vessel Class Calls at Savannah 140
Table 106: Carrier Reported Sailing Drafts at World Harbors with 45-Foot Terminal Depth – PPX1 Vessel Class 141
Table 107: Post-Panamax Generation 1 Vessel Class – Sailing Draft Distributions 141
Table 108: Post-Panamax Generation 2 Vessel Class – Sailing Draft Distributions 143
Table 109: Underkeel Clearance Requirement 144
Table 110: Hourly Vessel Operating Costs Foreign Container Vessel Classes 145
Table 111: Container Fleet DWT 146
Table 112: LNG Vessel Operating Costs 146
Table 113: LNG Vessel Operating Cost 147
Table 114: 47-Foot Channel Depth - 2017 148
Table 115: 47-Foot Channel Depth – 2020 148
Table 116: 47-Foot Channel Depth – 2025 149
Table 117: 47-Foot Channel Depth - 2030 149
Table 118: Annual Benefits - 47-Foot Channel Depth 150
Table 119: Average Annual Benefits 151
Table 120: Construction Cost - Meeting Areas 151
Table 121: Average Annual Cost - Meeting Areas 151
Table 122: Benefit Cost Ratio - Meeting Areas 152
Table 123: Tide Delay Methodology 153
Table 124: 46-Foot Fleet, 45 to 46-Foot Depth - 2017 154
Table 125: 46-Foot Fleet, 45 to 46-Foot Depth - 2020 154
Table 126: 46-Foot Fleet, 45 to 46-Foot Depth - 2025 155
Table 127: 46-Foot Fleet, 45 to 46-Foot Depth – 2030 155
Table 128: 47-Foot Fleet, 46 to 47-Foot Depth – 2017 156
Table 129: 47-Foot Fleet, 46 to 47-Foot Depth – 2020 156
Table 130: 47-Foot Fleet, 46 to 47-Foot Depth – 2025 157
Table 131: 47-Foot Fleet, 46 to 47-Foot Depth – 2030 157
Table 132: Tide Delay Benefits 158
Table 133: Average Annual Benefits - Tide Delay 158
Table 134: Cumulative Benefits 159
Table 135: NED Benefits Summary FY-2011 (4.125%) 160
Table 136: Savings per TEU - Imports (2025) 164
Table 137: Population and Demographics–Selected Georgia and South Carolina Counties 168
Table 138: Employment Statistics - Selected Georgia and South Carolina Counties 169
Table 139: Housing and Households–Selected Georgia and South Carolina Counties 170
Table 140: Income and Poverty–Selected Georgia and South Carolina Counties 171
Table 141: Spending and LPCs 173

Table 142: Overall Summary Economic Impacts 173
Table 143: Economic Impact at Local Region 174
Table 144: Economic Impact at Bi-State Level 175
Table 145: Economic Impact at National Level 176

List of Figures

Figure 1: Selected World Harbor Depths Comparison 3
Figure 2: Trends in Size of Containerships Calling at U.S. Container Ports, 2004 to 2009 4
Figure 3: Savannah Harbor Project Map 5
Figure 4: Savannah Harbor Hinterland 6
Figure 5: Garden City Terminal 7
Figure 6: FE (Panama) ECUS Trade Map 10
Figure 7: FE (Suez) ECUS Trade Map 11
Figure 8: Savannah Harbor Historical Commerce - All Commerce (short tons) 13
Figure 9: Historical Loaded TEUs 14
Figure 10: Origin of Container Vessels Prior to Calling at Savannah 16
Figure 11: Destination of Container Vessels after Calling Savannah 16
Figure 12: Import/Export Balance of Trade 17
Figure 13: Savannah Container Calls by Day of Week 18
Figure 14: Services Calling North American Ports 19
Figure 15: Europe to North America Deployment 20
Figure 16: Asia to North America Deployment 20
Figure 17: Channel Reliability by Project Depth 23
Figure 18: Historical Vessel Sailing Drafts - All Vessels 24
Figure 19: Schematic Overview of the CSPS Model 45
Figure 20: FCC Contracting 1980-2010 48
Figure 21: Forecast of Deliveries by TEU Band 2011-2030 49
Figure 22: Forecast of Vessel Scrapping by TEU Bands 2011-2030 50
Figure 23: World Fleet: Historical and Forecasted FCC by TEU Band 2000-2030 51
Figure 24: World Fleet: Forecast of Selected TEU Bands 52
Figure 25: Correlation Between Trade and Nominal Capacity in the US Fleet 53
Figure 26: Correlation between Trade and Nominal Capacity at Savannah 54
Figure 27: Initial Forecast of Post-Panamax Vessels Calling at Savannah 57
Figure 28: PPX1 Calls by Route Service 59
Figure 29: PPX2 Calls by Route Service 60
Figure 30: Illustration of Load Factor Capacity Allocation 66
Figure 31: Unit Cost by Sailing Draft 67
Figure 32: Order of Cargo Allocation (by fleet type) 79
Figure 33: HarborSym Iterations - Hours 130
Figure 34: Savannah Harbor Node Network 131
Figure 35: Panamax Vessel Class – Cumulative Sailing Draft Distribution 139
Figure 36: Post-Panamax Generation 1 Vessel Class–Cumulative Sailing Draft Distribution 142
Figure 37: Post-Panamax Generation 2 Vessel Class–Cumulative Sailing Draft Distribution 144
Figure 38: Georgia County Map 166

Figure 39: South Carolina County Map 167

Attachments

1 Carrier Letters
2 Transportation Cost Savings Model Flow Chart
3 HarborSym Approval for Use White Paper
4 GEC Multiport Analysis for the Savannah Harbor Expansion Project (July 2006)
5 GEC Savannah Harbor Expansion Project Deep Draft Channel Improvements Economic Analysis: Commodity Projections Parts 1-4 (August 2004)
6 GEC Regional Economic Impact Study

LIST OF ACRONYMS

ACP	Panama Canal Authority
CD	Circuit Distance
CSPS	Container Shipping Planning Service
EIS	Environmental Impact Statement
FCC	Fully Cellular Container Vessels
GI	HIS Global Insight
GPA	Georgia Ports Authority
GRR	General Reevaluation Report
IWR	Institute for Water Resources
LFA	Load Factor Analysis
LNG	Liquid Natural Gas
LSE	Lloyd's Shipping Economist
MARAD	Maritime Administration
MPC	Maximum Practicable Capacity
MPD	Maximum Practicable Draft
MPLD	Maximum Practicable Loading Draft
MSA	Metropolitan Statistical Area
MSI	Maritime Strategies International, Limited
MXSLLD	Maximum Summer Load Line Draft
NED	National Economic Development
PDT	Project Delivery Team
PX	Panamax Vessel Class
PPX	Post-Panamax Vessel Class
PPX1	Generation 1 Post-Panamax Vessel Class
PPX2	Generation 2 Post-Panamax Vessel Class
RED	Regional Economic Development
RTG	Rubber-tired Gantries
SHEP	Savannah Harbor Expansion Project
SPX	Sub-Panamax Vessel Class
STS	Ship-to-Shore
TCSM	Transportation Cost Savings Model
TEU	Twenty Foot Equivalent Unit
TPI	Tons per Inch Immersion
UKC	Underkeel Clearance
USACE	United States Army Corps of Engineers
USEC	United States East Coast
WTS	World Trade Service

Terminology Used in the Transportation Cost Model

Applied Cargo	The average weight of cargo per TEU, this includes carriage as well
Cargo Working TPI	This is the tons per inch over the range of immersion for cargo only.
Circuit Distance	The total distance of a trade route, defined as the sum of distances from all ports of call, expressed in nautical miles.
Draft-Restricted	The draft that a ship has available when tides are considered
Draft-Unrestricted	The draft that a vessel can use at anytime regardless of the tide
DWT	Deadweight tons
ECUS	East Coast United States
Empty TEUs	The number of empty TEU containers
FE	Far East
GPA Data	Georgia Ports Authority Data
Lading	Cargo within a TEU
Loaded TEUs	The number of boxes containing cargo
Maximum Practicable Capacity (MPC)	The highest reasonable practicable capacity based on weight and volume that a given vessel can hold assuming a fixed average import and export cargo weight (based on all cargo for a given service), a minimal rate of empty containers for all routes, bunkerage and ballast requirements, 5-feet of usable tide and other considerations. The TCSM does include some calls in which vessels exceeded its MPC, but never more than 15% of the time.
Maximum Practicable Draft	The sailing draft when a vessel is loaded at its MPC
Maximum Practical Load	The highest practicable tonnage capacity based on weight and volume that a given vessel can hold assuming a fixed average import and export cargo weight (based on all cargo for a given service), a minimal rate of empty containers for all routes, bunkerage and ballast requirements, 5-feet of usable tide and other considerations
Maximum Summer Load Line Draft	The maximum draft of a vessel at the summer load line
Project Reference Depth	Also known as the without project depth of -42 feet Mean Low Water
Reference Depth	The TCSM uses this term to define the channel depth at Mean Low Water for each alternative
Underkeel Clearance	The available amount of water beneath the bottom of the vessel (all vessels are required to sail with a level of clearance)

SAVANNAH HARBOR EXPANSION PROJECT
Economic Evaluations

1. INTRODUCTION

1.1. Document Layout

The following text documents the economic evaluations performed for the Savannah Harbor Expansion Project (SHEP). Initial document sections provide a description of existing conditions at Savannah Harbor. An assessment of future without and with project conditions follows and includes an evaluation and description of forecast trade, the vessel fleet and operations at the harbor. The document concludes with the presentation of National Economic Development (NED) benefits. The NED benefit assessment includes evaluation of project risk and uncertainty utilizing sensitivity analysis.

1.2. Study Purpose and Scope

The Savannah District of the U.S. Army Corps of Engineers (USACE) in conjunction with the Corps' Deep Draft Navigation Center of Expertise has developed the Savannah Harbor General Reevaluation Report (GRR) to determine the feasibility of improvements to the Federal navigation project at Savannah Harbor. The GRR and accompanying Tier II Environmental Impact Study (EIS) have been developed to fulfill the conditions of the conditional authorization granted in 1999. The GRR and Tier II EIS provide documentation of the technical and plan formulation analyses conducted in the development of a recommended plan for navigation improvement and environmental mitigation. The GRR includes a final mitigation plan and an incremental analysis of alternative channel depths from 42 to 48 feet, as required by the conditional authorization.

Potential navigation improvements include deepening and widening of navigational channels, turning basin expansion, and expanded channel wideners. The purpose of these potential improvements is to increase the efficiency of cargo vessel operations and to accommodate larger container ships, which are already calling at the Port and which are projected to use the Port in larger numbers in the very near future. This study identifies and evaluates alternatives that will:

- Accommodate recent and anticipated future growth in containerized cargo and containership traffic;
- Improve the efficiency of operations for containerships within the Savannah Harbor Navigation Project;
- Allow larger and more efficient container ships to use the Port; and
- Reduce vessel congestion in the river channel.

The Deep Draft Navigation Planning Center of Expertise of the USACE and the Institute for Water Resources (IWR) performed analyses contained within this Economic Appendix. In accordance with ER1105-2-100, the Project Delivery Team (PDT) determined the NED benefits of the project, which are defined primarily as the reduction in transportation costs as a result of channel deepening. Transportation costs can be reduced based on two actions on the part of the carriers: (1) a deeper channel allows carriers to load vessels with more cargo destined for Savannah and other ports; and (2) the deeper channel encourages shippers to substitute larger, more efficient vessels that previously were unable to call at Savannah Harbor. The savings increase, generally at a diminishing rate, for each incremental project depth. The NED plan, in turn, is defined as the project that maximizes the net benefits to the national economy. The PDT employed two models in calculating the benefits: (1) a Transportation Cost Savings Model (TCSM) which calculates the waterborne transit costs to and from other world locations to the Savannah Bar Channel and (2) the HarborSym model which uses vessel information generated by the TCSM combined with estimates of sailing drafts within the Savannah Harbor Channel to estimate the costs, delays and transportation savings within the harbor channel itself. The resulting benefits were categorized by transportation cost savings, reduction in meeting area delays and reduction in tidal delay costs. This economic appendix describes the three benefits in order but it should be noted that they are all interdependent.

1.3. Problems and Opportunities

Savannah Harbor is the second largest container port on the US east coast (by twenty foot equivalent unit (TEU) volume) and the fourth largest in the nation. However, Savannah Harbor also has one of the shallowest controlling depths for a major port. With a controlling depth of 42 feet, it is dwarfed by several other major US ports, many of which comprise key legs on Savannah's container voyages. For example, Norfolk and Baltimore Harbors are 50 feet deep whereas the Port of New York and New Jersey is currently being deepened to 50 feet. The problem is expected to worsen once the Panama Canal's expansion is completed in 2014, when an increased number of Post-Panamax vessels are expected to call on east coast ports including Savannah. Moreover, Savannah has been investing heavily to accommodate the forecasted cargo growth and future composition of Post-Panamax containerships, which make up a growing share of the world fleet. Upon its completion in 2020, the Savannah Harbor's Garden City Terminal will be the largest single container handling facility in the U.S. with more than 1,200 acres of storage space, 9,000 feet of berth, 33 post-Panamax size cranes, and two on-site intermodal transfer facilities serviced by two major rail lines. The facility, at full build out, will have an annual throughput capacity of 6.5 million TEUs. From 2017 to 2066 (the period of analysis), the volume of TEUs projected for Garden City Terminal will continue to increase; the vessel fleet calling at Garden City Terminal will continue to shift from predominantly Panamax size to Post-Panamax size; and the Panama Canal and most major ports on the US east coast, Europe, and Asia will be able to accommodate vessels with operating drafts in excess of 46 feet. Finally, continued competition will force carriers to look for ways of achieving transportation cost efficiencies.

Under future without-project conditions, the channel will remain at a controlling depth of 42 feet. Vessels requiring operating drafts of greater than 38 feet (Panamax) and 37.7 feet (Post-Panamax) will continue to be constrained in Savannah Harbor (i.e., due to underkeel clearance

requirements). This will create severe transportation cost inefficiencies since Savannah will remain at least eight feet less than controlling depths at the expanded Panama Canal, Norfolk Harbor, Baltimore, the Port of New York and New Jersey, as well as most of the foreign ports that serve Savannah (Figure 1).

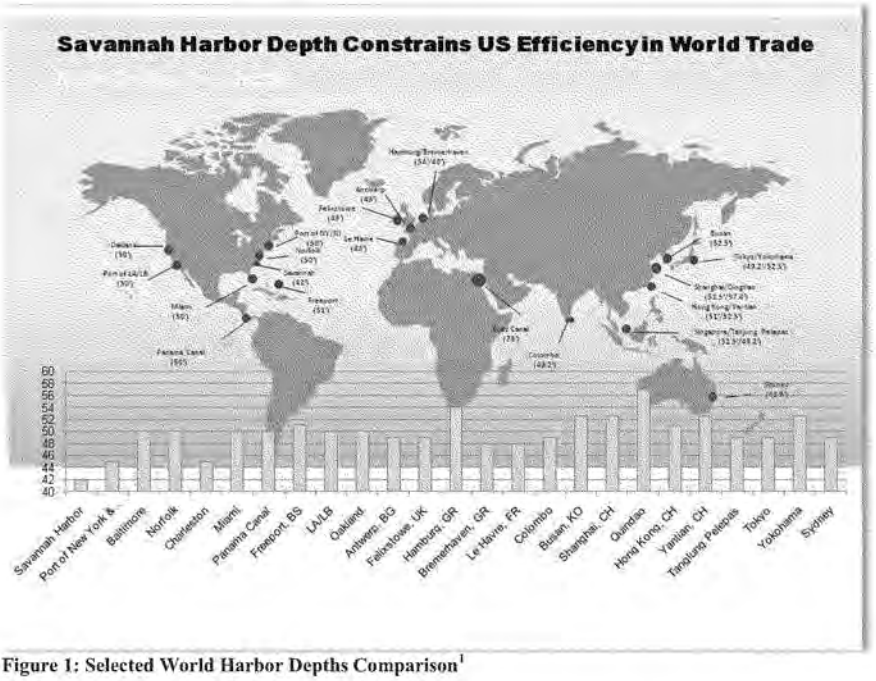


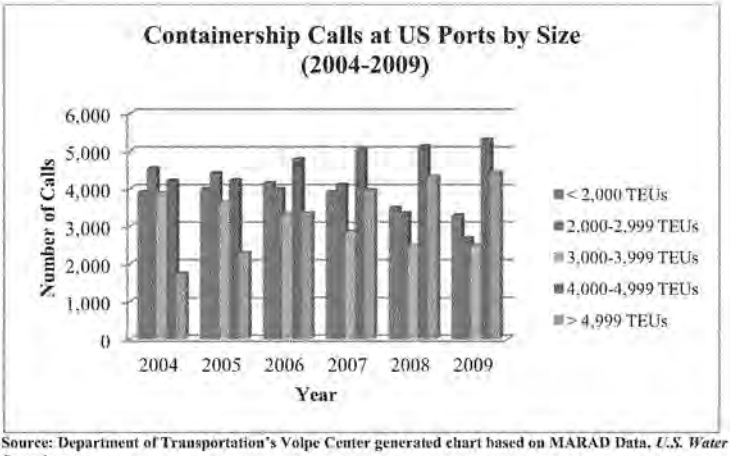
Figure 1: Selected World Harbor Depths Comparison[1]

Over time, these inefficiencies are expected to increase significantly as the volume of cargo continues to grow and as larger vessels comprise a greater share of the world vessel fleet. [2,3]

[1] Port of New York and New Jersey scheduled completion date (2014), Miami (2012).

[2] TEU container capacity of some of the containerships calling at U.S. ports is about 9,000 to 10,000 TEUs with vessel drafts of up to 46 feet. Some future forecasts are calling for 12,000 TEU ships with vessel drafts over 49 feet. There are projections of even larger vessels in design having 14,000 TEU-capacity vessels with drafts of 50 feet for entry in the U.S. market by 2020.

[3] CDM and the Tioga Group, *Maritime Transportation System: Trends and Outlooks*, Final Report, Report submitted to the USACE, March 13, 2007.



Source: Department of Transportation's Volpe Center generated chart based on MARAD Data. *U.S. Water Transportation Statistical Snapshot*

Figure 2: Trends in Size of Containerships Calling at U.S. Container Ports, 2004 to 2009

2. EXISTING CONDITIONS

Savannah Harbor is a deep draft harbor on the South Atlantic coast of Georgia. The harbor and deep draft navigation channel comprise the lower 21.3 miles of the Savannah River and 11.4 miles of channel across the bar to the Atlantic Ocean (Figure 3). The Savannah River, along with several of its tributaries, forms the boundary between the States of Georgia and South Carolina along its entire length of 313 miles.

The City of Savannah, Georgia, dominates the mainland on the south side of the river. The city's historic downtown is located on a south bluff approximately 18 miles above the river's mouth. Heavy industry and shipping facilities are located along the south side of the harbor upstream from the city's historic area to the upper limits of the harbor project. Additional heavy industries and a few shipping facilities line the harbor downstream from the city's historic area to the Atlantic Intracoastal Waterway.

From the Intracoastal Waterway to the river's mouth, both sides of the river predominately consist of islands, marshes, dredged material disposal areas, and other undeveloped sites. Land use on the South Carolina side of the Savannah River is basically agricultural, silvicultural (forestry-related), with some recreation. Wetland habitat types found along Savannah Harbor include saltwater aquatic, saltwater coastal flats, saltwater marshes, freshwater aquatic, freshwater flats, and freshwater marsh.

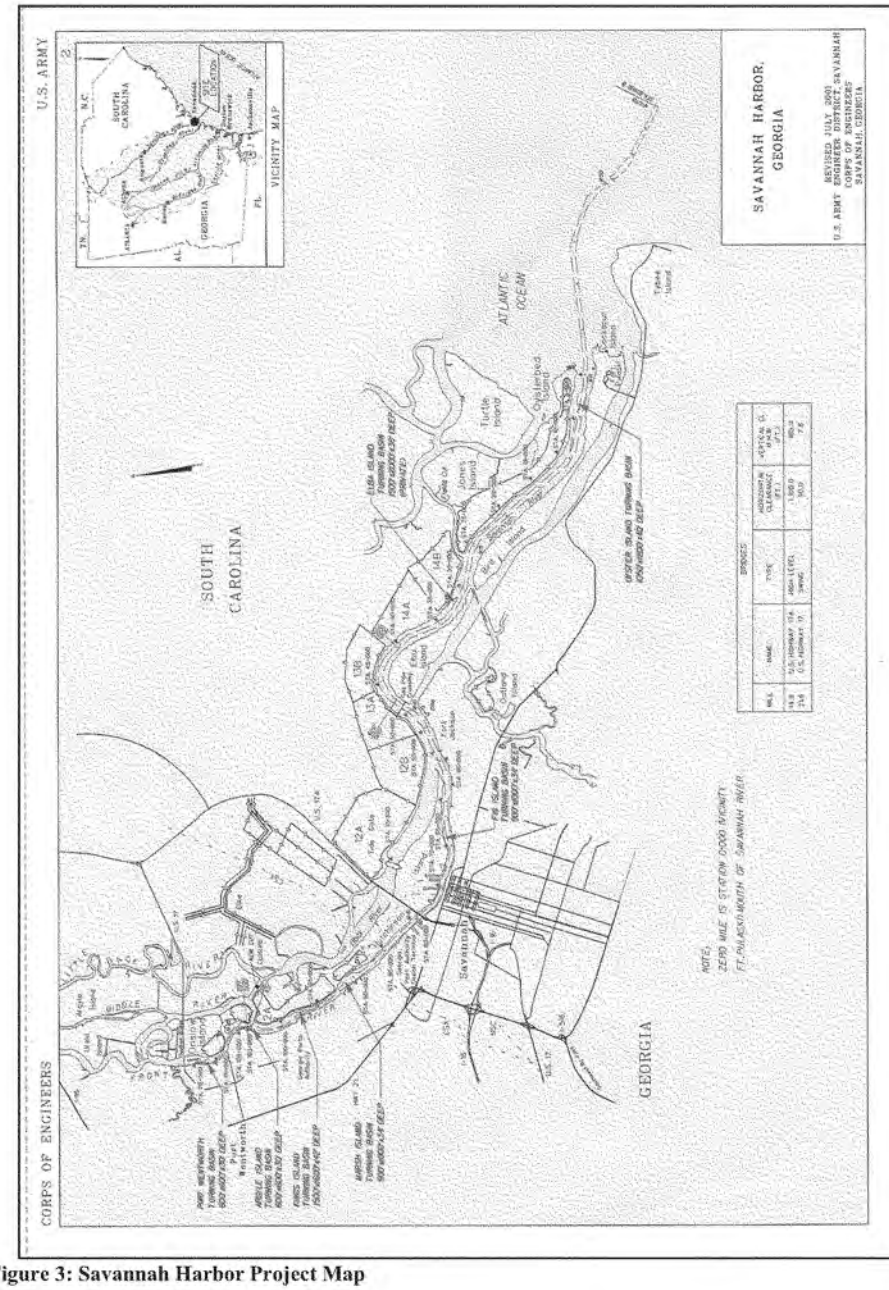


Figure 3: Savannah Harbor Project Map

2.1. Economic Study Area (Hinterland) and Regional Distribution Centers

The Savannah Harbor hinterland includes Birmingham, Atlanta, and Memphis and extends as far west as Dallas, Texas, and as far north as Detroit, Michigan (Figure 4). Savannah Harbor container services calling world regions for containerized imports compete with other major South Atlantic coast ports of Jacksonville, Charleston, and Wilmington, as well as Norfolk for interior U.S. markets. Container ports in South Florida, such as Miami and Port Everglades, are not considered to be competitors to Savannah because of the specificity of their hinterland relative to South Florida and associated transshipment services for the Caribbean and Latin America niche markets. While the majority of Norfolk's hinterland serves the North Atlantic region, it is often viewed as a competitor to Savannah, particularly for cargo to and from the Midwest.

Figure 4: Savannah Harbor Hinterland

Despite low population growth and a minor expansion of the 40-mile "trade radius" around Savannah, Savannah Harbor has been the fastest-growing container port since 1997, experiencing an average annual cargo growth rate of 11.3 percent (MARAD, 2010). The average annual population growth in the Savannah MSA and 40-mile trade radius grew at annual rates of 1 and 2 percent, respectively, over the same period. The large cargo growth is attributable to the port's favorable infrastructure, aggressive marketing, solid transportation network, and new distribution centers that were developed on former farmland in Chatham and surrounding counties. Large scale distribution centers have developed in the area because of the availability of large tracts of undeveloped land and the proximity to road, rail, and waterborne transportation infrastructure.

Distribution centers are typically located within a one-day's drive of the local retail stores with one distribution center potentially supplying inventory for over a dozen local retail stores. The

Distribution centers are typically located within a one-day's drive of the local retail stores with one distribution center potentially supplying inventory for over a dozen local retail stores. The very large distribution centers located near Garden City Terminal also supply regional distribution centers located in the hinterland, which in turn supply local retail stores. Large scale distribution centers reduce the amount of inventory needing to be stored by the local retail stores. The centers also reduce the risk that an inappropriate volume of inventory would be delivered to a local retail store. According to the GPA, Wal-Mart, Kmart/Sears, Dollar Tree, Lowes, IKEA, Pier One Imports, Home Depot and Dick's Sporting Goods are some of the larger distribution centers in the region.

The 24 largest distribution centers using Garden City terminal have a combined warehouse area of 19.7 million square feet (Georgia Ports Authority (GPA), 2007). The Savannah/Chatham County industrial real estate inventory for warehouse/distribution facilities, light manufacturing buildings, and flex/business service space has more than doubled from 1998 to 2007, increasing from 11.0 million square feet in 1998 to 28.3 million square feet in 2007. Additions to the industrial real estate inventory are currently expanding beyond Chatham County into nearby Bryan, Effingham, and Liberty Counties. Build-out of sites acquired and in the planning stage would add an additional 25 million square feet to the inventory (Neely/Dales, 2007).

2.2. Facilities and Infrastructure

2.2.1. Garden City Terminal

The Garden City Terminal is a secured, dedicated container terminal owned and operated by the Georgia Ports Authority (Figure 5). The terminal is the largest single-terminal operation in North America. The facility's single-terminal design allows the port to operate in an environment of maximum efficiency and flexibility, as well as increased security, due to the concentration of all manpower, technology and equipment in one massive container operation.

Figure 5: Garden City Terminal

Garden City Terminal is a gateway to rail and road distribution networks that offer efficient and reliable intermodal access to markets across the U.S. Southeast and Midwest, including those with the fastest-growing populations and capital investments. The James D. Mason Intermodal Container Transfer Facility, upgraded in 2007 to include 2,500 feet of track, moves an average of 17 double stack trains to Atlanta each week. The Mason ICTF is served by CSX and Norfolk Southern Railroad and provides overnight rail service to Atlanta, with two to four day delivery to inland destinations of Charlotte, North Carolina; Chicago, Illinois; Dallas, Texas; and Memphis, Tennessee. Approximately 20% of Garden City Terminal's throughput moves by train.

Additionally, immediate interstate access is available via Interstates 95 (North/ South) within 5.6 miles and 16 (East/ West) within 6.3 miles. Truck traffic is serviced by three separate gates with 37 lanes, 25 of which are pre-check lanes.

The terminal covers approximately 1,200 acres. Its nine container berths provide 9,693 continuous linear feet of waterfront. Garden City Terminal is equipped with 25 container cranes, eight of which are of super Post-Panamax class (the largest of the Post-Panamax vessel) and capable of handling vessels loaded with 22 containers across the vessel's beam. The seventeen remaining cranes are all Post-Panamax class and capable of servicing vessels loaded with 16-18 containers across.

Garden City terminal berths run in a line that parallels the Savannah River navigational channel. The linear berth space is divided into four segments as follows:

- Container Berth 1 – 1,690 feet;
- Container Berths 2 and 3 – 2,358 feet;
- Containers Berths 4, 5, and 6 – 2,369 feet; and
- Container Berths 7, 8, and 9 – 3,276 feet.

2.2.2. Elba Island Natural Gas Facility

The Elba Island Liquid Natural Gas (LNG) terminal and inland pipeline are owned by Southern LNG/El Paso Corporation; however, both Shell LNG and British Gas LNG Services have long term leases at the facility, both owning and distributing the product. The LNG brought into the facility is distributed throughout Georgia and in parts of South Carolina. The facility has 4 storage tanks with a total capacity of 350,000 cubic meters.

2.2.3. Ocean Terminal

The Ocean Terminal is a secured, dedicated break-bulk and RoRo facility owned and operated by the GPA. A range of shipments including forest and solid wood products, steel, industrial and farm equipment, automobiles, project shipments and heavy-lift cargoes move through this 208-acre, 10-berth facility every day. The site features 6,674 linear feet of deepwater berthing, 1.5 million square feet of covered storage, and 83 acres of open storage. Ocean Terminal is located 1.2 miles from Interstate 16, 10 miles from Interstate 95, and 1.5 miles from Interstate 516. Norfolk Southern Railroad provides switching services on-terminal. Line-haul services are provided by Norfolk Southern Railroad and CSX Transportation. Additional land is available for future expansion of this facility.

2.2.4. Other Facilities

Other harbor tenants include Willamette Industries, Savannah Electric Power Generating Station – Southern Company, Atlantic Wood Industries, Savannah Food and Industries, Vopak, National Gypsum Company, SIT, Citgo Asphalt Refinery, Georgia Kaolin International, Savannah Steel Corporation, Global Ship Systems, Colonial Oil Industries, Blue Circle Cement, Savannah Marine Services, Crescent Towing Services, Moran Towing, Liberty Terminal, East Coast Terminals/Woodchip Exporting Corporation, Georgia Pacific Gypsum, Nustar, Conoco Phillips, Tronox, and Southern LNG.

2.3. Container Services

This economic analysis focuses primarily on container trade at the Savannah Harbor. This type of trade is the newest and fastest growing and is also very dynamic. Recent trends in the container industry include consolidation of carriers, increases in vessel size, and slot sharing, which is an increasingly common practice that allows multiple companies to share space on a single containership. The impetus for these trends is increased economic efficiency, which is driven by competition among carriers. The major trade lanes and ports are serviced by multiple carriers; therefore, competition on these trade lanes is strong. The baseline presented in this evaluation documents Garden City and vessel operations through calendar year 2007.

In 2007, more than 50 container ship services included regularly scheduled calls at Garden City Terminal. Some services handled more than 100,000 TEUs at Garden City; others handled only a few hundred TEUs. These containership services are considered liner services which call weekly on a fixed day schedule. Savannah Harbor is typically one of multiple US east coast ports called on by a liner service. Vessels on a liner service are typically of similar size in order to provide a consistent port service. A typical liner service to the US east coast loads goods bound for the US east coast from a number of foreign ports (as few as two or as many as six) then calls at two, three, or more US east coast ports to discharge imports and pick-up exports. The vessel then returns to the same foreign ports-of-call serviced on the in-bound leg.

Liner services may also have more diverse itineraries. Liner services from Asia may stop at US west coast ports before calling at the US east coast. Liner services from the Mediterranean and Europe may call at many ports before arriving at the US east coast, and may also include US Gulf ports in the rotation. Some services from Asia call at the US east coast then continue on to Europe before coming back to the US east coast on the return trip to Asia, thereby connecting Asia, the US east coast, and Europe in a single liner service. Another feature of liner service operations is transshipment, which occurs when a container terminal is used as a transfer point from one liner service to another. For example, MSC uses Freeport, BS (port depth -51 feet) as a transshipment terminal. MSC liner services from Asia to the US east coast and MSC liner services from Europe to the US east coast include a stop at Freeport where European goods bound for Asia and Asian goods bound for Europe can switch liner services. Transshipment terminals are also used for transfer of cargo from larger long haul vessels to smaller feeder vessels.

As mentioned, numerous container services call on the Garden City Terminal. These services are operated by many carriers and have trade routes which originate in various parts of the world. In the interest of protecting proprietary information, services were grouped by the world region that they serve. For example, there are a number of services that call on various ports in the Far East (FE), transit the Panama Canal, proceed to ports along the east coast of the United States (ECUS), and then return to the Far East. Services that represent trade within this world area were grouped and entitled "FE (Panama) ECUS" according to the naming convention described. The economic analysis will focus on Savannah Harbor services utilizing the nomenclature provided in Table 1.

Table 1: Savannah Harbor Container Services

World Region	Acronym
East Coast United States (US) Africa	ECUS Africa
East Coast US Australia Pendulum (PEN)	ECUS AU PEN
East Coast US, West Coast and East Coast South America[4]	ECUS WCSA-ECSA
East Coast US, Europe, Gulf of Mexico, PEN	ECUS EU GULF PEN
East Coast US, Mediterranean	ECUS MED
Far East, East Coast US, Europe Pendulum	FE ECUS EU PEN[5]
Far East, East Coast US, Mediterranean Pendulum	FE ECUS MED PEN
Far East, Panama Canal, East Coast US	FE (Panama) ECUS
Far East, Suez Canal, East Coast US	FE (Suez) ECUS
Round the World	RTW
Australia, East Coast US, Europe Pendulum	AU ECUS EU PEN

Figure 6 and Figure 7 are trade route maps for the FE (Panama) ECUS and FE (Suez) ECUS services, respectively. These maps are provided to illustrate the world areas covered by container services using the nomenclature identified in Table 1.

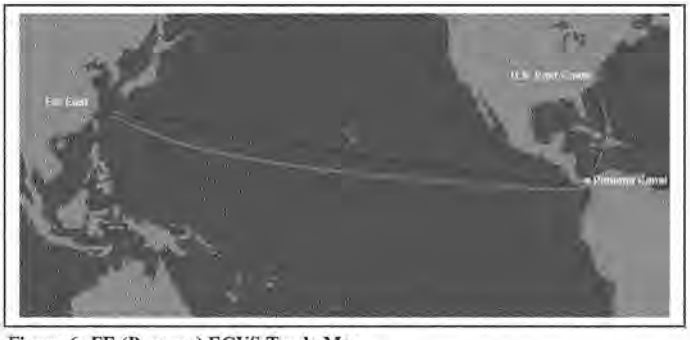


Figure 6: FE (Panama) ECUS Trade Map

As shown in Figure 6, the FE (Panama) ECUS service calls on Far East ports, crosses the Pacific Ocean, and transits the Panama Canal before calling on U.S. East Coast ports. After completing the vessel's ECUS port rotation, the ship returns to the Far East via the Panama Canal. Similarly, the FE (Suez) ECUS service calls on various ports in the Far East and Africa before transiting the Suez Canal and stopping at a Mediterranean port (Figure 7). After its Mediterranean port of call, the vessel crosses the Atlantic and calls on numerous East Coast U.S. ports before returning to the Far East by calling on many of the same ports visited during the first leg of its voyage.

[4] The ECUS WCSA-ECSA is a combined world region service and represents both the ECUS WCSA and ECUS ECSA services. These services were initially analyzed separately (as shown in document text describing the commodity forecast (tonnages)) but were later combined since these services represent a small fraction of total project containerized movements.

[5] "PEN" indicates a pendulum service. In the shipping world, a pendulum service generally involves a trans-oceanic string of ports structured as a continuous loop, much like a pendulum.

Figure 7: FE (Suez) ECUS Trade Map

It should be noted that each trade route contains unique characteristics such as cargo volume, cargo weight, ports of call, vessel types, mix of vessels, etc. and was therefore evaluated separately before being combined as part of the NED analysis. Only eight routes will benefit from channel modifications at Savannah Harbor. However, the non-benefitting routes were still carried forward in the evaluation as the number of future calls will contribute to harbor congestion and will influence other benefit categories outside of the main transportation cost model (i.e., meeting area and tide delay analyses).

Since the inception of containerized cargo in the 1950's, the container shipping industry has been evolving toward greater efficiency. Greater efficiency involves moving more loaded boxes per voyage, which in turn has created incentives to build even larger vessels. However, there are constraints to increased vessel sizes. Perhaps the most obvious constraint is the size of the Panama Canal. Over time, the industry has addressed the physical limitations of the Panama Canal by designing vessels that can accommodate more containers. For example, the Panamax vessel used as the design vessel for the previous Savannah Harbor deepening analysis in 1991 was a 4,000 TEU vessel, which was still under construction at the time. The most recently-built Panamax vessels are rated at just over 5,000 TEUs.

Another limiting factor is the channel depths at other major U.S. container ports. The existing planned, and future controlling depths at these ports are shown in Table 2. Several services, ports such as New York or Norfolk, comprise Savannah's prior or post ports of call.

Table 2: Controlling Depths at US East Coast Ports

Port	Existing[6] (feet)	Planned Depth - Date (feet)
Port of New York and New Jersey	45	50 (2014)
Baltimore	50	50
Norfolk	50	50
Charleston	45	45[7]
Miami	42	50 (2012)
Jacksonville	40	45 (no date)
Port Everglades	44	49 (2012 pending)
Panama Canal Expansion	39	50 (2014)[8]
Savannah	42	???

Much of the Corps' guidance is applicable to bulk-type ports, which serve niche markets and often have regular cargo schedules and predictable loading patterns. Containership ports (with Savannah in particular) are entirely different and are very difficult to evaluate. For one thing, it is nearly impossible for an analyst to track everything that is on the vessel at a given time since many containerships load and offload simultaneously and call at multiple ports during its voyage. Secondly, for each particular voyage, Savannah is seldom the first or final port of call. Third, the total East Coast or other ports of call forecasts by trade route are often unknown, making it difficult to forecast the strings of ports on a voyage. Some vessel strings call at other ECUS ports, and some call at EU and other foreign destinations on their route. Unless Savannah is the first or last port of call on an itinerary, every vessel carries a mix of import and export commodities. For these reasons, the PDT decided to examine sailing drafts (which are available), and relied on averages when determining unit costs. Estimates of vessel loading can be inferred based on the characteristics of the vessel as well as assumptions on loading practices and evolution.

2.4. Historical Commerce

Figure 8 shows historical total commerce at Savannah Harbor as reported in the Waterborne Commerce of the United States. The red squares depict total commodity shipments for each year from 1995 to 2009. While total port commerce has varied over time, the graph clearly illustrates that commerce has increased since 1995, with substantial growth occurring over the last decade. More recent figures show Savannah moving 33.97 million short tons in 2006; 36.5 million short tons in 2007; 35.3 million short tons in 2008, and 32.3 million short tons in 2009. The black line represents the long term trendline for identified commerce.

[6] The existing and planned depths at the identified locations are controlling depths. Note that the tidal variation differs at each location.
[7] Charleston Harbor has begun studies on a harbor deepening project.
[8] Once completed, the expanded Panama Canal will accommodate vessels drafting up to 50' tropical fresh water.

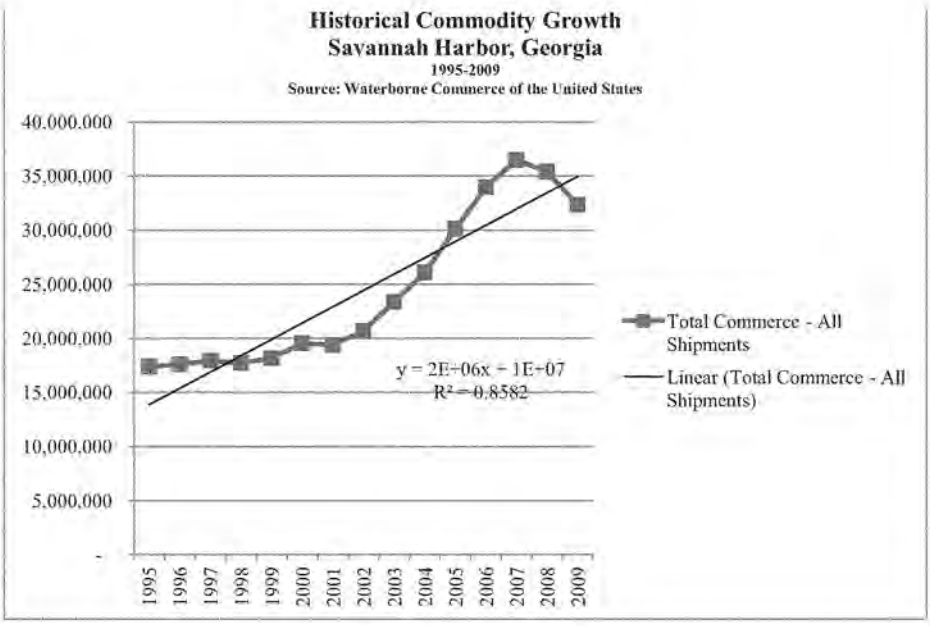


Figure 8: Savannah Harbor Historical Commerce - All Commerce (short tons)

GPA-reported data in Figure 9 illustrates that the number of loaded export and import TEUs at Savannah Harbor grew significantly over the last decade. As indicated by the blue diamonds, export TEUs grew 8 percent between 2007 and 2008, decreased by 5.1 percent during the height of the recession (2008 and 2009), and rebounded to grow by 11.7 percent between 2009 and 2010. Loaded import TEUs (represented by the red squares) rose 0.2 percent between 2007 and 2008, fell by 17.6 percent between 2008 and 2009, and grew by 11.7 percent between 2009 and 2010. By 2010, the GPA reported that 1,144,554 loaded TEUs were exported and 1,050,466 loaded TEUs were imported. Much of Savannah's container growth can be attributed to the availability of affordable land, incentives by local governments to attract distribution centers, congestion at West Coast ports, the distinct hinterland market and the types of commodities transported through Savannah.

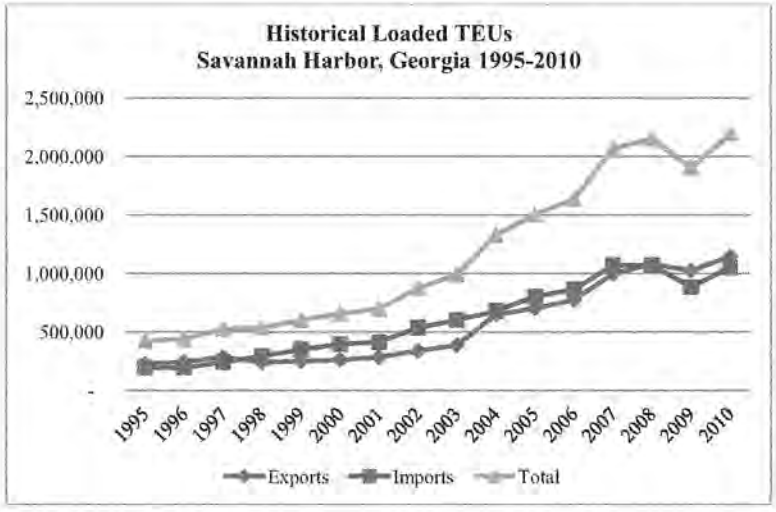


Figure 9: Historical Loaded TEUs

2.5. Existing Fleet

2.5.1. Vessel Classes

It is common practice to separate the containership fleets into TEU bands or classes to analyze supply within the industry. However, due to the evolution of vessel design over time, these TEU bands do not correspond to a breakdown of the fleet by dimensions such as beam or draft. Accordingly, breakdowns in terms of beam and draft straddle different TEU classes. For instance, within the 3.9 k to 5.2 k TEU band, which is generally regarded as the Panamax range, a number of ships fall within that category yet have beams that are too large to pass safely through the current Panama Canal, despite what their name suggests. Conversely, there are many Panamax vessels in the world fleet that fit easily through the Panama Canal while carrying large volumes of TEUs.

The PDT contracted with Maritime Strategies International, Limited (MSI) for information related to the existing and forecast future world fleet of container vessels. MSI is a firm that specializes in vessel forecasting for each shipping sector and provides financial advice to ship owners, shipyards, brokers, investors, insurers and equipment providers.

In the following Table 3, fleet dimensions and TEU ranges used by MSI and the Corps are shown by vessel class. As mentioned, TEU range and vessel dimensions overlap among container vessel classes.

Table 3: Vessel Size Class Definitions

Vessel	TEU Range (TEUs)	Dimension	Feet	
			From	To
Sub-Panamax	100 – 2,900	Beam	34.8	98.2
		Draft	8.2	38.1
		LOA	221.7	813.3
Panamax		Beam	98.4	106.3
		Draft	30.8	44.8
		LOA	572.0	967.5
Panamax Category 1	1,300 – 5,200	Beam	100.1	106.0
		Draft	30.8	38.9
		LOA	572.0	899.0
Panamax Category 2	2,900 – 5,200	Beam	98.4	106.3
		Draft	39.1	44.8
		LOA	899.3	967.5
Post-Panamax	2,900 – 7,600	Beam	106.4	138.8
		Draft	35.4	47.6
		LOA	660.8	1,044.7
Super Post-Panamax	5,200 – 12,000	Beam	138.8	143.9
		Draft	39.4	49.2
		LOA	910.7	1,205.0
Ultra Post-Panamax	7,600 – 12,000+	Beam	144.0	158.1
		Draft	42.7	49.5
		LOA	1,036.7	1,200.8
New Post-Panamax	7,600 – 12,000+	Beam	140.9	185.0
		Draft	50.9	52.6
		LOA	1,140.0	1,304.8

2.5.2. Analysis of Vessel Calls by Prior and Post Port

A useful method of evaluating vessel behavior is to examine the prior and post port of call for vessels calling at Savannah. It is often the case that the first and final ports of call tend to contain vessels carrying the most cargo and subsequently requires the deepest sailing drafts. Figure 10 illustrates that the majority of vessels calling at Savannah (78 percent) had another US port as their prior port of call. Of these, 58 percent were other East Coast ports and 19 percent were Gulf Coast ports. Also it is important to note that 13 percent of the vessels came directly from the Panama Canal. This provides a useful clue that once the Panama Canal's expansion is completed, additional vessels could call at Savannah via the Panama Canal.

Figure 11 displays the next port of call for Savannah traffic. Again, other US ports dominate the figure at 58 percent, split almost evenly between US East Coast and Gulf Coast Ports. The Panama Canal is the next port of call for 24 percent of the vessels. As the Panama Canal has an appointment system, these vessels must schedule their departure from Savannah to ensure arrival

at the canal at the scheduled time. Calls at Savannah are expected to generally continue to be the "second in" or "third in" call in US port rotations in the future, due to its location and current liner network practices.

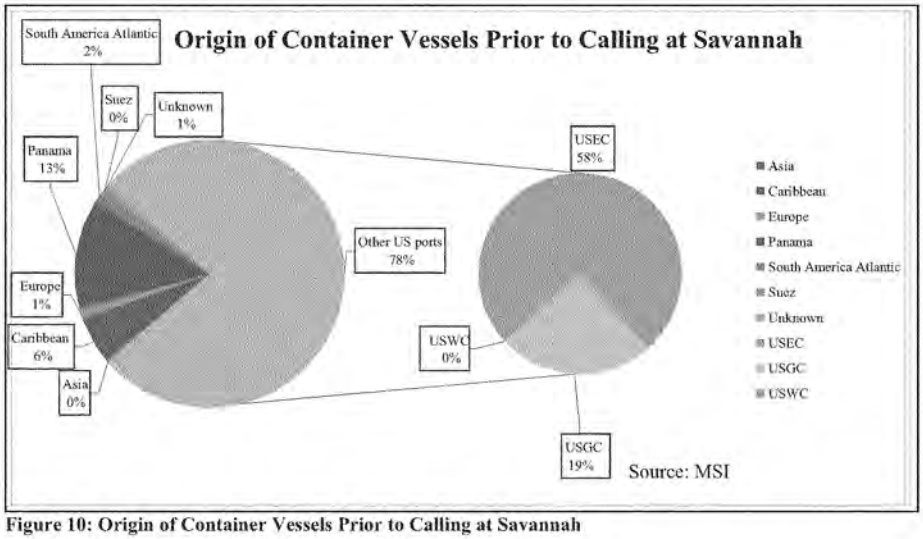


Figure 10: Origin of Container Vessels Prior to Calling at Savannah

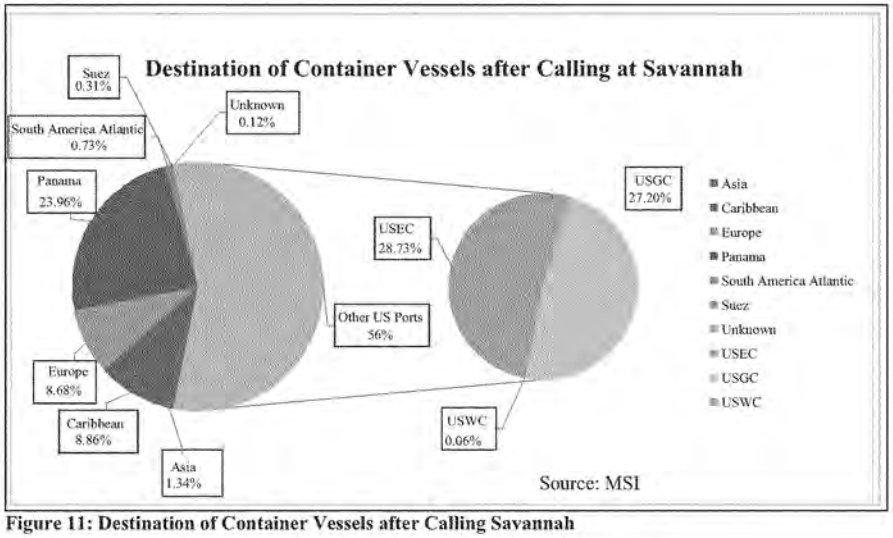


Figure 11: Destination of Container Vessels after Calling Savannah

2.5.3. Trade Balance

The quantity of containerized exports and imports were also examined. A port is said to have "balanced" trade when its exports are equal to its imports. Figure 12 shows Savannah to have larger export traffic (in terms of metric tons) than import traffic for the years 2002 through 2008. This difference is slight, however, and most would categorize Savannah as having a balanced trade. Moreover, this only applies to tonnage, not the number of TEUs, nor the value of the cargo being moved.

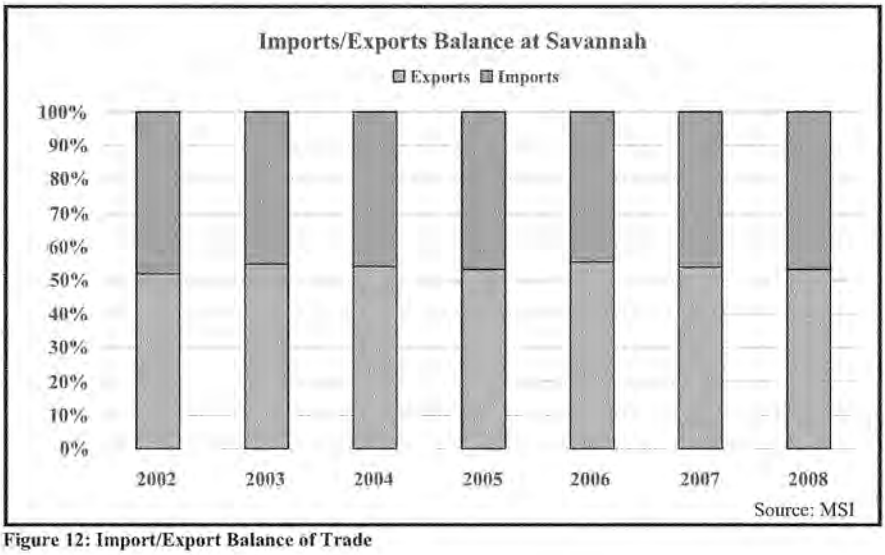


Figure 12: Import/Export Balance of Trade

2.5.4. Historical Calls by Day of Week

Container vessels calling at Savannah have historically been distributed fairly evenly across each day of the week. The peak day has been Mondays with 15 percent of the weekly calls. The low point has been Fridays with an average of 13 percent of weekly calls. Figure 13 displays Waterborne Commerce Statistics data for the years 2002 to 2007 for all vessels calling at Savannah. This analysis was performed as a way of validating whether changes in delivery schedules could be implemented possibly as a non-structural measure of the project. Given that the movements have been evenly distributed, rescheduling does not appear to be a viable non-structural option. Examining the delivery schedule could also be used to estimate the maximum capacity of the port in the future. Much of the vessels originating from Asia tended to call earlier in the week whereas vessels from other world regions called later in the week.

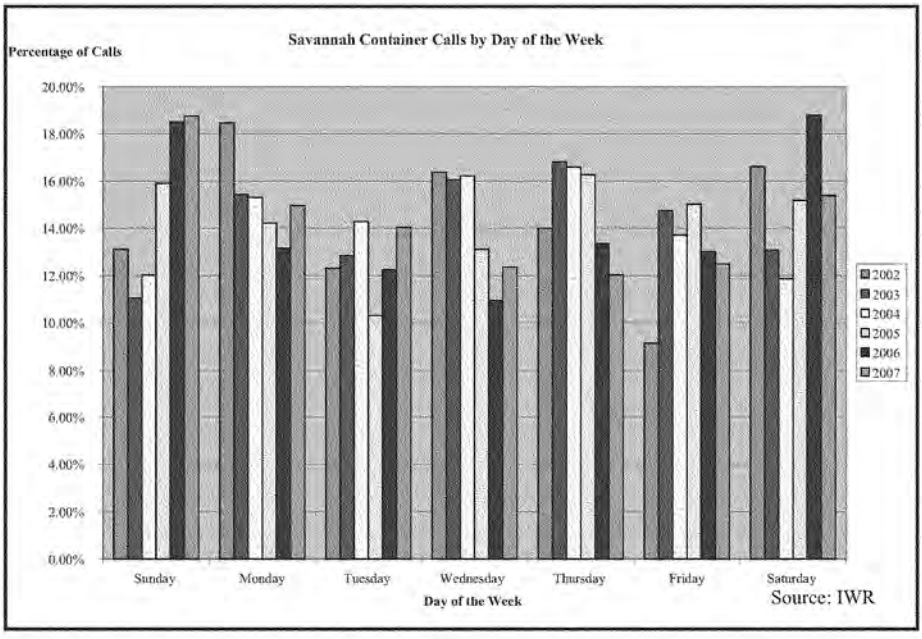


Figure 13: Savannah Container Calls by Day of Week

Table 4 displays this same information in tabular form. For the Garden City Terminal to reach the Georgia Ports Authority's projected future maximum capacity of 6.5 million TEUs per year (estimated to occur in 2030), vessel calls will need to be distributed fairly even across the days of the week similar to historical patterns. Furthermore, round-the- clock operations within the port would need to be abided by to achieve this maximum capacity.

Table 4: Savannah Container Calls by Day of the Week

	2002	2003	2004	2005	2006	2007
Sunday	13.11%	11.05%	12.03%	15.90%	18.51%	18.74%
Monday	18.46%	15.42%	15.31%	14.22%	13.15%	14.96%
Tuesday	12.30%	12.84%	14.29%	10.31%	12.25%	14.04%
Wednesday	16.37%	16.06%	16.22%	13.10%	10.95%	12.36%
Thursday	14.01%	16.81%	16.58%	16.26%	13.35%	12.02%
Friday	9.13%	14.75%	13.71%	15.02%	13.02%	12.50%
Saturday	16.61%	13.08%	11.86%	15.18%	18.77%	15.38%

2.5.5. Liner Services by Region

Competition in liner service can be indicated by the number of operators serving a geographic area. The number of services calling North American ports has doubled from 2001 to 2007. Most of this increase is coming from the Asia to North America trade. The number of services for the Europe to North America has also grown. Figure 14 displays the growth in liner services calling at North American ports by trade regions. The near doubling of the number of services indicates that the environment has become even more competitive for shippers; therefore, further efficiency improvements (slot sharing, consolidations) are likely to be sought by the shipping community.

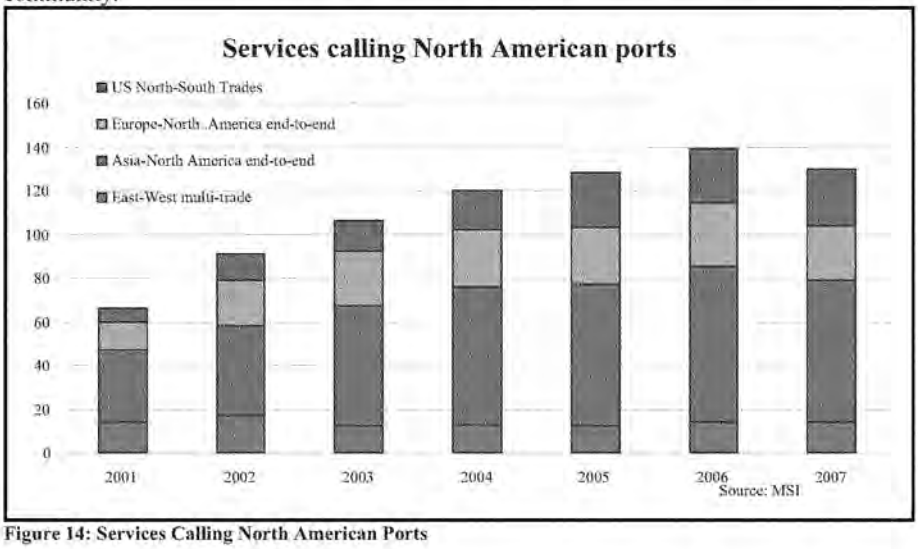


Figure 14: Services Calling North American Ports

2.5.6. Vessel Deployment to North America

By examining the deployment history, reasonable assumptions can be made about deployment in the future. Figure 15 shows total deployment in TEUs by vessel TEU class to the Europe-North America (typically East Coast US) trade from 2000-2007. Vessels above 4,300 TEUs were first introduced to this particular trade in 2002, but in short order these vessels took up an increasing portion of the fleet. Nevertheless this trade deployment continued to feature a large number of smaller class vessels, i.e., including those under 4,300 TEUs over the same time period.

For the Asia to North America route (Figure 16), a different trend emerged as evidenced by the dominance of vessels designed to carry 4,300 TEUs or more. Many of the West Coast ports provide adequate water depths to accommodate such large vessels. Furthermore, many of these vessels do not have to face the limiting constraints of the Panama Canal. MSI and others in the shipping industry, expect that once the Panama Canal expansion is complete in 2014, deployment from Asia to the East Coast will begin to closely resemble the fleet mix calling at the West Coast, which often do not face the limitations of the Panama Canal.

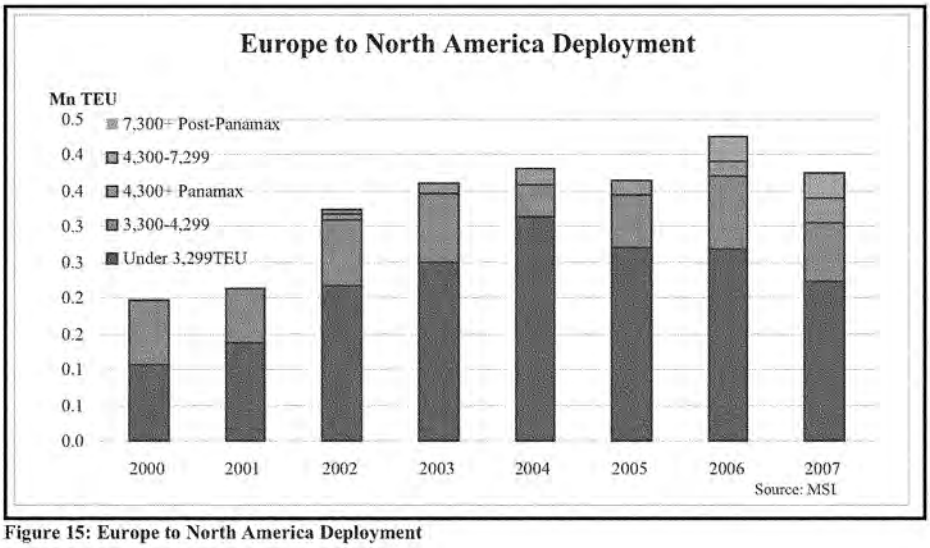


Figure 15: Europe to North America Deployment

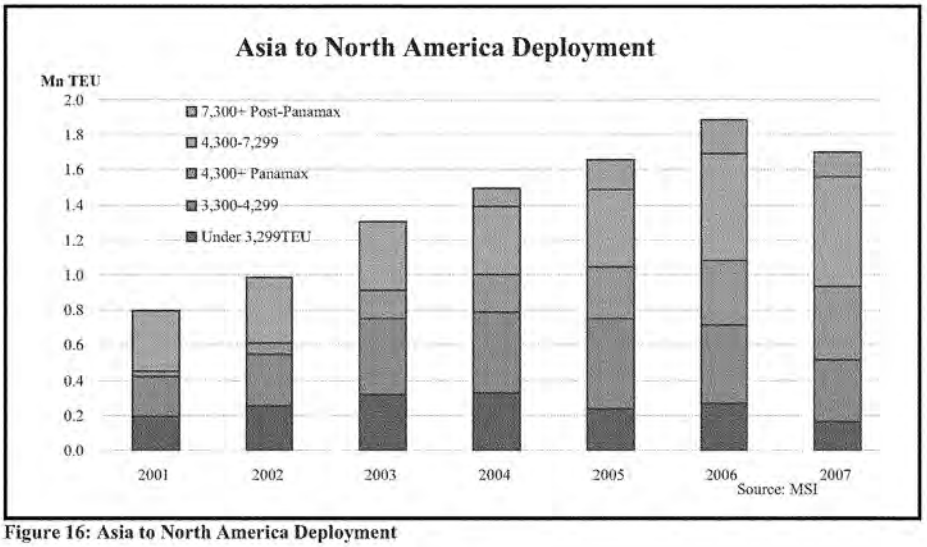


Figure 16: Asia to North America Deployment

2.6. Shipping Operations

Most container vessels calling at Savannah Harbor are part of scheduled liner services that call at multiple East Coast ports in conjunction with Savannah Harbor. Consequently, shippers engage in the practice of "just in time" deliveries of cargo and avoid schedule disruptions whenever possible. There are very few pilot operating restrictions for container traffic transiting the Savannah Harbor. With existing channel dimensions, any container vessel combination (e.g., 2 Post-Panamax or Post-Panamax/Panamax vessels) can pass in the straight channel segments. Container vessels can also pass empty liquid natural gas (LNG) vessels. However, when a loaded LNG vessel is entering the channel, the channel must be clear within 1.5 hours of sailing time or (90,000 feet of a nearby vessel).

2.6.1. Underkeel Clearance

The determination or measure of underkeel clearance (UKC) applied for economic studies is per directive of planning guidance which mandates evaluation of actual vessel operator and pilot practice subject to present conditions with adjustment as appropriate or practical for with-project conditions. Generally, practices for underkeel clearance are determined through review of written pilotage rules and guidelines, interviews with pilots and vessel operators, and analysis of actual past and present practices based on relevant data for vessel movements. With regard to evaluation of data concerning actual practices, typically underkeel clearance is benchmarked or measured relative to measured immersed vessel draft in the static condition (i.e., motionless at dockside). Evaluation of when the vessel is moved or initiates transit relative to immersed draft, tide stage and commensurate water depth allows reasonable evaluation of clearance throughout the course or time of vessel transit within a given waterway. When clearance is measured in the static condition explicit estimation or allowances for squat, trim, and sinkage are unnecessary as the pilot or vessel operator has already accounted for such influences within allowances observed.

Evaluation of all movements renders a distribution of clearance. Evaluation of minimized clearance (i.e., some level of clearance below which operators or pilots will not move a vessel due to concerns for insufficient safety) helps to quantify the window(s) of time each day a given vessel with a specified immersed draft can be moved relative to tide. Given the measurement of clearance in the described manner combined with input from pilots on their practices has revealed that underkeel clearance in Savannah is slightly more than many U.S. coastal ports.

General evaluation of practices for UKC at most coastal ports in the United States has revealed that clearances for all vessel types are often 2.0 to 3.0 feet measured in the static condition for many historical fleets having Panamax or lesser service with an average of approximately 2.7 feet for vessels of Handymax up through about Panamax size. Most coastal ports also have comparatively limited runs or distances between ocean approaches and dock facilities (i.e., less than 20 miles) so loss of tidal advantage during transit is less of a concern compared to Savannah.

Regarding vessel size under with-project conditions, it is understood that most post-Panamax vessels need more clearance depending on blockage factors, currents, and relative confinement of the waterway. As such, most post-Panamax containerships need about 3.3 to 3.6 feet for vessels with breadths of 120 to nearly 150 feet, lengths overall (LOA) approaching 1,150 feet and summer loadline drafts of 46 to approximately 49.0 feet.

At Savannah, the required clearance for vessel sizes of Panamax and up through the first generation of post-Panamax hulls (approximately 123 feet in breadth and up to approximately 1,120 feet in length) based on pilot guidance and actual experience is approximately 4.0 feet. The additional margin above 3.3 to 3.6 feet is due to time for the relatively long run upriver and downriver between the ocean approach and dock facilities (about 25 miles), currents and blockage, and the notable change in salinity and resulting influence for sinkage associated with the more prevalent freshwater environment upriver.

During the course of studies it was discussed with the pilots whether the larger classes of containerships (beyond first generation post-Panamax hulls) would require more clearance and it was indicated that larger hulls would likely require some increase in UKC to maintain an acceptable level of safety though how much had not been determined. Given experience with hydraulics of the waterway, past traffic, and the relative stability in clearance allowances based on size progression from Handymax and Panamax through first generation post-Panamax, it was asked if another quarter of a foot would be sufficient and the pilots indicated this to be acceptable for study purposes with the estimate rounded up to the nearest tenth of a foot (to 4.3 feet) as ultimately applied for analysis of second generation post-Panamax containerships.

As described, container vessels operate with various levels of underkeel clearance (Table 5) accounting for safety, trim, squat and freshwater sinkage. The largest Post-Panamax vessels require more than 4 feet. It is assumed that any Panamax vessel with a reported sailing draft of 38.0 feet or greater and any Post-Panamax vessel with a sailing draft of 37.7 feet or greater are effectively using tide to have sufficient water and clearance to sail at Savannah Harbor.

Table 5: Vessel Underkeel Clearance Requirements

Vessel Class	Total Underkeel Clearance (feet)
Handy Size	3.50
Sub-Panamax	3.75
Panamax	4.00
Post-Panamax Gen 1	4.20
Post-Panamax Gen 2	4.30

2.6.2. Tidal Range

The variability of sea level must be considered when determining the level of water needed for navigation (Figure 17). The Garden City Terminal enjoys a large tide range of 6.9 feet and a wide tide window. Over twenty percent of the Post-Panamax vessels currently calling at Savannah make use of the tide. Currently, Savannah has 100 percent access for vessels drafting

38 feet and less. As larger vessels with potentially deeper sailing drafts call at Savannah in larger numbers, the percent of reliable access depth and the width of the tide window will become a constraint on vessel operations. The following graph shows channel reliability at alternative project depths. The current project depth of 42 feet is 94 percent reliable. That is, it provides at least 42 feet of water 94 percent of the time. The existing condition provides 46 feet of water with 50 percent reliability and 50 feet of water with 5 percent reliability. A project depth of 46 feet would provide 46 feet of water with 94 percent reliability and 50 feet of water with 50 percent reliability. A 48-foot project would provide 50 feet of depth with 68 percent reliability.

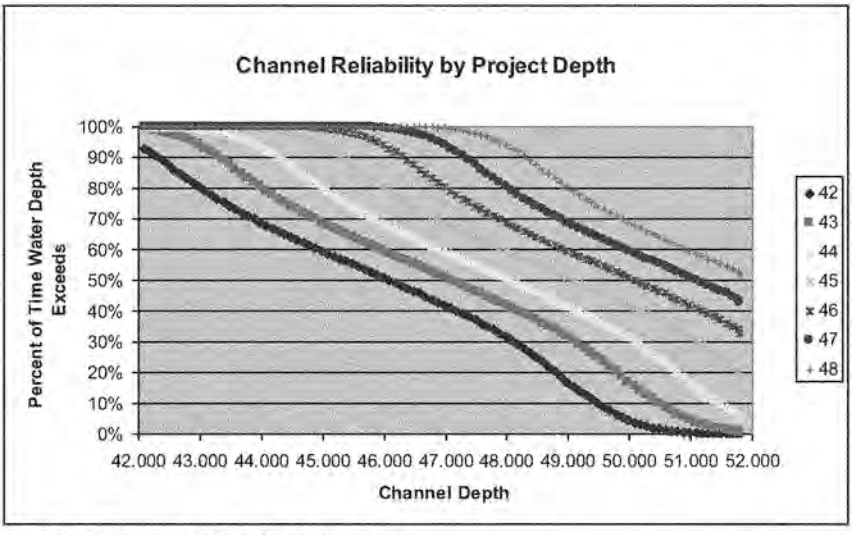


Figure 17: Channel Reliability by Project Depth

2.6.3. Sailing Practices

As shown in Figure 18, the vessel call frequency and sailing drafts grew significantly between 2001 and 2009. At the same time, the number and proportion of larger vessels, i.e., those with operating drafts greater than 35 feet grew at a rapid clip. In the figure below, the purple bars represent vessels drafting 33 to 35 feet, the green bars represent those with a sailing draft of 36 to 38 feet, the orange bars represent vessels sailing at drafts between 39 and 40 feet, and the blue bars indicate those vessels drafting 41 feet or more.

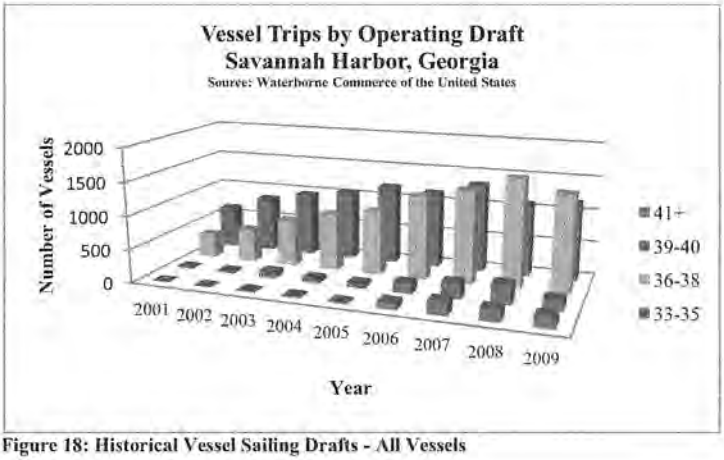


Figure 18: Historical Vessel Sailing Drafts - All Vessels

The recent trend has been even more dramatic. In 2007, there were a total of 2,892 Panamax and Post-Panamax vessel transits at the Garden City Terminal (i.e., 1,446 calls - inbound and outbound). Approximately 45 percent of these transits were on vessels drafting more than 35 feet. Of the total number of transits, approximately 69 percent were by services that transit the Panama Canal: ECUS AU PEN, FE ECUS EU PEN, FE ECUS MED PEN, FE (Panama) ECUS, RTW and AU ECUS EU PEN. As shown in Table 6 many of these vessels typically operated at drafts approaching the depth limitations of the Canal. This suggests that the current dimensions of the canal are a limiting factor when considering the depth at which vessels call on the Savannah Harbor and other U.S. East Coast ports. It should be noted that several of these services have stops at Manzanillo, Panama or Kingston, Jamaica prior to or after calling on Savannah Harbor. These stops are made in effort to redistribute or load more cargo after transiting the canal or to offload cargo before entering the canal[9]. The maximum Panama Canal draft is nearly identical to the existing project at Savannah Harbor with allowance for underkeel clearance. The maximum Canal transit is 39.5 feet Tropical Fresh Water, which is close to the maximum fresh water available at Savannah River upstream near Garden City terminal. Table 7 displays the number of Post-Panamax transits at Savannah in 2007. Since they bypassed the Panama Canal, only two services deployed Post-Panamax vessels, i.e., those on the Far East (Suez) ECUS and the ECUS EU GULF PEN routes.

[9] According to internet sources, Manzanillo, Panama has channel and pier depths of 46 feet. Kingston, Jamaica channel depth is 36-40 feet; however, dredging contracts have been issued to deepen Kingston's navigation channel to 51.5 feet.

Table 6: 2007 Panamax Vessel Transits – Sailing Draft

World Region Service	Vessel Sailing Draft									
	<36	37	38	39	40	41	42	43	44	TOTAL
ECUS Africa	0	0	0	0	0	0	0	0	0	0
AU ECUS EU PEN	14	0	0	0	0	0	0	0	0	14
ECUS WCSA-ECSA	59	7	6	2	2	1	0	0	0	77
ECUS EU GULF PEN	93	1	0	0	0	0	0	0	0	94
ECUS MED	221	20	24	8	7	14	23	1	0	318
FE ECUS EU PEN	82	44	68	49	48	19	3	0	0	313
FE ECUS MED PEN	29	28	41	24	17	23	44	1	0	207
FE (Panama) ECUS	841	241	220	53	27	16	3	0	0	1,401
FE (Suez) ECUS	132	29	32	12	9	5	9	2	0	230
RTW	23	15	17	4	0	0	0	0	0	59
TOTAL	**1,494**	**385**	**408**	**152**	**110**	**78**	**82**	**4**	**0**	**2,713**
PERCENT OF TOTAL	**55%**	**14%**	**15%**	**6%**	**4%**	**3%**	**3%**	**0%**	**0%**	**100%**

Table 7: 2007 Post-Panamax Vessel Transits - Sailing Draft

World Region Service	Vessel Sailing Draft									
	<36	37	38	39	40	41	42	43	44	TOTAL
ECUS Africa	0	0	0	0	0	0	0	0	0	0
AU ECUS EU PEN	0	0	0	0	0	0	0	0	0	0
ECUS WCSA-ECSA	0	0	0	0	0	0	0	0	0	0
ECUS EU GULF PEN	6	6	4	1	2	9	26	0	0	54
ECUS MED	0	0	0	0	0	0	0	0	0	0
FE ECUS EU PEN	0	0	0	0	0	0	0	0	0	0
FE ECUS MED PEN	0	0	0	0	0	0	0	0	0	0
FE (Panama) ECUS	0	0	0	0	0	0	0	0	0	0
FE (Suez) ECUS	96	14	11	1	1	1	1	0	0	125
RTW	0	0	0	0	0	0	0	0	0	0
TOTAL	**102**	**20**	**15**	**2**	**3**	**10**	**27**	**0**	**0**	**179**
PERCENT OF TOTAL	**57%**	**11%**	**8%**	**1%**	**2%**	**6%**	**15%**	**0%**	**0%**	**100%**

Table 8 provides a summary of the total Panamax and Post-Panamax transits by sailing draft. In comparison to other services, the FE (Panama) ECUS service utilized the channel more frequently at depths of 38 feet or more (319 total transits).

Table 8: 2007 Panamax and Post-Panamax Vessel Transits - Sailing Draft

World Region Service	Vessel Sailing Draft (feet)									
	≤36	37	38	39	40	41	42	43	44	TOTAL
AU ECUS EU PEN	14	0	0	0	0	0	0	0	0	14
ECUS WCSA-ECSA	59	7	6	2	2	1	0	0	0	77
ECUS EU GULF PEN	99	7	4	1	2	9	26	0	0	148
ECUS MED	221	20	24	8	7	14	23	1	0	318
FE ECUS EU PEN	82	44	68	49	48	19	3	0	0	313
FE ECUS MED PEN	29	28	41	24	17	23	44	1	0	207
FE (Panama) ECUS	841	241	220	53	27	16	3	0	0	1401
FE (Suez) ECUS	228	43	43	13	10	6	10	2	0	355
RTW	23	15	17	4	0	0	0	0	0	59
TOTAL	**1,596**	**405**	**423**	**154**	**113**	**88**	**109**	**4**	**0**	**2,892**
PERCENT OF TOTAL	**55%**	**14%**	**15%**	**5%**	**4%**	**3%**	**4%**	**0%**	**0%**	**100%**

By 2008, the inadequate channel depth caused one carrier to temporarily dropping one of its Savannah legs from its rotation due to the increased demand for cargo moving from the United States to Europe. For many other carriers, it meant loading the vessels light. These types of disruptions can be very costly and illustrate the detrimental impacts that channel depth constraints can have on a port's operations. Moreover, these disruptions are likely to increase in the future as carriers shift to larger, more efficient vessels.

Total U.S. container traffic fell slightly in early 2008. With the dollar's decline in value, U.S. imports were down; however, exports increased. According to an article in Traffic World published on 23 June 2008, the ports of Savannah, Los Angeles, and Long Beach boasted huge first quarter increases in exports over the same timeframe in 2007 – up 25 percent, 23 percent and 19 percent, respectively. However, a big issue facing U.S. ports at that time was an inadequate supply of empty containers given the surge in exports relative to imports and the weak dollar. Savannah Harbor's exported cargo (e.g., frozen poultry, lumber, linerboard, kaolin clay, etc.) typically weighs more than its imported retail products. With one loaded export box taking the place of approximately 6 empty boxes, transport and repositioning of empty boxes to be returned for import products creates problems for ports experiencing channel depth constraints. This issue is currently compounded by the limitations not only imposed by channel depth at Savannah but also by the Panama Canal.

2.7 Design Vessel

The post-Panamax S-class containership, the *Susan Maersk*, was chosen as the design vessel for the Savannah Harbor Expansion Project in September 2001. The *Susan Maersk* is considered the best representation of the vessel of the future considering length, width and draft. Dimensions of the *Susan* or "S" Class Maersk are: 1,138 ft long, 140.4 ft wide, 47.6 ft design draft.

A preliminary channel layout for a 48 ft project depth channel was developed by Savannah District based on EM 1110-2-1613, *Hydraulic Design Guidance for Deep-Draft Navigation Projects*. This guidance states that "the design channel width for navigation projects with maximum currents greater than 3.0 knots should be developed with the assistance of a ship simulator design study". Savannah Harbor routinely experiences currents greater than 3.0 knots. Paragraph 7c of ER 1110-2-1403, *Studies by Coastal, Hydraulic, and Hydrologic Facilities and Others*, 1 January 1998 states that "Hydraulic design studies associated with the planning, design, construction, operation, and maintenance of navigation channels will include a ship or tow simulation investigation unless omission of such an investigation is approved by HQUSACE". Ship simulation was conducted by ERDC for the SHEP and details are documented in the reports titled: 1) *Navigation Study for Savannah Harbor Channel Improvements 2004* 2) *Savannah Harbor Simulations Study 2009* 3) *Savannah Harbor Entrance Channel Simulations 2010 Report* 4) *Vertical Ship Motion Study for Savannah, GA Entrance Channel 2010*. These documents are included in the Engineering Investigations Supplemental Materials and the Channel Design Drawings, including typical sections, are located in Attachment 1 to the Engineering Investigations Appendix.

3. FUTURE CONDITIONS - WITHOUT AND WITH PROJECT

3.1. Garden City Terminal

The GPA's capital improvement plan includes many equipment purchases and upgrades, transportation infrastructure improvements, and container storage area expansions. The plan states that the Garden City Terminal will have 33 ship-to-shore (STS) cranes operational by 2020. GPA plans to purchase 4 cranes in 2013, which will go into operation in 2015. At that time their two oldest cranes will be taken out of service. Therefore, Garden City Terminal will have 25 Post-Panamax and super Post-Panamax STS cranes in operation in 2015. GPA will purchase another 4 super Post-Panamax cranes in 2016 which will be put into service in 2018. This will be followed by purchase of another 4 super Post-Panamax cranes in 2018 which will be put into service in 2020.

The GPA is transitioning from using a combination of top-lifts and rubber-tired gantries (RTG's) to an all RTG operation in the container field. This will allow the port to move the stacks closer together thereby increasing capacity. The total RTG's that will be needed for the container field is 169. Garden City Terminal currently has 71 RTGs in operation with 25 on order. By 2012, they will have 96 RTG's in operation, by 2015 there will be 138, and by 2020 the GPA will have acquired the noted 169.

Planned infrastructure improvements include the construction of a new 8 lane gate on the west side of the terminal at Grange Road. This gate will be completed in 2015. Additionally, expansion of Gate 4 from 15 to 24 lanes will be completed in 2014.

Other improvements include additional rail and automation features to be added to the Chatham Yard ICTF between 2015 and 2019. Further, the Mason ICTF will be expanded in two phases. The first phase will be constructed in 2014 and second phase will be constructed in 2019.

Three areas will be specified at the rear of the container terminal for empties. Each will be complete with rail mounted gantry cranes. The stacks will be more densely configured to create more storage. Each segment of berth will have a designated area, which will be constructed in phases: Container Berth (CB) 7-9 in 2011; CB 4-6 in 2013; and CB 1-2 in 2015.

Personal parking will also be consolidated on the terminal to three separate, distinct areas. These will all be constructed by 2012. Finally, additional reefer racks will be added throughout the terminal. Construction of the racks will be completed in 2015. Each of these improvements will be accomplished within the existing footprint of the Garden City Terminal. It is important to note that all these investments are in the works regardless of whether or not federal navigation improvements are made[10].

[10] The assumptions pertaining to crane capability have been consistently applied to the without and with project conditions.

3.2. Operations

Nine of the top ten carriers at GPA (based upon TEUs for July 2004 through June 2005) were interviewed in May-June 2006 to update information that had previously been provided and confirm assumptions used in the benefits model. Several carriers have been contacted since 2006 for further confirmation. Each of the carriers interviewed were very supportive of channel modification at Savannah Harbor and stated that without a deeper channel, shipping inefficiencies would worsen given the growth in cargo and the increased vessel sizes (Attachment 1 – Carrier Letters). Under future conditions, the ECUS AU PEN, AU ECUS EU PEN and the ECUS WCSA-ECSA services will continue to operate as they have historically. Their respective vessel fleets are comprised of Handysize, Sub-Panamax and/or Panamax vessels which have utilized the existing channel at depths far less than what is available. Interviews with these carriers confirmed that their existing fleet will meet future service needs. As a result, these services were excluded from deepening benefits. However, the total number of calls for services was applied to the meeting area and tidal delay analysis.

In 2006, the Panama Canal Authority (ACP) announced plans for expansion of the Panama Canal. Their announcement came at the end of a multi-year comprehensive study and analysis by the ACP. Panama's president recommended Canal expansion to the National Assembly and it was passed during a national referendum before the Panamanian people at the end of 2006. Design plans include lock chambers of 1,400 feet long, 180 feet wide and 60 feet deep. Accordingly, the expansion will provide the capacity to accommodate vessels up to 1,200 feet long, 160 feet wide and 50 feet deep, or with a cargo volume up to 170,000 DWT and 12,000 TEU. The current project schedule has construction being completed in 2014; however, when interviewed regarding expansion plans, representatives of the ACP noted that the schedule was extremely conservative and construction would likely be completed in 2013, making the expanded canal available for use in 2014. The project is estimated to cost $5.25 billion and will be funded through a variety of sources including existing ACP resources, toll increases, and external sources (e.g., bond, series of bonds, or credit).

The Panama Canal's expansion will pave the way for larger containerships to be deployed to the U.S. East Coast. Presently, the Panama Canal has restricted container traffic shipments to vessels drafting less than 39.5 feet. This essentially prevented any Far East/East Coast US shipments from taking advantage of the economies of scale of loading larger ships to deeper sailing drafts. In the evaluation of without project conditions for the Savannah Harbor Expansion Project, the PDT assumed that the expansion of the Panama Canal would be completed by 2014 and that carriers would begin making adjustments to their fleet soon after, in 2015. This practice has been proven historically (i.e., maximizing vessel size through the canal) and was further supported by the carrier interviews. To back up this claim, the PDT examined new vessel orders and found them to be largely comprised of Post-Panamax vessels. Accordingly, it was assumed that by 2015 the following Panama Canal services will begin to shift their existing vessel fleet, from mainly Panamax vessels, to a mix of Panamax and Post-Panamax vessels: FE ECUS EU PEN, FE ECUS MED PEN, FE (Panama) ECUS, and RTW.

Construction of the Panama Canal expansion is underway and on schedule for opening on its 100th anniversary in 2014.

Both the ECUS MED and ECUS EU GULF PEN services will also begin to shift to a Panamax and Post-Panamax vessel fleet by 2015. These shifts reflect carrier trends to retire older, smaller vessels out of the existing fleet and upgrade with larger vessels which meet the needs of their operations.

The FE (Suez) ECUS service already has an existing fleet comprised of Panamax and Post-Panamax vessels and will continue to replace older, smaller vessels with larger vessels that meet their operational needs.

3.3. Commodity Forecast

3.3.1. Baseline

An essential step when evaluating navigation improvements is to analyze the types and volumes of cargo moving through the port. Detailed cargo history, provided that it is accurate and representative of trends, can offer key insights into a port's long term trade forecast (i.e., the estimated cargo volume upon which future vessel calls are based). Under future with project conditions, the same volume of cargo is assumed to move through Savannah Harbor; however, a deepening project will allow shippers to load their vessels more efficiently or take advantage of larger vessels[11]. This is the main driver of the NED benefits.

In an effort to reduce the impact that any single year or potential anomalies in trade volume may have on the long term forecast, six years of data was utilized in establishing the baseline for the commodity forecast. Data started with 2005 and extended through calendar year 2010. As such, the historical record captured both prosperous port years as well as the economic downturn which occurred in the 2008-2009 timeframe.

Since there was fluctuation in the historical record, a regression analysis of the data was performed to establish the new 2010 starting point for the import and export forecasts (Table 9 and Table 10). It was used for all services with the following exceptions. Over the past 6 years, the ECUS Africa service has called on Savannah Harbor somewhat intermittently. Accordingly, trade on this world region route was averaged and used as its baseline. For the FE ECUS EU PEN, 2010 trade levels actually dropped below that experienced in 2009 and on the FE (Panama) ECUS service, 2010 trade grew only slightly above that of the prior year. Since historically there had been fairly significant growth on these routes, the regression analysis resulted in 2010 estimates that were higher than that realized during the 2010 calendar year. As such, trade on these routes was capped at that which actually occurred in 2010.

[11] In 2006, a multiport study of various hinterland origins and destinations and various Mid-Atlantic and South Atlantic ports was performed for the SHEP. This study found that with harbor expansion, there would be no substantial changes in origins or destinations of imports and exports to key US markets served by Savannah. Based upon this prior study, a basic assumption in this study effort is that there would not be substantial changes in the hinterland service area and thus no change in overall cargo volume without and with channel improvements at Savannah Harbor.

3.3.1.1. Containerized Imports

Table 9 illustrates historical containerized imports (metric tons) moved through the Savannah Harbor between 2005 and 2010. The table includes the 2010 baseline as determined through methods mentioned in the preceding paragraph.

As shown in Table 9, containerized imports grew from 5.3 million metric tons in 2005 to 7.3 million metric tons in 2010. Trade with Northeast Asia dominated Savannah's import market, followed by Southeast Asia and Northern Europe, respectively. Furniture has been the top import commodity since 2005 (in terms of TEU volume)[12]. Following furniture, Savannah's leading commodities include retail consumer goods; machinery, appliances and electronics; hardware and housewares; food; automotive; apparel; toys; minerals; and rugs, sheets, towels, and blankets. For the new 2010 baseline (last column in the table), imports from all world regions were estimated to total approximately 6.8 million tons. This import trade volume represents the baseline from which forecast commerce was then calculated.

Table 9: Historical Containerized Imports (metric tons)

World Region	World Region Service	2005	2006	2007	2008	2009	2010	2010 Baseline
		(metric tons)						
Africa	ECUS AFRICA	16,857	1,406	-	-	-	-	3,044
Oceania	ECUS AU PEN	45,366	4,548	-	-	137,660	105,682	62,554
Oceania	AU ECUS EU PEN	4,953	175,523	310,910	426,778	66,878	84,803	228,208
ECSA/WCSA	ECUS WCSA-ECSA	131,720	226,075	379,351	364,290	233,909	270,875	318,004
N Europe	ECUS EU GULF PEN	19,546	114,500	145,366	55,173	148,582	464,815	317,883
MED	ECUS MED	281,827	310,637	324,140	200,750	263,771	303,187	269,491
NE Asia	FE ECUS EU PEN	800,447	733,373	767,942	1,309,812	1,033,754	700,211	700,211
NE Asia	FE ECUS MED PEN	613,603	598,308	516,637	557,397	427,819	544,873	484,938
NE Asia	FE (Panama) ECUS	2,608,255	2,723,926	3,266,646	2,837,208	2,247,652	2,277,866	2,277,866
NE Asia	RTW	185,344	233,667	139,354	-	315,103	793,893	502,729
SE Asia	FE (Suez) ECUS	593,443	676,684	1,309,872	1,511,875	1,133,068	1,737,311	1,681,126
Total		**5,301,363**	**5,798,647**	**7,160,219**	**7,263,284**	**6,008,197**	**7,283,516**	**6,846,053**

Source: Georgia Ports Authority

3.3.1.2. Containerized Exports

Containerized exports grew from 7.4 million metric tons in 2005 to 11.8 million metric tons by 2010 (Table 10). As with imports, containerized trade with Northeast Asia dominated the Savannah Harbor's export market with just under one half of Savannah's exports destined for this world region. The new 2010 baseline totaled approximately 11.3 million metric tons. Savannah is one of the few ports in the U.S. in which its exports (expressed in metric tons) have historically exceeded its imports. However, since the cargo weight of exports are considerably higher than that of imports, the number of Savannah's TEU imports has exceeded the number of TEU exports.

From 2005 to 2010, wood pulp was the leading export commodity shipped from Savannah. In 2005 and 2006, clay was the next largest commodity group; however, by 2007, TEU volume for

[12] Georgia Ports Authority website –www.gaports.com

clay had fallen, placing it in fourth after paper and paperboard and food, a trend which continued through 2010. Other leading commodity exports during the 2005 to 2010 timeframe consisted of: retail consumer goods; chemicals; machinery, appliances and electronics; resins and rubber; automotive; fabrics including raw cotton; and other commodities.

Table 10: Historical Containerized Exports (metric tons)

World Region	World Region Service	2005	2006	2007	2008	2009	2010	2010 Baseline
		(metric tons)						
Africa	ECUS Africa	44,216	7,297	-	-	-	-	8,586
Oceania	ECUS AU PEN	112,681	12,018	-	-	392,018	438,094	253,538
Oceania	AU ECUS EU PEN	2,849	209,631	436,210	632,382	115,576	162,630	414,047
ECSA/WCSA	ECUS WCSA-ECSA	191,533	231,437	422,925	414,506	493,857	829,084	713,885
N Europe	ECUS EU GULF PEN	23,321	188,786	263,287	80,319	586,370	802,164	674,327
MED	ECUS MED	587,291	659,080	930,679	787,731	1,241,854	1,272,171	1,272,404
NE Asia	FE ECUS EU PEN	1,037,912	1,122,315	941,704	1,860,804	1,383,200	871,756	871,756
NE Asia	FE ECUS MED PEN	652,515	629,196	617,640	859,299	692,778	875,470	831,662
NE Asia	FE (Panama) ECUS	3,908,159	4,038,746	4,560,683	4,154,449	3,680,376	3,167,768	3,167,768
NE Asia	RTW	158,402	139,044	169,682	-	345,634	709,391	482,623
SE Asia	FE (Suez) ECUS	702,381	828,944	1,834,138	2,261,260	1,784,586	2,672,025	2,619,289
Total		**7,421,260**	**8,066,495**	**10,176,949**	**11,050,751**	**10,716,249**	**11,800,552**	**11,309,885**

Source: Georgia Ports Authority

Table 11 summarizes the 2010 baseline by world region and service route for both imports and exports.

Table 11: Commodity Forecast Baseline

World Region	World Region Service	Imports	Exports
		(metric tons)	
Africa	ECUS Africa	3,044	8,586
Oceania	ECUS AU PEN	62,554	253,538
Oceania	AU ECUS EU PEN	228,208	414,047
ECSA/WCSA	ECUS WCSA-ECSA	318,004	713,885
N Europe	ECUS EU GULF PEN	317,883	674,327
MED	ECUS MED	269,491	1,272,404
NE Asia	FE ECUS EU PEN	700,211	871,756
NE Asia	FE ECUS MED PEN	484,938	831,662
NE Asia	FE (Panama) ECUS	2,277,866	3,167,768
NE Asia	RTW	502,729	482,623
SE Asia	FE (Suez) ECUS	1,681,126	2,619,289
Total		**6,846,053**	**11,309,885**

3.3.2. Trade Forecast

3.3.2.1. Background

The draft Economics Appendix made available for public review in December 2010 utilized a commodity forecast baseline established by determining the weighted average of the historical data (2005-2007). However, during the draft SHEP report public review and comment period, the analysis was updated to extend the historical record to include calendar years 2008-2010. As

such, the preceding document section described the evaluation performed to establish the current baseline. The text describes this updated analysis and does not include a description of the prior methodology as the process was revised due to inclusion of a longer period of record for baseline estimation. Document sections that follow include a description of the methodologies utilized to develop the import and export long term trade forecasts for the December 2010 draft report and for this document. Initial sections describe the original analysis as this background is required to understand the relationship and application of the new forecast.

There are several ways to develop a long term trade forecast for a navigation study: the analyst develops the forecast using readily available indices, forecasts are obtained from a reputable firm specializing in the type of forecast required; and/or a combination of the aforementioned methods. The latter method was employed for establishing a commodity forecast for the SHEP.

First, Corps analysts established the forecast baseline from historical trade information. Next, a long term trade forecast for the North Atlantic Region, South Atlantic Region, and the Savannah Harbor was obtained from IHS Global Insight (GI). This first GI forecast was obtained in 2008. In lieu of strictly using the GI trade forecast, the Corps decided that using the Corps' baseline established through empirical data provided by the GPA and applying growth rates calculated from the GI forecast would result in a forecast with less uncertainty than that which is typically present in long term forecasts. The following paragraphs describe the process utilized for developing the long term containerized trade forecasts for Savannah Harbor.

3.3.2.2. IHS Global Insight

In November 2008, containerized trade forecasts were obtained from GI. GI is a well-known consulting firm that provides comprehensive economic and financial information on countries, regions and industries. When making global trade forecasts, GI employs sophisticated macroeconomic models which contain all commodities that have physical volume. The commodities are then grouped into 77 categories derived from the International Standard Industrial Classification. GI tracks 54 major countries then groups the remaining world trade partners into 16 regions according to their geographic location. Accordingly, they forecast 77 commodities among 70 countries or regions and include 270,000 trade flows.

3.3.2.2.1. GI Trade Data Sources. GI obtains trade history data from several sources: Statistics Canada, OECD International Trade by Commodity Statistics, U.S. Customs, and IMF Direction of Trade. The primary data source is the United Nations, information from which is processed and published by Statistics Canada. Custom agencies in United Nations member countries are the origin of these export and import trade statistics.

U.S. Customs data and IMF Direction of Trade data are used to calibrate and supplement that obtained from Statistics Canada. Data is then recorded in different classification systems and units of measurement, converted into thousands of current U.S. dollars and converted into 1997 real commodity value.

GI world trade forecast models utilize its comprehensive macroeconomic history and forecast databases and in particular, data on population, GDP, GDP deflators, industrial output, foreign

exchange rates, and export prices by country. These data are used as exogenous variables in the trade forecast models.

3.3.2.2.2. ***GI Model Structure.*** The basic structure of the nonlinear, multi-stage switch trade flow models assumes that a country's import from another country '…are driven by the importing country's demand forces, enabled by the exporting country's capacity of exporting (supplying) the commodity, and affected by the exporting country's export price and importing country's import cost for the commodity. A country will import more of a commodity if its demand for this commodity increases. At the same time, the country will import more of this commodity from a particular exporting country if that exporter's capacity to export this commodity is larger and its export price for this commodity is lower than in other exporting countries.' Accordingly, importers purchasing based on delivered cost will import more when the cost decreases. Note that distance between countries is an important factor when determining the scale of trade between countries; therefore, distance as a constant is embedded in GI models to help determine the scale of the base.

3.3.2.2.3. ***GI Trade Forecasts – 2008.*** As mentioned, the GI trade forecast for Savannah included 70 countries (e.g., Italy) or region (e.g., Western Africa). To utilize the data for the SHEP, the locations were first grouped by the world region where they are geographically located. The world regions which trade with Savannah Harbor were used for this grouping: Africa, East Coast South America, Mediterranean, Northeast Asia, Europe, Oceania, Southeast Asia and West Coast South America. Table 12 lists the world region applied to the SHEP study and the respective country or blocks of countries that fall within region.

Table 12: Trade Partner and World Region Groupings

SHEP World Region	Global Insight Trade Locations
Africa	Kenya; Other East Africa; Other North Africa; Other Southern Africa; South Africa; Western Africa
East Coast South America	Argentina; Brazil; Caribbean Basin; Mexico; Other East Coast of S. America; Venezuela
Mediterranean	Israel; CIS West; France; Greece; Italy; Other Mediterranean Region; Portugal; Spain; Turkey
Northeast Asia	Taiwan; Hong Kong; China; Japan; Other Asia; South Korea; Canada[13]; Caribbean Basin; Central America
Europe	Baltics; Belgium; Denmark; Finland; Ireland; Norway; Sweden; United Kingdom; Bulgaria; Czech Republic; Hungary; Poland; Romania; Russia; Austria; Germany; Netherlands; Other Europe; Slovak Republic; Switzerland
Oceania	Australia; New Zealand
Southeast Asia	CIS Southeast; Indonesia; Malaysia; Other Asia; Philippines; Singapore; Thailand; Vietnam; Cambodia; India; Other Indian Subcontinent; Egypt; Saudi Arabia; United Arab Emirates; Other Arabian Gulf; Pakistan
West Coast South America	Chile; Colombia; Other West Coast of S. America; Peru

[13] Canada was included in the Northeast Asia world trade region because Savannah Harbor container services calling on Canada originate in Northeast Asia.

3.3.2.2.3.1. ***GI's Containerized Imports.*** The GI database obtained for SHEP contained over 181,000 rows of cargo-related data; the following table was developed to summarize pertinent information regarding Savannah's import commodities and associated trade partners. Savannah's top ten import trade regions are identified in Table 13. The first column provides the commodity's country or region of origin (World Trade Service (WTS) Region). The second column (Commodity Description) provides a description of the commodity being imported. For each country or trade region, the top five commodities (in terms of total tonnage) are then displayed, along with their corresponding tonnage and TEU volume. The fifth and sixth columns (Tons-Sum and TEUs-Sum, respectively) identify total tons and TEUs for those leading commodities. The final columns identify total tons and TEUs for all commodities imported from the trade region. For example, imports from China dominated the Savannah Harbor import trade market. The leading commodity group imported from China was furniture and fixtures, accounting for 541,146 tons (123,482 TEUs). The top five commodities imported from China totaled 1.621 million tons (300,340 TEUs) or about 50 percent of total containerized goods imported from China (3.256 million tons or 555,352 TEUs). In 2007, the top ten import trade partners (shown below) accounted for over 71 percent of total Savannah Harbor containerized imports. It should be noted that total tonnages as reported from GI's database vary slightly from the figures reported by the GPA.

Table 13: GI Reported Containerized Commodities - 2007 Imports

WTS Region	Commodity Description	Tons-Sum	TEUs-Sum	Tons-Sum	TEUs-Sum	Total Tons	Total TEUs
		Top five commodities				*All commodities*	
China	Furniture and Fixtures	541,146	123,482				
	Other Manufacturing, nec.	393,846	96,990				
	Metal Products	315,461	36,406				
	Non-Metallic Products, nec.	186,399	16,838				
	Plastic Products, nec.	184,569	26,625	1,621,420	300,340	3,255,760	555,352
Brazil	Non-Metallic Products, nec.	179,507	16,215				
	Textiles	56,575	8,076				
	Iron and Steel	46,702	3,327				
	Cork and Wood	33,951	4,137				
	Wood Products	32,633	3,831	349,368	35,586	447,027	50,061
Italy	Non-Ferrous Metals	639	67				
	Grain	152	18				
	Inorganic Chemicals	1,561	174				
	Iron and Steel	5,943	470				
	Leather and Products	17	3	8,311	732	373,750	41,287
Japan	Iron and Steel	72,887	5,193				
	Machinery and Equipment, nec.	38,689	5,576				
	Special Industrial Machinery	36,172	4,808				
	Parts of Motor Vehicles	31,071	4,315				
	Rubber Products	23,182	4,900	202,002	24,793	335,920	41,108
Germany	Electrical Appliances and Housewares	36,095	6,016				
	Wood Products	35,722	4,659				
	Synthetic Resins	19,205	2,381				
	Petroleum Refineries	18,509	1,699				
	Iron and Steel	16,673	1,320	126,203	16,075	298,840	37,434
Thailand	Natural Rubber	63,111	6,126				
	Wearing Apparel	23,001	4,863				
	Non-Metallic Products, nec.	20,786	1,878				
	Iron and Steel	15,484	1,103				
	Furniture and Fixtures	12,993	2,746	135,374	16,717	265,660	34,695
South Korea	Synthetic Resins	107,348	13,253				
	Special Industrial Machinery	28,200	3,748				
	Textiles	23,459	3,349				
	Metal Products	19,741	2,278				
	Rubber Products	16,915	3,575	195,663	26,203	262,924	34,275
India	Textiles	39,023	5,570				
	Non-Metallic Products, nec.	32,222	2,911				
	Iron and Steel	28,053	1,999				
	Agricultural Machinery	17,298	2,302				
	Wearing Apparel	10,201	2,157	126,797	14,939	196,385	24,350
Taiwan	Metal Products	41,703	4,813				
	Synthetic Resins	23,862	2,946				
	Rubber Products	20,189	4,267				
	Iron and Steel	14,603	1,040				
	Furniture and Fixtures	11,403	2,410	111,760	15,477	192,973	26,932
Indonesia	Natural Rubber	49,570	4,812				
	Wearing Apparel	22,478	4,753				
	Furniture and Fixtures	20,822	4,401				
	Other Food	13,060	1,295				
	Wood Products	10,147	1,191	116,078	16,452	187,081	26,455
SUBTOTAL TOP TEN WORLD REGIONS				**3,251,578**	**493,454**	**5,816,318**	**871,950**
TOTAL IMPORTS						**8,149,133**	**1,159,226**

Source: IHS Global Insight

Table 14 displays GI's imports forecast by world region for selected years occurring over the forecast period. The world region aggregate was developed by combining the tonnages from each country or region identified in Table 12. GI's forecast indicates that Northeast Asia will remain the major source of Savannah Harbor imports, growing to 12.5 million metric tons by 2028. Similarly, Southeast Asia will continue to follow this world region in terms of total import volume (metric tons).

Table 14: GI's Savannah Harbor Containerized Trade Forecast – Imports (metric tons)

SHEP World Region	2015	2020	2025	2026	2027	2028
	(metric tons)					
Africa	30,729	35,155	42,498	43,417	45,647	46,661
ECSA[14]	734,114	881,747	1,109,270	1,145,539	1,207,584	1,252,345
Mediterranean	1,237,171	1,444,858	1,732,464	1,769,677	1,842,109	1,896,237
Northeast Asia	6,460,416	8,271,695	10,761,609	11,229,087	11,934,618	12,466,810
Europe	911,307	1,076,378	1,284,336	1,319,408	1,376,644	1,416,841
Oceania	216,917	259,923	319,663	320,238	332,902	344,123
Southeast Asia	1,740,846	2,125,556	2,678,188	2,805,041	2,954,348	3,092,080
WCSA[15]	210,839	242,562	304,335	310,491	325,478	337,886
Total Imports	**11,542,339**	**14,337,875**	**18,232,363**	**18,942,898**	**20,019,330**	**20,852,983**

Source: IHS Global Insight

The import forecast rate of change between each year is shown in Table 15. The rate of change was calculated from the annual commodity forecast developed by GI. The data illustrates that economic conditions are cyclical and that the fastest growth will take place in developing countries.

Table 15: GI's Savannah Harbor Containerized Import Metric Tons - Rate of Change

SHEP World Region	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Africa	-1%	5%	9%	-1%	4%	3%	10%	-2%	-4%	15%	2%	5%	4%	3%	0%	7%	5%	2%	5%	2%
ECSA	3%	6%	7%	4%	4%	6%	11%	-1%	-1%	11%	4%	5%	7%	2%	4%	4%	6%	3%	5%	4%
Mediterranean	3%	4%	5%	4%	4%	5%	8%	0%	1%	7%	4%	4%	6%	1%	4%	2%	5%	2%	4%	3%
NE Asia	8%	4%	7%	7%	7%	5%	9%	3%	3%	8%	6%	5%	7%	4%	5%	5%	6%	4%	6%	4%
Europe	4%	2%	4%	5%	4%	3%	5%	2%	3%	5%	4%	4%	5%	2%	4%	3%	4%	3%	4%	3%
Oceania	-1%	7%	7%	2%	4%	4%	5%	3%	3%	5%	3%	4%	4%	3%	5%	2%	7%	0%	4%	3%
SE Asia	7%	0%	4%	6%	5%	5%	9%	1%	1%	8%	5%	5%	6%	4%	4%	5%	5%	5%	5%	5%
WCSA	6%	2%	4%	6%	2%	8%	14%	-4%	-2%	12%	4%	5%	8%	0%	5%	3%	6%	2%	5%	4%

Source: IHS Global Insight

3.3.2.2.3.2. GI's Containerized Exports. China led world trade regions as the top recipient of Savannah Harbor exports in 2007 (approximately 2.2 million metric tons or 230,308 TEUs) (Table 16). Leading exports to this trade region were comprised of meat/dairy/fish requiring refrigeration (44,168 TEUs), followed by stone, clay and other crude minerals (23,575 TEUs), pulp (26,855 TEUs), scrap (19,581 TEUs), and synthetic resins (29,592 TEUs). The top ten export trade partners accounted for nearly 64 percent of containerized export trade tonnage in 2007 (62 percent of export TEUs).

[14] East Coast South America
[15] West Coast South America

Table 16: GI Reported Containerized Commodities - 2007 Exports

WTS Region	Commodity Description	Tons-Sum	TEUs-Sum	Tons-Sum	TEUs-Sum	Total Tons	Total TEUs
		Top Five Commodities				*All Commodities*	
China	Meat/Dairy/Fish requiring Refrigeration	387,524	44,168				
	Stone, Clay and Other Crude Minerals	316,983	23,575				
	Pulp	283,064	26,855				
	Scrap	239,761	19,581				
	Synthetic Resins	207,418	29,592	1,434,749	143,770	2,160,922	230,308
Japan	Stone, Clay and Other Crude Minerals	1,164,794	86,628				
	Pulp	171,522	16,272				
	Oil Seeds	51,609	3,590				
	Synthetic Resins	37,145	5,299				
	Organic Chemicals	33,980	2,735	1,459,050	114,525	1,580,172	129,342
Turkey	Cotton	233,642	29,619				
	Paper and Paperboard and Products	176,460	18,455				
	Pulp	102,753	7,936				
	Meat/Dairy/Fish requiring Refrigeration	26,830	3,058				
	Stone, Clay and Other Crude Minerals	10,452	777	550,137	59,845	594,060	64,851
Taiwan	Stone, Clay and Other Crude Minerals	249,205	18,534				
	Paper and Paperboard and Products	33,684	4,323				
	Pulp	29,540	2,802				
	Waste Paper	27,973	3,540				
	Synthetic Resins	27,506	3,924	367,908	33,123	471,868	44,460
South Korea	Stone, Clay and Other Crude Minerals	146,084	10,864				
	Synthetic Resins	78,280	11,168				
	Pulp	46,004	4,364				
	Waste Paper	27,466	3,476				
	Paper and Paperboard and Products	20,418	2,620	318,251	32,493	469,304	48,493
Italy	Pulp	114,276	9,806				
	Paper and Paperboard and Products	75,317	8,752				
	Stone, Clay and Other Crude Minerals	58,466	4,348				
	Waste Paper	25,346	3,564				
	Synthetic Resins	6,698	934	280,102	27,405	325,986	32,985
Australia	Beverages	29,479	2,631				
	Paper and Paperboard and Products	27,729	3,558				
	Rubber Products	25,834	5,461				
	Synthetic Resins	20,789	2,966				
	Organic Chemicals	19,236	1,549	123,066	16,164	265,363	34,809
Brazil	Pulp	86,740	8,229				
	Synthetic Resins	42,678	6,089				
	Stone, Clay and Other Crude Minerals	21,747	1,617				
	Paper and Paperboard and Products	19,443	2,495				
	Organic Chemicals	11,990	965	182,598	19,396	235,358	25,581
Indonesia	Cotton	53,940	5,868				
	Stone, Clay and Other Crude Minerals	40,746	3,030				
	Synthetic Resins	28,165	4,018				
	Animal Feed	25,131	2,652				
	Pulp	19,930	1,891	167,912	17,459	217,929	23,410
United Kingdom	Pulp	64,016	5,493				
	Paper and Paperboard and Products	48,112	5,032				
	Stone, Clay and Other Crude Minerals	21,108	1,570				
	Chemical Products, nec.	16,168	1,804				
	Textiles	7,888	1,472	157,292	15,371	214,647	22,033
SUBTOTAL TOP TEN WORLD REGIONS				**5,041,065**	**479,551**	**6,535,610**	**656,272**
TOTAL EXPORTS						**10,261,389**	**1,066,812**

Source: IHS Global Insight

Northeast Asia is forecast to receive nearly half of the exports shipped from Savannah Harbor (Table 17). Exports to this region were forecast to total 8.2 million metric tons in 2015, growing to 11.2 million metric tons by 2028. Southeast Asia and the Mediterranean are forecast to continue their relative importance in the overall commodity forecast, receiving approximately 3.3 million and 2.6 million metric tons, respectively, by 2028.

Table 17: GI's Savannah Harbor Containerized Trade Forecast – Exports (metric tons)

SHEP World Region	2015	2020	2025	2026	2027	2028
	(metric tons)					
Africa	191,997	224,634	253,220	261,651	268,826	275,806
ECSA	634,830	765,961	884,058	918,848	948,735	978,433
Mediterranean	1,995,832	2,262,243	2,470,427	2,540,529	2,595,571	2,645,603
Northeast Asia	8,229,779	9,222,053	10,431,617	10,619,153	10,886,165	11,150,995
Northern Europe	1,377,283	1,594,610	1,758,081	1,807,166	1,848,966	1,887,184
Oceania	466,315	551,593	635,367	654,845	674,433	693,632
Southeast Asia	2,311,052	2,692,970	3,022,767	3,109,093	3,196,722	3,266,979
WCSA	280,886	328,916	369,946	382,784	393,326	403,415
Total Exports	**15,487,974**	**17,642,979**	**19,825,482**	**20,294,069**	**20,812,744**	**21,302,048**

Source: IHS Global Insight

The export forecast rates of change are shown in the following table. As illustrated, the rate of change varies by trade region and year. The volatility of exports appears to be less pronounced than that of the forecasted imports. Also, the rate of change in exports is lower than that of imports.

Table 18: GI's Savannah Harbor Containerized Export Metric Tons - Rate of Change

SHEP World Region	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Africa	3%	5%	5%	2%	5%	2%	2%	4%	4%	2%	2%	4%	3%	2%	2%	3%	2%	3%	3%	3%
ECSA	2%	7%	6%	3%	6%	2%	3%	5%	5%	2%	3%	4%	4%	3%	2%	4%	2%	4%	3%	3%
Mediterranean	2%	5%	4%	2%	4%	2%	2%	3%	3%	2%	1%	3%	3%	1%	1%	2%	1%	3%	2%	2%
Northeast Asia	8%	2%	3%	5%	3%	3%	7%	0%	3%	4%	3%	3%	5%	0%	2%	2%	3%	2%	3%	2%
Europe	1%	7%	5%	1%	5%	0%	0%	5%	6%	-1%	2%	3%	2%	2%	1%	3%	1%	3%	2%	2%
Oceania	4%	3%	5%	2%	5%	2%	2%	4%	5%	2%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Southeast Asia	2%	7%	5%	3%	5%	2%	2%	4%	4%	2%	2%	3%	3%	2%	2%	3%	2%	3%	3%	2%
WCSA	1%	6%	5%	2%	5%	2%	2%	4%	4%	2%	2%	4%	3%	2%	2%	3%	2%	3%	3%	3%

Source: IHS Global Insight

The rates of change developed from the 2008 Global Insight forecast over the period 2010 to 2028 were used to populate the long term forecasts for both imports and exports (i.e., applying the rates of change to the baseline). Since Global Insight forecasts were only developed through 2028, data for the last five years of the forecast, for each respective service, were averaged to establish the growth rate that would be used beyond 2028.

3.3.2.2.4. GI Trade Forecasts – 2010. As previously mentioned, a new South Atlantic containerized trade forecast was obtained from GI during the fall of 2010. Since the GI forecast was for the South Atlantic region only, the relationship between the region and Savannah Harbor trade had to be established. Accordingly, it was assumed that for each forecast year, each respective Savannah world region route would comprise the same share of total South Atlantic commerce as had been assumed for each route in the 2008 forecast. For example, if in the

original GI forecast, the ECUS MED world region route comprised 4% of imports forecast for the South Atlantic region in forecast year 2016, then in year 2016 of the updated forecast, it was assumed that the ECUS MED service would again comprise 4% of total South Atlantic imports. The same assumption was made for exports based upon each respective route's percent share, by year, in the original export forecast. The following table illustrates the South Atlantic 2010 forecasts obtained from GI and the import and export forecasts estimated for Savannah Harbor utilizing the methodology described above.

Table 19: 2010 Containerized Imports and Exports Forecasts

	2010	2015	2017	2020	2025	2028
	(metric tons)					
Savannah Harbor Imports:						
ECUS Africa	18,064	23,988	22,547	27,658	33,996	37,790
ECUS AU PEN	6,217	8,050	8,482	9,722	12,157	13,250
AU ECUS EU PEN	124,544	161,280	169,916	194,774	243,556	265,448
ECUS WCSA-ECSA	519,133	737,651	717,136	884,562	1,130,811	1,287,894
ECUS EU GULF PEN	553,022	711,386	743,771	846,851	1,027,402	1,147,469
ECUS MED	716,602	965,763	974,452	1,136,756	1,385,880	1,535,721
FE ECUS EU PEN	588,462	861,347	912,171	1,111,511	1,470,334	1,724,456
FE ECUS MED PEN	431,702	631,893	669,178	815,416	1,078,652	1,265,079
FE (Panama) ECUS	2,289,050	3,350,541	3,548,238	4,323,648	5,719,427	6,707,935
RTW	136,201	199,361	211,124	257,261	340,312	399,129
FE (Suez) ECUS	983,708	1,358,943	1,386,919	1,672,302	2,142,410	2,504,209
Total Savannah Imports	**6,366,706**	**9,010,203**	**9,363,934**	**11,280,462**	**14,584,936**	**16,888,380**
Total South Atlantic Imports	**19,846,974**	**26,359,171**	**28,796,971**	**33,225,999**	**41,497,960**	**47,204,816**
	2010	**2015**	**2017**	**2020**	**2025**	**2028**
Savannah Harbor Exports:						
ECUS Africa	141,113	184,584	199,719	216,962	250,359	277,784
ECUS AU PEN	29,120	38,087	41,521	45,261	53,369	59,351
AU ECUS EU PEN	313,643	410,225	447,215	487,494	574,821	639,256
ECUS WCSA-ECSA	662,632	880,363	963,482	1,057,485	1,239,839	1,391,761
ECUS EU GULF PEN	1,065,229	1,324,110	1,469,546	1,540,151	1,738,221	1,900,722
ECUS MED	1,502,017	1,918,777	2,033,789	2,184,982	2,442,520	2,664,581
FE ECUS EU PEN	963,731	1,322,089	1,348,630	1,488,360	1,723,414	1,876,678
FE ECUS MED PEN	596,281	818,005	834,426	920,881	1,066,313	1,161,141
FE (Panama) ECUS	4,057,216	5,565,871	5,677,605	6,265,859	7,255,411	7,900,639
RTW	150,223	206,083	210,220	232,001	268,640	292,530
FE (Suez) ECUS	1,702,678	2,221,828	2,409,426	2,600,999	2,988,620	3,290,415
Total Savannah Exports	**11,183,884**	**14,890,022**	**15,635,579**	**17,040,435**	**19,601,526**	**21,454,860**
Total South Atlantic Exports	**22,513,608**	**29,902,537**	**31,873,150**	**35,137,493**	**41,134,349**	**45,109,858**

Next, the rate of change between forecast years was determined for each world region route for both imports and exports (Table 20).

Table 20: Savannah Harbor Containerized Imports and Exports- Rate of Change (2010 update)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Rate of Change - Imports																		
Africa	11%	1%	4%	4%	10%	-2%	-4%	13%	3%	6%	5%	3%	1%	7%	5%	3%	6%	3%
Oceania	9%	3%	4%	5%	6%	3%	3%	5%	4%	5%	5%	3%	5%	3%	8%	1%	4%	4%
ECSA&WCSA	8%	6%	4%	7%	12%	-2%	-1%	11%	5%	6%	8%	2%	5%	4%	6%	3%	6%	4%
Europe	5%	6%	5%	4%	6%	2%	2%	5%	4%	4%	5%	2%	4%	4%	5%	3%	5%	3%
Mediterranean	7%	6%	4%	5%	8%	0%	1%	7%	4%	5%	6%	2%	5%	3%	5%	3%	4%	3%
Northeast Asia	8%	9%	8%	6%	9%	3%	3%	8%	6%	6%	7%	4%	5%	5%	7%	5%	7%	5%
Southeast Asia	6%	7%	6%	5%	9%	1%	1%	8%	5%	6%	6%	4%	5%	5%	5%	5%	6%	5%
Rate of Change - Exports																		
Africa	9%	5%	7%	4%	3%	4%	4%	2%	2%	4%	4%	2%	2%	4%	2%	4%	3%	3%
Oceania	9%	5%	7%	4%	3%	4%	5%	2%	3%	4%	3%	3%	3%	4%	3%	4%	4%	3%
ECSA&WCSA	9%	5%	8%	4%	3%	5%	5%	2%	3%	4%	4%	3%	3%	4%	3%	4%	4%	4%
Europe	8%	4%	8%	2%	1%	5%	6%	0%	2%	3%	2%	3%	1%	4%	2%	3%	3%	3%
Mediterranean	8%	5%	7%	3%	3%	3%	3%	2%	2%	4%	3%	2%	2%	3%	2%	3%	3%	3%
Northeast Asia	6%	7%	6%	5%	8%	-1%	3%	4%	3%	3%	6%	0%	3%	3%	4%	2%	3%	3%
Southeast Asia	8%	5%	7%	4%	3%	4%	4%	2%	3%	3%	3%	3%	2%	4%	3%	3%	3%	3%

3.3.3. SHEP Long Term Trade Forecast – Metric Tons

3.3.3.1. SHEP Containerized Import Trade – Metric Tons

The respective world region route import rates of change were applied to the 2010 baseline (Table 11) to estimate the SHEP long term import trade forecast. Note, port capacity was forecast to be reached in 2030; therefore, the long term forecast was constrained at that point. As shown in Table 21, it is forecast that Northeast Asian trade will continue to dominate Savannah Harbor imports over the forecast period, growing from approximately 4 million metric tons in the 2010 baseline to just under 13 million metric tons in 2030. Imports from Southeast Asia will likewise grow from 1.7 million metric tons to 4.7 million metric tons in 2030.

Table 21: SHEP Containerized Trade Forecast - Import Metric Tons

World Region	World Region Service	2010 Baseline	2015	2017	2020	2025	2030
Africa	ECUS Africa	3,044	4,042	3,799	4,660	5,728	6,972
Oceania	ECUS AU PEN	62,554	81,005	85,343	97,828	122,330	143,580
Oceania	AU ECUS EU PEN	228,208	295,519	311,345	356,893	446,277	523,802
ECSA&WCS	ECUS WCSA-ECSA	318,004	451,862	439,295	541,855	692,699	865,792
N Europe	ECUS EU GULF PEN	317,883	408,912	427,527	486,779	590,561	712,110
MED	ECUS MED	269,491	363,192	366,460	427,497	521,184	620,286
NE Asia	FE ECUS EU PEN	700,211	1,024,916	1,085,391	1,322,585	1,749,548	2,291,526
NE Asia	FE ECUS MED PEN	484,938	709,816	751,698	915,970	1,211,667	1,587,020
NE Asia	FE (Panama) ECUS	2,277,866	3,334,170	3,530,901	4,302,522	5,691,481	7,454,598
NE Asia	RTW	502,729	735,857	779,276	949,575	1,256,120	1,645,244
SE Asia	FE (Suez) ECUS	1,681,126	2,322,391	2,370,200	2,857,911	3,661,311	4,748,979
TOTAL IMPORTS		**6,846,053**	**9,731,681**	**10,151,235**	**12,264,074**	**15,948,907**	**20,599,909**

3.3.3.2. SHEP Containerized Export Trade – Metric Tons

The export tons forecast is shown in Table 22. Exports to Northeast Asia are forecast to grow from 5.4 million metric tons in 2010 to 11.1 million metric tons in 2030. As with imports, the FE (Panama) ECUS world region service is forecast to lead all other Savannah Harbor services in total trade volume.

Table 22: SHEP Containerized Trade Forecast - Export Metric Tons

World Region	World Region Service	2010 Baseline	2015	2017	2020	2025	2030
Africa	ECUS Africa	8,586	11,231	12,151	13,200	15,232	18,054
Oceania	ECUS AU PEN	253,538	331,611	361,513	394,073	464,665	554,566
Oceania	AU ECUS EU PEN	414,047	541,547	590,379	643,551	758,833	905,648
ECSA&WCS	ECUS WCSA-ECSA	713,885	948,457	1,038,005	1,139,279	1,335,738	1,612,215
N Europe	ECUS EU GULF PEN	674,327	838,207	930,273	974,968	1,100,353	1,276,659
MED	ECUS MED	1,272,404	1,625,454	1,722,883	1,850,964	2,069,132	2,380,355
NE Asia	FE ECUS EU PEN	871,756	1,195,915	1,219,922	1,346,318	1,558,939	1,799,535
NE Asia	FE ECUS MED PEN	831,662	1,140,912	1,163,815	1,284,397	1,487,239	1,716,770
NE Asia	FE (Panama) ECUS	3,167,768	4,345,685	4,432,924	4,892,217	5,664,833	6,539,108
NE Asia	RTW	482,623	662,084	675,375	745,351	863,062	996,262
SE Asia	FE (Suez) ECUS	2,619,289	3,417,916	3,706,505	4,001,209	4,597,500	5,389,006
TOTAL EXPORTS		**11,309,885**	**15,059,018**	**15,853,747**	**17,285,528**	**19,915,526**	**23,188,179**

3.3.3.3. SHEP Containerized Trade – TEU Equivalents

Since cargo movements and container vessel capacities are often expressed in TEUs and not tons, the PDT converted these tonnage forecasts into their TEU equivalents. As previously mentioned, the weight of containers can vary widely by trade route and by haul direction. For example, major products destined for the Mediterranean are heavier pulp and kaolin clay whereas imports from the Far East involve lighter manufactured goods and textiles. For each service, the historical average weight per TEU was calculated and used for this conversion. Table 23 presents the average weights, which were derived from historical data provided by the GPA (2005-2010).

The historical percent of empty containers was applied as a means of forecasting the number of empty containers moving through Savannah Harbor. It is important to account for empty containers when determining future loading practices and draft requirements. According to a Drewry Consulting report, if Savannah is among the final port calls in a service's rotation, vessels may be carrying a larger proportion of empties inbound, but have fewer empties for exports as vessels load up for the return voyage. The FE ECUS EU PEN shows percentages of 47% and 16%, for empty imports and exports, respectively. The average weight of an empty container is approximately 2 metric tons and was factored into the vessel loading and estimated draft requirements.

Table 23: Average Container Box Weight and Empty Percentages by Service

Route	Metric Tons per TEU

	Imports	Exports	Percent Empties to Loaded Imports	Percent Empties to Loaded Exports
ECUS AU PEN	10.98	8.67	62.11%	3.94%
AU ECUS EU PEN	10.73	8.94	62.11%	3.94%
ECUS WCSA-ECSA	10.10	10.14	76.62%	14.84%
ECUS EU GULF PEN	8.77	9.64	34.55%	7.31%
ECUS MED	9.67	10.56	81.64%	8.11%
FE ECUS EU PEN	7.12	9.83	15.31%	13.01%
FE ECUS MED PEN	6.37	10.54	7.61%	29.74%
FE (Panama) ECUS	5.78	10.84	7.88%	56.53%
RTW	6.65	10.58	9.62%	99.45%
FE (Suez) ECUS	7.76	10.08	18.28%	27.18%

Table 24 shows the resulting TEU forecast for Savannah Harbor.

Table 24: TEU Forecast for Selected Years

Year	Loaded Export TEUs	Loaded Import TEUs	Total Loaded TEUs	Total Exports (loaded and empty)	Total Imports (loaded and empty)	Total TEUs
2005	701,857	803,693	1,505,550	989,295	864,668	1,853,963
2006	774,056	862,763	1,636,819	1,186,311	953,299	2,139,610
2007	998,516	1,070,018	2,068,534	1,397,723	1,196,065	2,593,788
2008	1,079,421	1,072,075	2,151,496	1,386,329	1,224,470	2,610,799
2009	1,024,279	883,013	1,907,292	1,243,873	1,109,222	2,353,095
2010	1,101,836	983,434	2,085,270	1,446,361	1,158,350	2,604,711
2017	1,544,968	1,470,981	3,015,949	2,028,305	1,722,487	3,750,792
2020	1,683,960	1,780,666	3,464,626	2,214,037	2,082,314	4,296,351
2025	1,940,501	2,324,044	4,264,545	2,552,885	2,710,699	5,263,584
2030	2,260,378	3,013,260	5,273,638	2,970,714	3,503,311	6,474,025

3.4. Vessel Fleet

3.4.1. World Fleet

In addition to a commodity forecast, an accurate forecast of the future fleet is required when evaluating navigation projects. To develop projections of the future fleet calling at Savannah, the study team obtained a World Fleet forecast of containerships developed by Maritime Strategies Inc, (MSI) and a general methodology to forecast total capacity calling at Savannah Harbor and a breakdown of the capacity calling into containership size and TEU classes. The general methodology developed by MSI was then modified and linked to the commodity forecast developed by the PDT.

By combining information from the commodity forecast with MSI's forecasted fleet *capacity*, the PDT was able to allocate a number of Post-Panamax (PPX), Panamax (PX) and Sub-Panamax vessels calls (SPX) to Savannah's fleet. The number of transits, particularly those made by larger vessels, is a key variable in calculating the transportation costs.

MSI's forecasting technique begins with performing a detailed review of the current world fleet and how it is deployed on the trade routes of the world. Forecasting of the world fleet was made possible through MSI's proprietary Container Shipping Planning Service (CSPS) model, which applies historical and forecasted time series data from 1980 to 2030 for:

- Macroeconomic and trade variables including:
  - Annual GDP growth rates by region
  - Industrial Production
  - Population Growth
  - Inflation and Interest Rates
  - Currency Exchange
- Global container trade and movements in TEU lifts by region including:
  - Primary Lifts
  - Transshipment Lifts
  - Loaded/Empty Lifts
- Sector-specific fleet dynamics including:
  - Fleet nominal capacity by vessel size and age
  - Contracting, order book, deliveries, cancellations, slippage and scrapping
  - Container fleet by size
- Sector-specific supply/demand balances
- Time charter rates and vessel operating costs
- Freight rates including:
  - Headhaul rates
  - Backhaul rates
- New building, second-hand (by age) and scrap prices for standard sizes

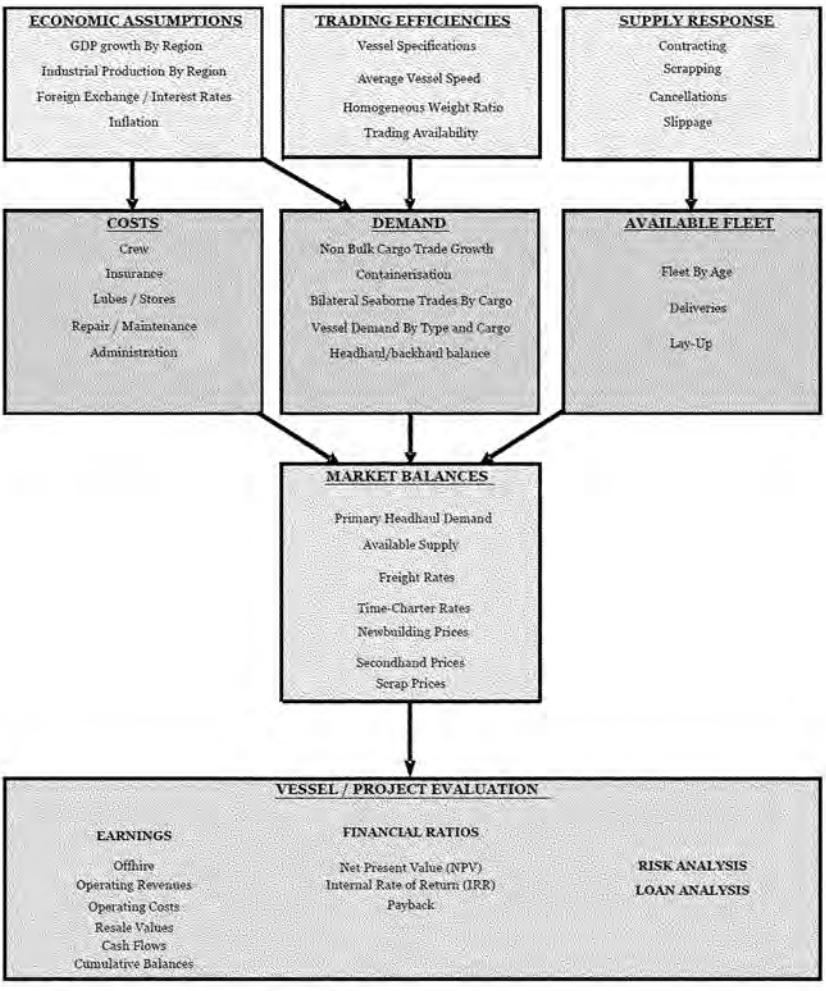


Figure 19: Schematic Overview of the CSPS Model

Data sources for the CSPS model include:

- Macroeconomics: Oxford Economics, leading investment banks;
- World Trade: UNCTAD, Drewry Shipping Consultants, Containerization International;
- Fleet Supply: LR-Fairplay, Worldyards, Howe Robinson; and
- Charter Rates, Freight Rates and Vessel Prices: Drewry Shipping Consultants, Howe Robinson, Clarksons and various contacts at shipping lines.

When evaluating data on vessel composition, vessel age, and container markets, MSI then considered the "order book" to estimate new deliveries to the fleet into the future. Vessel scrapping is accounted for based on historical scrapping rates by vessel class and age. Containerships, particularly the largest ones, are relatively new, so widespread scrapping is not expected to take place until well in the future. Likewise, when economies are strong, vessel owners are more likely to hold onto their existing vessels (or build new ones) and less likely to scrap them. The forecasted world fleet provides a frame of reference to verify the validity of the Savannah fleet forecast and is provided as background information.

There is a strong relationship between the economic condition of a port and its total nominal vessel capacity. As an economy grows, exports from the port often increase (from the increased output) or demand for imports increase (from increased consumer purchasing power). Vessels respond accordingly to satisfy this increased level of trade. MSI examined the empirical relationship between the nominal capacity of the fleet calling Savannah and the historical tonnages moving through Savannah and found the variables to be highly correlated, having an R-squared value of 0.967. This statistical relationship was then applied to the forecasted tonnages in order to estimate future nominal TEU vessel capacity calling Savannah. As the tonnage in Savannah grows over time, the nominal TEU vessel capacity, i.e., the total number of available container slots, grows. Capacity is adjusted by operators to match demand. Once the forecasted nominal TEU vessel capacity at Savannah was determined, the future containers were allocated to various vessel classes (PPX, PX and SPX). The allocation to vessel classes was based on MSI's examination of historical utilization of Panamax vessels, current trends in vessel design and orders and the world wide redeployment of vessels affected by the expansion of the Panama Canal.

3.4.1.1. World Fleet End of Period 2010

A projection of the World Fleet provides the necessary background for evaluating the future fleet forecast for Savannah. The starting point for this projection was the world fleet by vessel class as extracted by MSI from the Lloyds Register (LR)-Fairplay database for the year 2010[16]. The 2010 fleet is shown by TEU bands in the following table.

Table 25: World Feet by TEU Band - 2010

TEU Band	Count
0.1 k to 1.3k TEU	1,622
1.3 k to 2.9 k TEU	1,437
2.9 k to 3.9 k TEU	356
3.9 k to 5.2 k TEU	703
5.2 k to 7.6 k TEU	454
7.6 k to 12 k TEU	256
12 k TEU +	36
Total	**4,864**

[16] LR Fairplay maintains the largest maritime databases covering ships, movements, owners and managers, maritime companies, ports & terminals.

3.4.1.2. The "Order Book"

The "order book" is short hand for the vessels that have been contracted to be built by ship builders around the world. Vessel deliveries are primarily a function of new building contracting. These contracts can take several forms. There are firm contracts for vessels that are under construction. There are also option contracts that secure the capacity of the ship yard but do not require the buyer to exercise the option to construct the vessel. Some contracts have financing that is committed, others do not. There are several other nuances and the challenge is to translate the number of vessels and types of contracts into future vessels coming on line at a specific time. This requires knowledge and expertise of this market and this process. Forecasts must be made for future contracts, vessel scrapping and vessel deliveries[17]. Over the long term, new building investment tends to equate to the incremental demand for new tonnages to meet cargo growth or replacement of aged or obsolete ships.

A historical breakdown of contracting by TEU band was accomplished using a widely recognized fleet database provided by LR-Fairplay. The breakdown was expressed as a percentage of ships for each TEU band size band. These percentages were used as a baseline for forecasting future contracting. The following figure depicts historical contracting by TEU bands for fully cellular *container (FCC) vessels*[18].

[17] Factors such as economic conditions, price of steel, exchange rates, and a host of others can influence the forecasted world fleet.

[18] The term, "fully cellular" refers to vessels that are purpose built to carry ocean containers. The containers are generally stored in vertical slots on the ship.

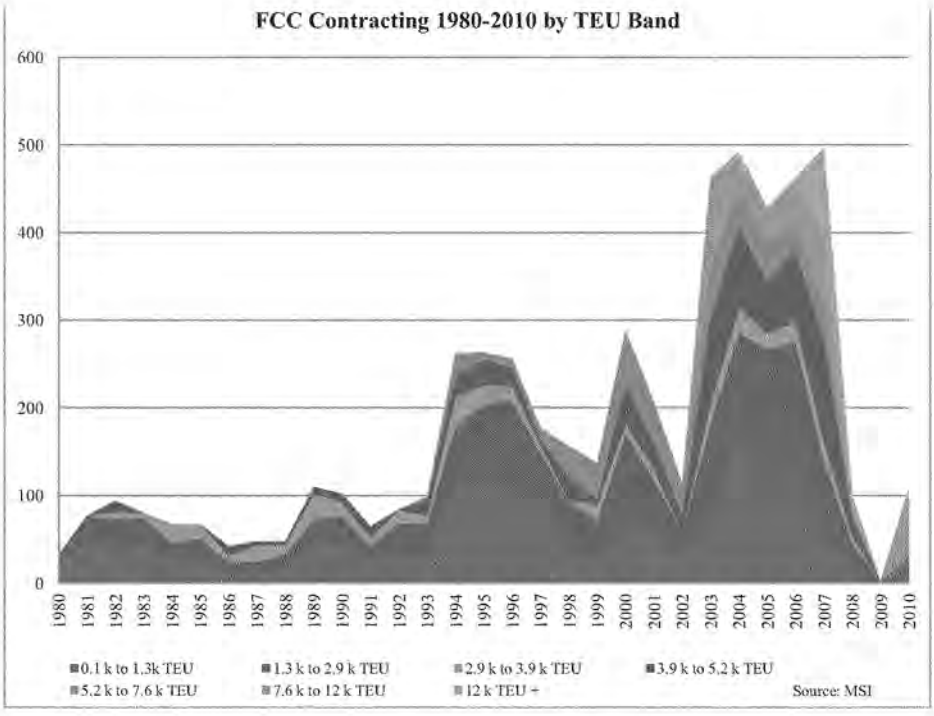


Figure 20: FCC Contracting 1980-2010

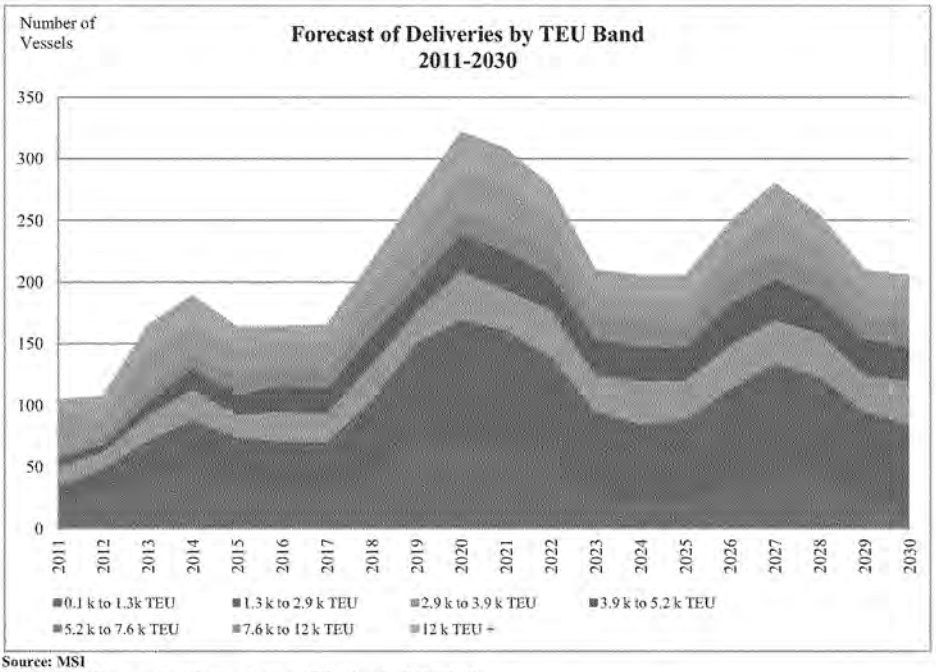
The steep economic contraction that occurred in 2009 led to an almost zero ordering that year. Cancellations and slippage produced a considerable change to the order book profile and the pace of deliveries to the fleet. Going forward MSI perceives there to be an over-supply in containerships. This had material impacts on both expected deliveries and scrapping of vessels in the future.

3.4.1.3. Deliveries and Scrapping Assumptions

The perceived over-supply in containerships is expected to bear heavily on investors' sentiment, resulting in deliveries falling from historical expectations. Conversely, the deletions are expected to occur in excess of historical expectations. Long-term, container fleet growth expectations have been significantly reduced. However, it must be stressed that the ship classes that have suffered most from the fleet re-orientation were those with a capacity below 5.2 k TEU.

MSI modeled the relationship between annual contracting and annual deliveries. They estimated this relationship by TEU band. The forecast of deliveries by TEU band are depicted in the

following figure. The number of new vessel deliveries is expected to increase each year until a 2020 peak, and then taper off to the end of the forecast period, with an upward bounce in 2027.



Source: MSI

Figure 21: Forecast of Deliveries by TEU Band 2011-2030

An estimate of annual scrapping was accomplished by examining the LR-Fairplay database for the world fleet each year and noting which vessels drop out each year. This was done by TEU band and transformed into a scrapping profile for each band. **Figure 22** shows the estimated scrapping by TEU band class. The surge in vessel scrapping in 2009 (210 vessels) was not expected to be repeated until 2022, when many vessels reach the end of their useful lives.

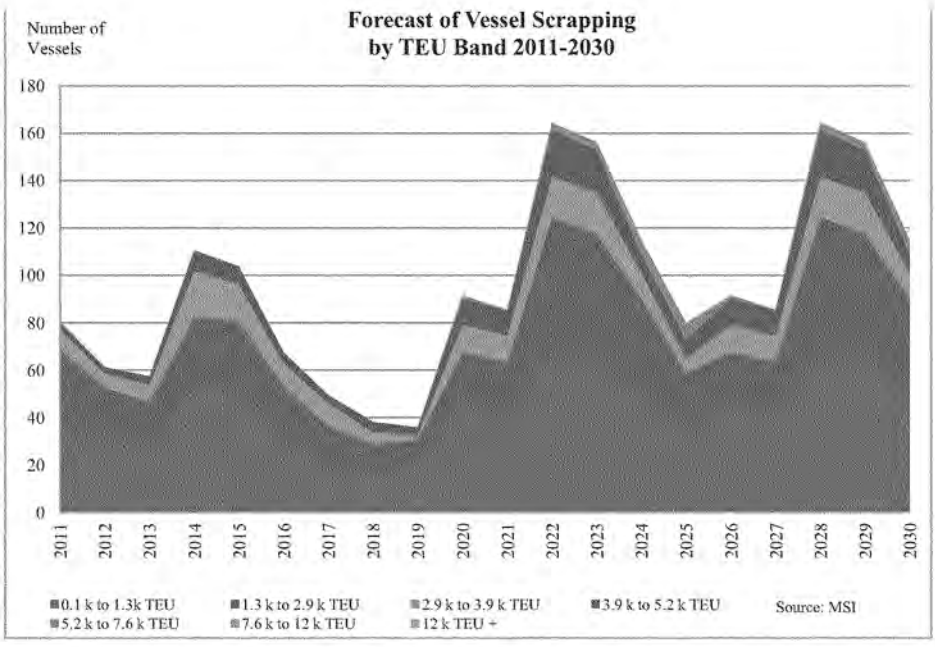


Figure 22: Forecast of Vessel Scrapping by TEU Bands 2011-2030

3.4.1.4. World Fleet Forecast

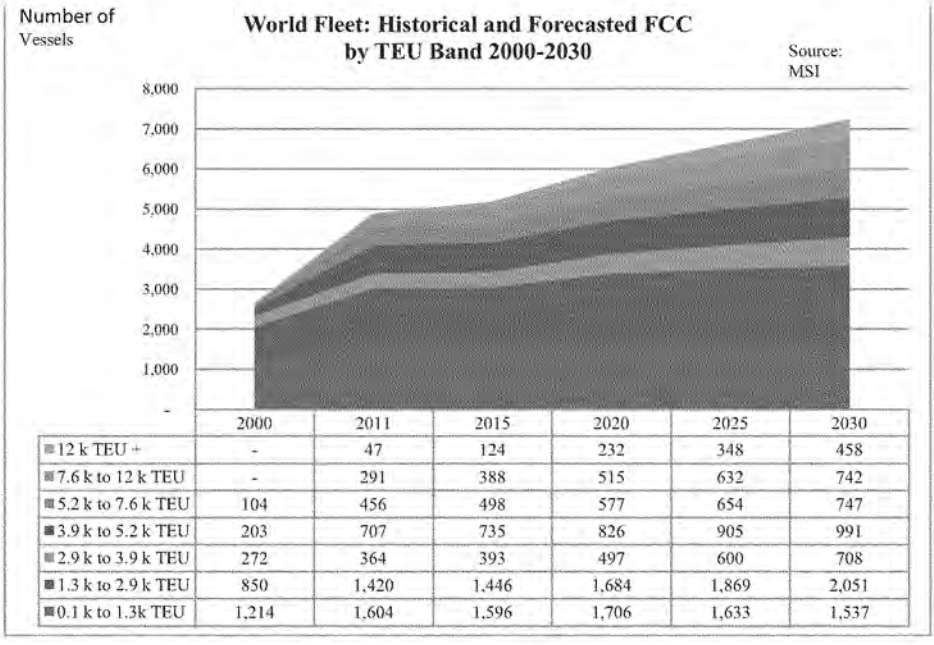
With data for deliveries, scrapping and the 2010 fleet calculated, forecast of the fleet for the end of each forecast year was estimated using the following equation:

Equation 1: Fleet End of Period

$$\text{Fleet EoP (Year)} = \text{Fleet EoP (Year-1)} + \text{Deliveries (Year)} - \text{Scrapping (Year)}$$

EoP = End of period

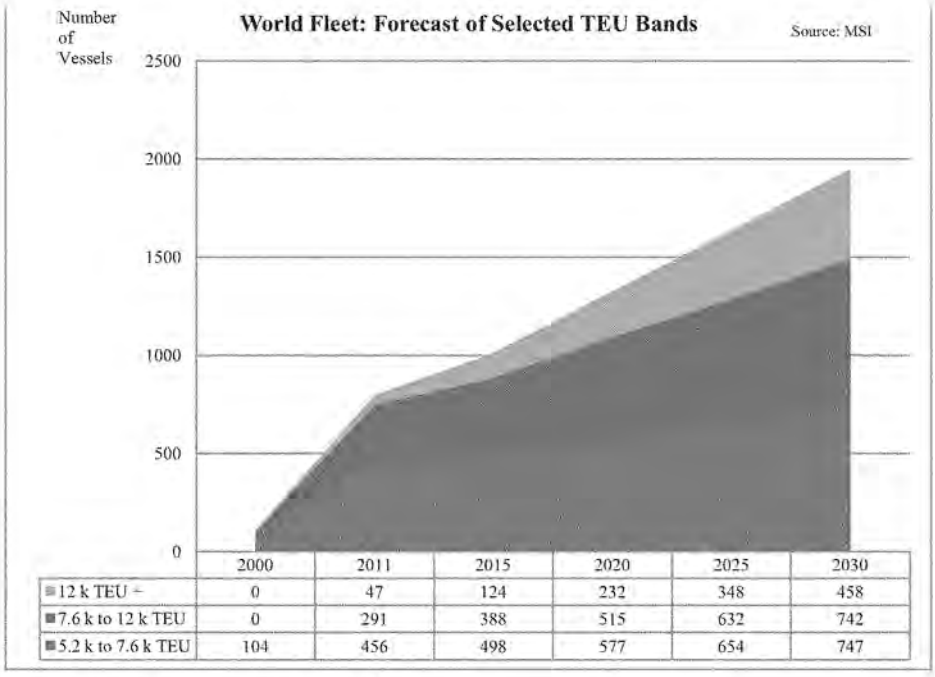
Figure 23 displays the world fleet fully cellular *container* forecast by TEU band through 2030.



	2000	2011	2015	2020	2025	2030
12 k TEU +	-	47	124	232	348	458
7.6 k to 12 k TEU	-	291	388	515	632	742
5.2 k to 7.6 k TEU	104	456	498	577	654	747
3.9 k to 5.2 k TEU	203	707	735	826	905	991
2.9 k to 3.9 k TEU	272	364	393	497	600	708
1.3 k to 2.9 k TEU	850	1,420	1,446	1,684	1,869	2,051
0.1 k to 1.3k TEU	1,214	1,604	1,596	1,706	1,633	1,537

Figure 23: World Fleet: Historical and Forecasted FCC by TEU Band 2000-2030

Figure 24 shows the growth in selected Post-Panamax TEU bands. These types of vessels are a key factor in the evaluation of port deepening studies like Savannah Harbor.



	2000	2011	2015	2020	2025	2030
12 k TEU +	0	47	124	232	348	458
7.6 k to 12 k TEU	0	291	388	515	632	742
5.2 k to 7.6 k TEU	104	456	498	577	654	747

Figure 24: World Fleet: Forecast of Selected TEU Bands

3.4.2. Container Vessels Calling at Savannah

3.4.2.1. Trade Through North America and Savannah Vessel Capacity

The Lloyd's Shipping Economist (LSE) is an annual publication that details the fleet deployment on most containership service routes. The report details the number of vessels deployed on each service by TEU-band. MSI had access to these publications since 2000, and used those as an indicator of deployment for the year prior to publication.

The TEU bands used by LSE do not specify vessel capacity. MSI used LR Fairplay data to calculate the average vessel size within the LSE size bands for each year. This capacity estimate was used to estimate the nominal capacity deployed on each route. For the purpose of this study all the services calling North American ports were aggregated.

The capacity deployed on each trade route was compared to the annual container volumes for the US using a simple regression technique. The fit showed a very high R-squared of 94 percent against the observed data. This close relationship demonstrates how capacity is adjusted by operators to match demand. Figure 25 shows this relationship.

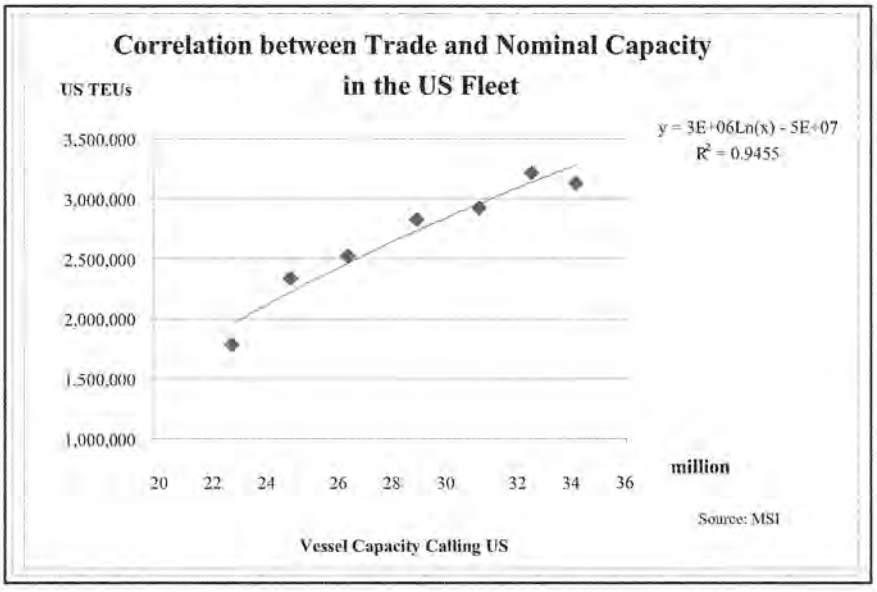


Figure 25: Correlation Between Trade and Nominal Capacity in the US Fleet

Similarly, MSI preformed an analysis of port throughput at Savannah. TEU capacity of vessels calling at Savannah in each of the years between 2000 and 2010 was compared to TEUs at Savannah. Again, the R-squared value is very high at .967 percent, confirming that forecasted trade volumes could be used to forecast capacity deployed on services calling at Savannah in the future. Figure 26 displays this result.

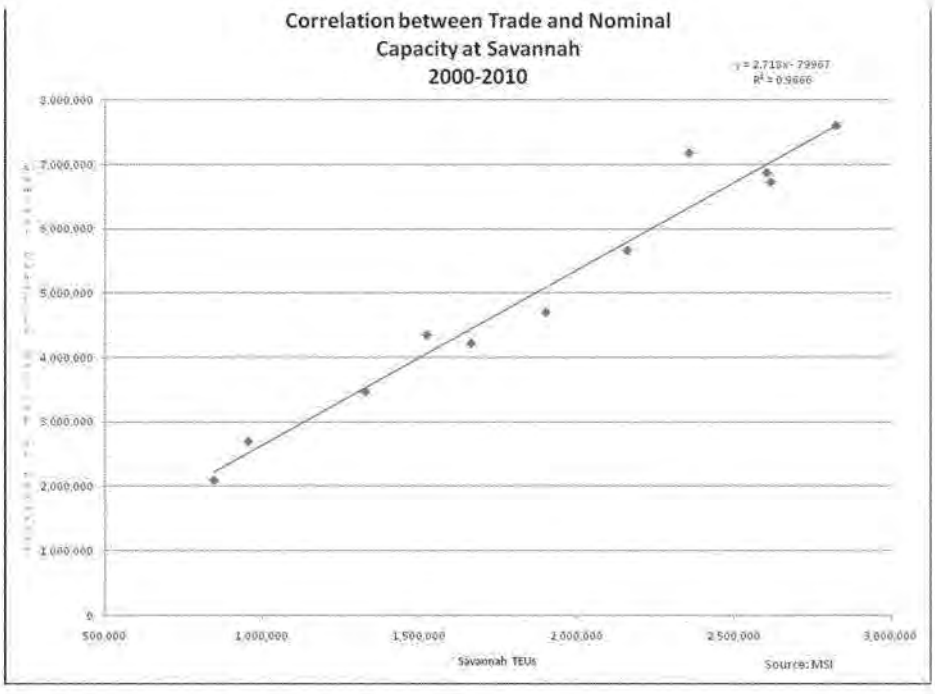


Figure 26: Correlation between Trade and Nominal Capacity at Savannah

Table 26 and Table 27 show the historical calls at Savannah by TEU band and the percent share of the calls.

Table 26: Historical Vessel Calls at Savannah by TEU Band 2000-2010

Vessels Calling Savannah by TEU Band 2000-2010											
TEU Bands	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
0.1 - 1.3 k TEU	1	2	4	35	34	79	86	58	42	87	124
1.3 - 2.9 k TEU	256	323	284	286	274	315	325	444	321	217	227
2.9 - 3.9 k TEU	319	311	411	364	231	194	212	195	134	153	171
3.9 - 5.2 k TEU	114	228	346	552	627	723	819	1,028	1,101	1,145	1,096
5.2 - 7.6 k TEU	1	1		3			77	76	67	126	212
7.6 - 12.0 k TEU											5
12.0 k TEU +											
TOTAL	**691**	**865**	**1,045**	**1,240**	**1,166**	**1,311**	**1,519**	**1,801**	**1,665**	**1,728**	**1,835**

Table 27: Historical Share of Nominal Vessel Capacity Calling Savannah by TEU Band

Share by TEU Band of Nominal Vessel Capacity Calling Savannah 2000-2010											
TEU Bands	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
0.1 - 1.3 k TEU	0.1%	0.1%	0.1%	0.9%	0.9%	1.8%	1.7%	1.0%	0.7%	1.3%	1.7%
1.3 - 2.9 k TEU	26.5%	25.1%	17.5%	15.1%	14.7%	15.0%	12.7%	14.5%	11.3%	6.9%	6.7%
2.9 - 3.9 k TEU	49.5%	37.5%	38.6%	28.2%	19.2%	14.6%	13.0%	10.0%	6.9%	7.3%	7.9%
3.9 - 5.2 k TEU	23.7%	37.1%	43.8%	55.3%	65.2%	68.6%	64.8%	68.1%	75.4%	74.1%	66.0%
5.2 - 7.6 k TEU	0.3%	0.2%	0.0%	0.4%	0.0%	0.0%	7.9%	6.5%	5.8%	10.4%	17.1%
7.6 - 12.0 k TEU	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%
12.0 k TEU +	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
TOTAL	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

3.4.2.2. Forecasted Vessel Capacity Calling Savannah

The SHEP TEU forecast (see section "Commodity Forecast") was used to estimate total annual nominal capacity calling at Savannah for the years 2011-2030. The forecast was developed using the linear regression equation from above, solving for x (nominal capacity), with "y" being the forecasted number of TEUs at Savannah.

$$y = 2.718\ x - 79967\ \text{TEU}$$

Once the study team determined the total annual nominal capacity over the period of analysis, they then allocated the estimated capacity into TEU bands since this demand is likely to be satisfied by a range of vessels. The allocation was based on TEU band shares developed by MSI's CSPS model.

3.4.2.3. Forecasted Post-Panamax Share of Vessel Capacity

The forecasted capacity calling at Savannah was allocated to SHEP Post-Panamax vessel classes according to MSI's forecast of capacity share.

Table 28: Forecasted Post-Panamax Share of Vessel Capacity

Approximate SHEP Vessel Classes	Forecasted Share by TEU Band of Nominal Vessel Capacity at Savannah					
	TEU Bands	2011	2017	2020	2025	2030
Gen I	5.2 - 7.6 k TEU	17.7%	21.4%	25.5%	20.2%	23.9%
Gen II	7.6 - 12.0 k TEU	6.5%	22.5%	39.9%	45.9%	51.9%
Gen III	12.0 k TEU +	0.0%	0.0%	0.0%	0.0%	0.0%
Total TOTAL		**24%**	**44%**	**65%**	**66%**	**76%**

Source: MSI

The largest share of forecasted vessel capacity is in the 7.6 – 12.0 k TEU band. The vessels in this band vary significantly in physical dimensions and include vessels that will not be able to call at Savannah due to size constraints (width and air draft). Table 29 shows a detailed breakdown of the TEU band, first by vessel width, then by design draft. Vessels named Ultra Post-Panamax are not expected to call at Savannah because of size limitations. These vessels have widths in excess of 144 feet. The Savannah channel modification is designed for a maximum width of 144 feet. The vessel class named Super Post-Panamax more closely fit the design dimensions of the channel and are less likely to have air draft concerns with the Talmadge Memorial Bridge which provides a vertical clearance of 185-feet. In this vessel class 85% of the vessels have a design draft of less than 48 feet. While there are 15% that have design drafts greater than 48 feet it is expected that this share will decline over time as they are not as economically efficient as the similarly drafted Ultra Post-Panamax vessels and which have other size dimensions which take greater advantage of the new Panama Canal locks.

Within the Super Post-Panamax vessel class, by far the most common design draft is in the 47.5 to 48.0 foot range.

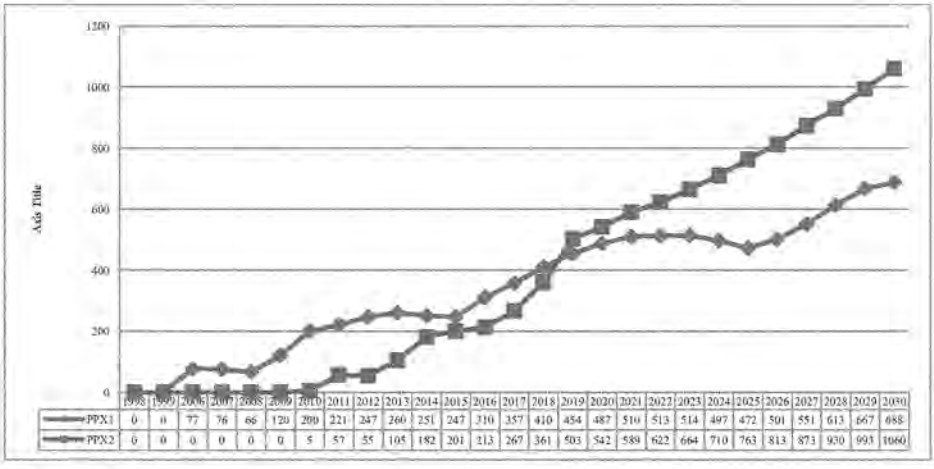
Table 29 – World Fleet: Detailed View of 7.6 - 12.0 TEU Band

Detailed View of 7.6 to 12.0 k TEU Band							
Vessel Widths	**Vessel TEU Capacity**	**Vessel Size Class**	**Draft brackets**	**Number in World 2010**	**Number in Order book End of Period 2010 for ships of known dimensions**	**Number with Combined World Fleet and Order Book**	**Percent of Class**
139 - 144 ft	7,600 - 12,000	Super Post-Panamax	Under 47 feet Draft	49	30	79	25.40%
			47.0 to 47.5	1		1	0.32%
			47.5 to 48.0	159	26	185	59.49%
			48.0 to 48.5	**5**	**13**	**18**	**5.79%**
			49.0 to 49.5	**25**	**3**	**28**	**9.00%**
144 - 158 ft	7,600 - 12,000	Ultra Post-Panamax	Under 47 feet Draft	16	38	54	39.42%
			47.5 to 48.0	32	6	38	27.74%
			49.0 to 49.5	28	13	41	29.93%
			49.5 to 50.0	4		4	2.92%

3.4.2.4. Initial Forecast of Post-Panamax Vessel Calls at Savannah

At this point, the PDT focused on development of an initial forecast of Post-Panamax Vessel calls at Savannah since it is these vessels where most of the project benefits will accrue. The Post-Panamax vessels were represented by TEU bands 5.2 k to 7.6 k (PPX1) and 7.6 k to 12 k (PPX2). The forecasted vessel calls for the Post-Panamax vessels was developed by applying the regression equation in paragraph 3.4.2.2. to the TEU forecast for Savannah in Table 24 to derive total capacity calling. Then, the percent of total capacity calling by PPX1 and PPX2 vessels (shown in Table 28) was applied to derive capacity calling by Post-Panamax vessel classes. PPX1 and PPX 2 capacity calling was then divided by the average TEU capacity of the respective vessel classes (6,146 for PPX1 and 8,653 for PPX2) to estimate number of calls by

Post-Panamax vessels. The initial forecast of Post-Panamax vessels through the year 2030 is depicted in Figure 27. Notice that the larger, Generation 2 Post-Panamax vessel becomes the more dominant type of vessel calling at Savannah from the year 2019 onward.



	1998	1999	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
PPX1	0	0	77	76	66	120	209	221	247	260	251	247	310	357	410	454	487	510	513	514	497	472	501	551	613	667	688
PPX2	0	0	0	0	0	0	5	57	55	105	182	201	213	267	361	503	542	589	622	664	710	763	813	873	930	993	1060

Figure 27: Initial Forecast of Post-Panamax Vessels Calling at Savannah

3.4.3. Initial Allocation of Post-Panamax Vessel Calls by Service

Once the number of Post-Panamax vessel calls was determined, these calls were then allocated to specific Savannah trade routes. The share for each route was based on the historical averages from 2005 to 2007 and increased over time by the route specific growth rates reflected in the commodity forecast. Some trade routes particularly those originating from the Far East would receive a larger allocation of vessels to meet the high demand. Other trade routes such as the AU ECUS EU PEN, ECUS AU PEN, and ECUS WCSA-ECSA do not expect any Post-Panamax vessels to deploy at all throughout the study period. Indeed, a large portion of cargo would still be moved on smaller, Sub-Panamax vessels and so the study team excluded Sub-Panamax vessels from the transportation cost savings analysis, but included them in the ultimate number of vessel calls to account for total vessel calls. However, the Sub-Panamax vessel class share of capacity calling at Savannah is expected to decline over time, as it has historically, and shift to Panamax vessels. Therefore, one adjustment was made to the historic values to account for this decline in Sub-Panamax shares. Table 30 shows the historic sub-Panamax share of capacity calling Savannah, while Table 31 shows the sub-Panamax share as forecast by MSI. The average sub-Panamax share for the 2005/07 historic years was 28 percent. By 2017 the sub-Panamax share of capacity calling Savannah is expected to decline to about 19%, or about 67% of the historic capacity calling in the period analyzed. While the forecast shows a continued decline through 2030, the Savannah analysis simply assumes a 33% reduction.

Table 30: Percentage of Sub-Panamax Vessel Capacity at Savannah ((Historically)

Composition of capacity calling at Savannah (Forecast)											
Vessel Class	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
A 0.1k - 1.3k TEU	0%	0%	0%	1%	1%	2%	2%	1%	1%	1%	2%
B 1.3K - 2.9K TEU	26%	25%	17%	15%	15%	15%	13%	15%	11%	6.9%	6.7%
C 2.9k - 3.9k TEU	49%	37%	39%	28%	19%	15%	13%	10%	7%	7.3%	7.9%
Total -SPX Vessels	**76%**	**63%**	**56%**	**44%**	**35%**	**31%**	**27%**	**25%**	**19%**	**16%**	**16%**

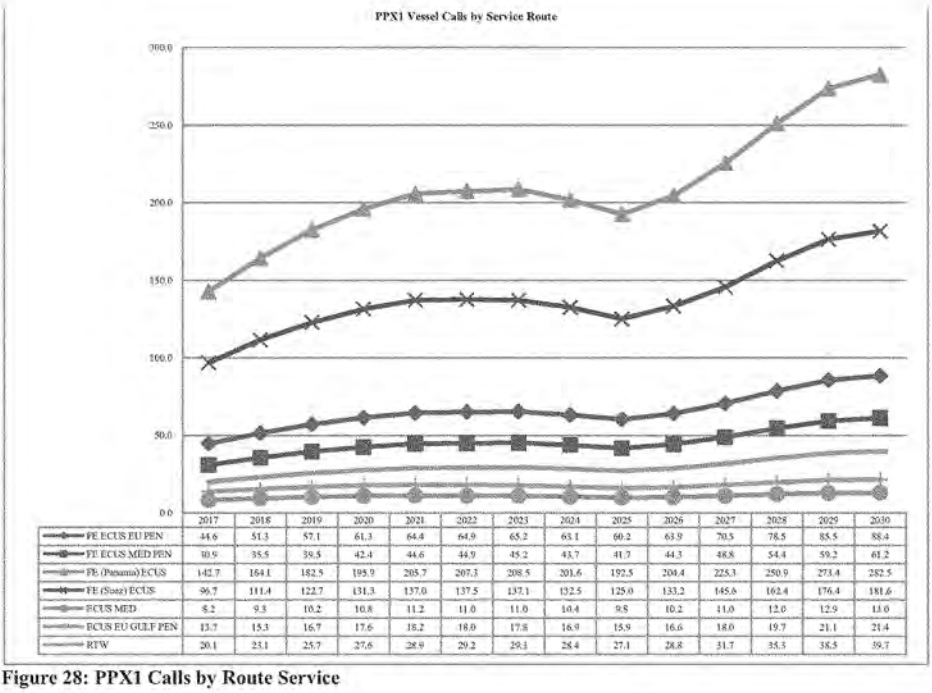
Table 31: Forecast Percentage of Sub-Panamax Vessel Capacity

Composition of capacity calling at Savannah (Forecast)											
Vessel Class	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
A 0.1k - 1.3k TEU	1.2%	1.3%	1.3%	1.3%	1.2%	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%
B 1.3K - 2.9K TEU	8.0%	8.8%	9.6%	10.1%	10.1%	9.5%	8.7%	8.3%	7.8%	7.3%	6.8%
C 2.9k - 3.9k TEU	8.1%	8.3%	8.5%	8.7%	8.9%	9.2%	9.4%	9.7%	9.9%	10.2%	9.5%
Total -SPX Vessels	**17%**	**18%**	**19%**	**20%**	**20%**	**20%**	**19%**	**19%**	**19%**	**19%**	**18%**

Post-Panamax vessel calls (shown in Figure 28) were then allocated to the benefiting trade routes based on each route's share of total Import cargo not expected to be carried by SPX vessels. Table 32 shows the allocations over time for the pertinent trade routes. Vessel calls by route service are depicted in Figure 28 and Figure 29 . This forecast assumed vessels have sufficient channel depth to call at Savannah.

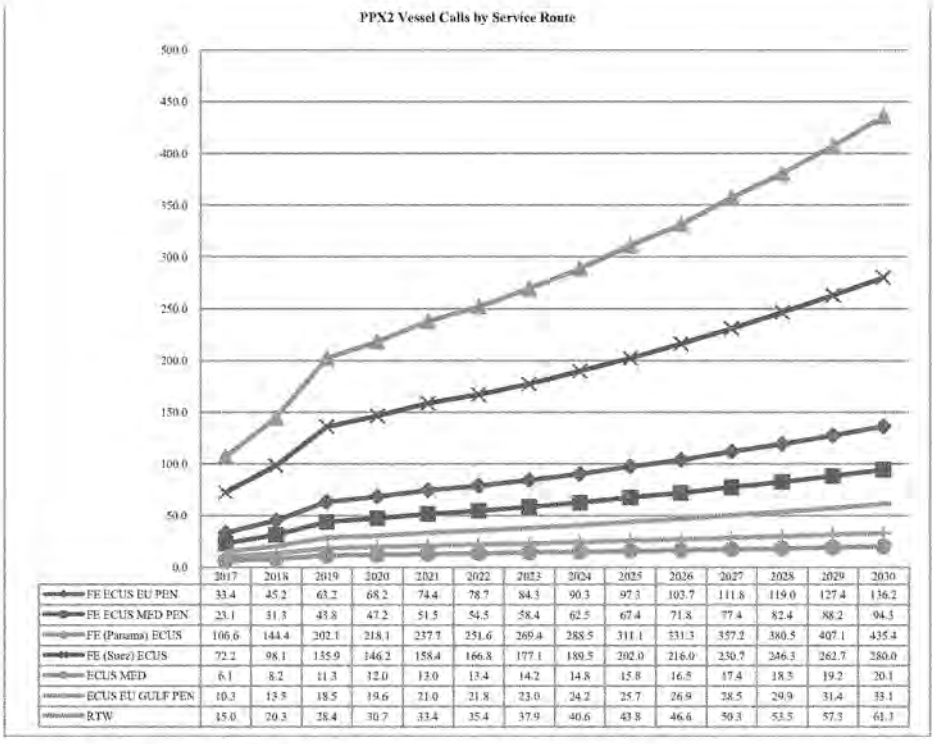
Table 32: Route Percent Share of Forecast PX and PPX Tonnes

SHEP Services	**2015**	**2020**	**2025**	**2030**	**2032**
FE ECUS EU PEN	12.4%	12.6%	12.8%	12.9%	12.9%
FE ECUS MED PEN	8.6%	8.7%	8.8%	8.9%	8.9%
FE (Panama) ECUS	39.5%	40.2%	40.8%	41.1%	41.3%
FE (Suez) ECUS	27.8%	27.0%	26.5%	26.4%	26.3%
ECUS MED	2.4%	2.2%	2.1%	1.9%	1.8%
ECUS EU GULF PEN	3.9%	3.6%	3.4%	3.1%	3.0%
RTW	5.6%	5.7%	5.7%	5.8%	5.8%
Total	**100%**	**100%**	**100%**	**100%**	**100%**



	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
FE ECUS EU PEN	44.6	51.3	57.1	61.3	64.4	64.9	65.2	63.1	60.2	63.9	70.5	78.5	85.5	88.4
FE ECUS MED PEN	30.9	35.5	39.5	42.4	44.6	44.9	45.2	43.7	41.7	44.3	48.8	54.4	59.2	61.2
FE (Panama) ECUS	142.7	164.1	182.5	195.9	205.7	207.3	208.5	201.6	192.5	204.4	225.3	250.9	273.4	282.5
FE (Suez) ECUS	96.7	111.4	122.7	131.3	137.0	137.5	137.1	132.5	125.0	133.2	145.6	162.4	176.4	181.6
ECUS MED	8.2	9.3	10.2	10.8	11.2	11.0	11.0	10.4	9.5	10.2	11.0	12.0	12.9	13.0
ECUS EU GULF PEN	13.7	15.3	16.7	17.6	18.2	18.0	17.8	16.9	15.9	16.6	18.0	19.7	21.1	21.4
RTW	20.1	23.1	25.7	27.6	28.9	29.2	29.1	28.4	27.1	28.8	31.7	35.5	38.5	39.7

Figure 28: PPX1 Calls by Route Service



	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
FE ECUS EU PEN	33.4	45.2	63.2	68.2	74.4	78.7	84.3	90.3	97.3	103.7	111.8	119.0	127.4	136.2
FE ECUS MED PEN	23.1	31.3	43.8	47.2	51.5	54.5	58.4	62.5	67.4	71.8	77.4	82.4	88.2	94.5
FE (Panama) ECUS	106.6	144.4	202.1	218.1	237.7	251.6	269.4	288.5	311.1	331.3	357.2	380.5	407.1	435.4
FE (Suez) ECUS	72.2	98.1	135.9	146.2	158.4	166.8	177.1	189.5	202.0	216.0	230.7	246.3	262.7	280.0
ECUS MED	6.1	8.2	11.3	12.0	13.0	13.4	14.2	14.8	15.8	16.5	17.4	18.3	19.2	20.1
ECUS EU GULF PEN	10.3	13.5	18.5	19.6	21.0	21.8	23.0	24.2	25.7	26.9	28.5	29.9	31.4	33.1
RTW	15.0	20.3	28.4	30.7	33.4	35.4	37.9	40.6	43.8	46.6	50.3	53.5	57.3	61.3

Figure 29: PPX2 Calls by Route Service

Following this allocation by trade route of Post Panamax vessels, the study team moved on to allocate all vessels calls by alternative channel depth through use of a Load Factor Analysis and a Transportation Cost model.

3.4.4. Load Factor Analysis and Unit Cost Estimation

One of the biggest challenges when undertaking a containership study is estimating the total volume of cargo stored on a vessel at a given time. Unlike bulk ports which generally serve niche markets, container ports are very dynamic. A useful way of thinking of the container trade is to consider the analogy of bus lines which make multiple stops on a particular route. Cargo is often loaded and unloaded simultaneously before calling at a string of other ports. As mentioned previously, the weight of cargo can vary greatly by trade route, whereas vessel operators can also carry large numbers of empty containers or sail with vacant slots. What further complicates matters is that as vessel operators share cargo, they may be carrying a wide mix of cargo boxes, each with entirely different weights.

A vessel load factor analysis (LFA) helps to capture valid relationships and parameters for estimating the disposition of cargo and non-cargo components of vessel loading which in turn helps to better estimate the amount of cargo on a ship at a given time. The basic methodology and logic of the load factor analysis is based on long-established practices which have been historically applied to Corps-sponsored economic evaluations of deep draft waterway improvements. A better snapshot of the cargo aids in identifying requirements for vessel immersion and draft. Cargo components of an LFA include carried tonnages, the containers that store the cargo as well as empty containers. Some of the non-cargo components that are considered in an LFA include allowances for ballast, bunkerage, vacant slots and any other load factor significant to reasonably estimating hull immersion and draft.

Once the commodity forecast and the initial PPX vessel call forecast by trade route were completed, a Load Factor and Vessel Cost analysis was undertaken. The Load Factor Analysis is described through the remainder of the benefit analysis and provides the rationale for deployment decisions associated with the potential economic efficiencies of channel deepening.

3.4.4.1. Load Factor Analysis

An LFA explores the various relationships between a ship's physical attributes, considerations for operations, and attributes of a trade route's cargo. In doing so, it allows the analyst to identify the unit costs and operating efficiencies of vessel classes for alternative sailing drafts, which are also inferred to alternate project depths.

The ships physical characteristics used in the LFA are:

- Aggregate Maximum Summer Load Line Draft (MXSLLD), which is the primary load line of a vessel;
- Deadweight Tonnage Rating at MXSLLD, this is the entire weight of the ship, including ballast, fuel and other non-cargo related items;
- Maximum Tonnage for Cargo at MXSLLD, this is the maximum amount of cargo that is practicable to be carried for that particular vessel;
- Nominal TEU Rating, this describes the maximum TEU capacity of the vessel; and
- Working Tons Per Inch Immersion (this helps describe the overall density of the ship). Larger vessels typically have higher immersion rates than smaller vessels.

The load factor tabs in the Savannah Transportation Cost Model characterize approximately 45 different classes of vessels which represent the world fleet expected to potentially call at Savannah. Information on the physical characteristics of the ships was taken from Lloyd's Registry of Ships and stored in an Excel spreadsheet (3).

Table 33: Screen shot of vessel information taken from Lloyd's Registry of Vessels and used in the LFA

Vessel Class Designator	General Vessel Group	General Vessel Sub-Grouping	General Vessel Class	Aggregate MXSLD Draft (Feet)	Underkeel Clearance (UKC) Requirement (Feet)	For Sinkage Where Applicable (Feet)	Requirement for Vessel UKC Clearance (Feet)	DWT Tonnage Rating MXSLD (DWT; Metric)	Max DWT Utilization Max Cargo Transit Draft	Working TPI (Metric Tonnes)	TEU Rating Nominal
4	SPX	- Ag	CL 4	26.23	2.70	0.70	3.40	11,726.3	10,013.6	59.200	907.3
10	SPX	- Ag	CL 10	34.57	2.70	0.90	3.60	24,812.3	19,551.9	96.300	1,778.2
17	PX	- Ag	CL 4	41.22	2.80	1.10	3.90	50,070.4	40,446.1	162.700	3,841.1
18	PX	- Ag	CL 5	42.53	2.80	1.10	3.90	56,791.8	43,684.1	176.700	4,125.2
19	PX	- Ag	CL 6	43.41	2.80	1.20	4.00	54,884.5	42,272.0	170.400	3,992.5
27	PPX	Gn I	5.50	46.05	3.00	1.20	4.20	74,069.5	64,599.0	222.300	6,185.8
41	PPX	Gn II	10.50	47.64	3.00	1.30	4.30	103,816.8	90,538.5	291.500	8,669.6

The LFA progresses by having the user input information on vessel operations. This information includes:

- Vessel operating speed at sea;
- Assumptions for ballast stored on each vessel;
- Allowances for bunkerage and fuel storage; and
- Hourly operating cost at sea.

Information on vessel operating speeds, assumptions for ballast and allowances for bunkerage were derived from industry publications and consultation with industry experts. Furthermore, the estimates, relationships, and potential range of parameters have been shared and discussed with industry analysts repeatedly throughout the study. The framework for the calculations was also vetted with the U.S. Naval Academy, Lloyd's Register-Fairplay. Vessel operating costs were based on HQUSACE published vessel operating cost estimates.

Attributes of each trade route are also required for the LFA and include:

- Allowance for empty containers;
- Allowance for unused or vacant slots;
- Average cargo weight in each container; and
- Average weight of an empty container.

The weight of the container itself is around 2.0 metric tons and was derived from published industry trade journals. Allowances for minimum empties and vacant slots were based on expert elicitation and a Drewry Consultant report prepared specifically for the Savannah study. The percentages assigned for vacant slots vary by trade route. For example, Panama Canal transits are limited by the size of the locks, line of sight restrictions and the seasonal depth of water in the lakes. Likewise, high cube containers and other non-standard cargo, including those that are gaseous or volatile, may result in vessels having large numbers of unused container slots.

The LFA mechanics of the calculation are as follows. For a given sailing draft, a calculation using vessel specific Tons per Inch Immersion (TPI) was made to determine capacity utilization

at that sailing draft, i.e., to determine how much space of the vessel was occupied by cargo, stores and other items having weight. This capacity utilized figure (metric tonnes) is then allocated to several factors. An estimate of ballast weight is accounted for on a variable scale. Empty container weight (carriage weight) is accounted for by applying a historical percentage of empty containers for each vessel on a particular trade route[19]. Container (lading) weight is accounted for, and finally the cargo itself. The remainder is the empty space on the vessel.

Initially, the PDT used historical averages for cargo weights based on GPA and PIERS data and estimated minimum percentages for empty containers and vacant slots, which seemed appropriate since vessels contain mixes of imports and exports plus the fact that Savannah is rarely the first or final port of call. However, when using these average cargo weights for imports and exports, and initial uniform estimates for all trade routes for minimum empties and vacant, the PDT discovered that for some of the trade routes, a large percentage of calls ended up exceeding their maximum practicable sailing drafts (MPD) more than 15 percent of the time. This lead the PDT to believe that the initial estimates of minimum empties and vacants, and average import and export cargo weights do not adequately capture the affects of port rotations on the amounts of import and export cargo carried on some vessels when they call Savannah Harbor. Therefore the model was then calibrated and rerun using estimated cargo weights and minimum empty and vacant slots which resulted in maximum practicable sailing drafts that were not exceeded 85 percent of the time. Table 344 presents the variables employed in the LFA, after calibrating the model.

Table 34: Variables Used in LFA upon Model Calibration

Trade Route	Avg. Cargo Weight (Tons/TEU)	Minimum % Empty Containers	Minimum % Unused (Vacant) Slots
AU ECUS EU PEN	10.35	4.36%	7.65%
ECUS AU PEN	9.72	1.30%	7.65%
ECUS EU GULF PEN	9.17	2.02%	4.65%
ECUS MED	10.33	10.5%	4.65%
ECUS WCSA-ECSA	10.50	30.24%	6.15%
FE (Panama) ECUS	7.98	6.46%	7.65%
FE (Suez) ECUS	8.46	8.74%	4.65%
FE ECUS EU PEN	8.71	11.38%	7.65%
FE ECUS MED PEN	8.48	2.45%	7.65%
RTW	10.32	14.91%	7.65%

By assembling this information in the LFA, the analyst can:

- Estimate the quantity of cargo on the vessel for any given sailing draft;
- Calculate the unit cost of operation for a given distance (This is a key variable in determining the voyage costs used in the transportation cost model);
- Calculate the draft at which a vessels "cubes out" (i.e., runs out of available space on the vessel) when carrying light boxes; and

[19] Ports do not usually record the weights of containers but they generally keep good records of the number of containers (loaded and empty), which can be used to derive the total weight carried on a ship.

- Calculate the number of boxes on board and empty slots when the vessel "weights out" (i.e., can no longer carry additional weight).

3.4.4.2. Maximum Practicable Loading Draft and Capacity

For the SHEP study, the Maximum Practicable Loading Draft (MPLD) was applied since it provides a realistic measure of the vessel behavior, as opposed to the maximum design draft. Container vessels carry *empty boxes*, which can cause the vessel to "volume out" or "cube out" before reaching its maximum design draft. Containers are also not always uniform in size. There are "high lift" containers and 50-foot containers. These size irregularities create *unused spaces or "slots"* on the vessel. Some vessels have *"line of sight"* requirements which restrict operators from using the entire number of slots on a vessel. The *bunkerage on a vessel* can fluctuate and is rarely 100% full. Most importantly, the average weight of the cargo in each box can be less than the weight required to reach the maximum design draft.

The MPLD may approach the vessel's maximum design draft or be less if the vessel "volumes out" or "cubes out" due to the presence of empty boxes. On the other hand, if a channel is not deep enough, carriers may not be able to load to their vessels to their MPLDs, after accounting for underkeel clearance requirements and examining the availability of tide. Finally, at the MPLD, the capacity of the vessel is reached and is termed the Maximum Practicable Capacity (MPC) of the vessel. The MPC is useful in describing the volume of cargo that could reasonably be loaded onto each vessel.

3.4.4.3. Utilization of the LFA in SHEP

3.4.4.3.1. Vessel Deployment. Since the ultimate product of the SHEP benefits analysis is the transportation costs (and reduction of transportation costs for each project depth), the unit cost estimates based on the MPC of various classes of container ships for each trade route at various channel depths were used to inform the deployment decisions. As a channel is deepened, the relative economic efficiency between the vessel classes can change giving one class an economic advantage over another. A comparison of unit costs of Panamax, PPX1, and PPX2 vessels derived from the LFA is used to predict the cost breakpoints in which it makes more economic sense to switch from one vessel to another. This unit cost information is used to inform the deployment decision in the SHEP analysis.

3.4.4.3.2. Savannah Share of Vessel Capacity. Using 2005 and 2007 vessel call data for Savannah for Panamax and Post-Panama vessels, the LFA was used to estimate the percent share of Savannah cargo that would be carried on average by Post-Panamax vessel calls. The LFA was used to estimate the MPC for each class of vessel for each trade route with the existing channel. The Savannah share of vessel capacity utilization was based on actual Savannah cargo carried, and the estimated total vessel cargo at MPD. In other words, actual Savannah cargo is used as the numerator, and vessel capacity at MPD is used as the denominator.

Equation 2: Percent of Cargo Transferred at Savannah

$$\frac{Laden\ Cargo\ Transferred\ \ Savannah\ (historical)}{Total\ Cargo\ on\ the\ Ship\ (at\ MPC)} = \%\ of\ Cargo\ Transferred\ at\ Sav.$$

The PDT assumed that Savannah's share of vessel capacity for alternate project depths would be the same as the share observed for the 42 ft deep channel and that additional project depths would not lead to rerouting of cargo from other ports. The vessel's MPC was then multiplied by the estimated share for Savannah as a means of deriving the quantity of cargo moved at Savannah for each vessel call. For larger vessels that are restricted by the channel, the quantity carried can increase with project depth because the MPLD (and thus MPC) increases as the channel restriction is eased.

3.4.4.4. Savannah Share of Route Costs

The LFA was used to estimate the percent share of each trade routes total circuit distance operating costs attributable to Savannah cargo. This share is calculated similar to the Savannah's share of vessel capacity, but includes the weight of the containers carried, both laden and empty, and is based on the actual observed operating drafts from the 2005 and 2007 vessel call data. In this calculation, total Savannah cargo plus laden and empty container weight is used in the numerator and total estimated vessel tonnage (cargo and container weight) carried for all vessels calls in 2005 and 2007 is used as the denominator.

3.4.4.5. Illustrated Example

Figure 30 depicts a LFA capacity allocation for the PPX2 vessel weighing a total of 103,800 DWT and with a design draft of 47.6 feet. The figure reveals how the allocation of capacity changes with vessel's sailing draft. The capacity is assigned to ballast, cargo, allocation for operations, weight of containers (empty and laden), and unallocated capacity. As this vessel loads more fully, its sailing draft increases. The amount of available deadweight tonnage (as indicated by the orange-colored wedge) begins to shrink while the cargo tonnage and carriage (blue, purple and maroon-colored areas) increase. Weight for operations and crew appear to be fairly uniform whereas ballast weight rises slowly and maxes out at about 12,000 DWT.

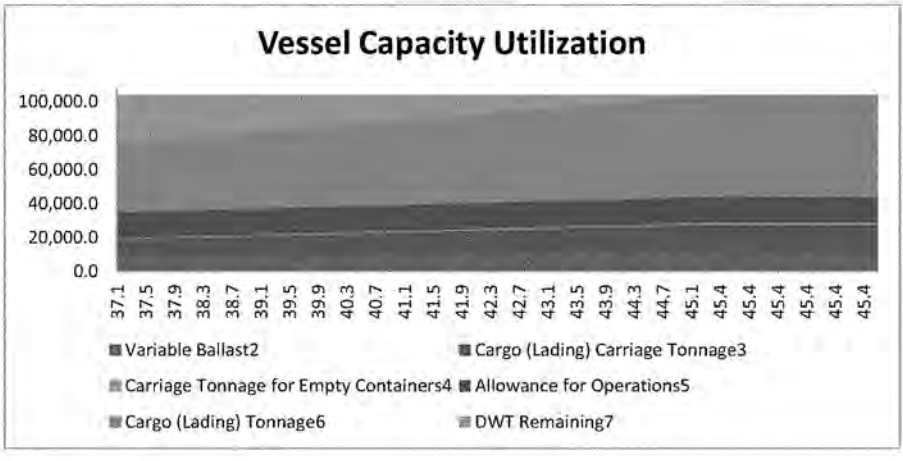


Figure 30: Illustration of Load Factor Capacity Allocation

The equivalent information in tabular form is presented below (Table 35).

Table 35: Vessel Capacity Utilization

MXSLLD (Feet):	47.64	47.64	47.64	47.64	47.64	47.64	47.64	47.64	47.64	47.64	47.64
Draft1	37	38	39	40	41	42	43	44	45	45.4	45.4
Variable Ballast2	8,699.8	9,153.4	9,607.0	10,060.7	10,514.3	10,967.9	11,421.5	11,875.1	12,328.7	12,427.0	12,427.0
Cargo (Lading) Carriage Tonnage3	10,092.3	10,694.6	11,296.9	11,899.2	12,501.5	13,103.8	13,706.1	14,308.4	14,910.7	15,041.1	15,041.1
Carriage Tonnage for Empty Containers4	652.0	690.9	729.8	768.7	807.6	846.5	885.4	924.3	963.2	971.7	971.7
Allowance for Operations5	15,363.0	15,363.0	15,363.0	15,363.0	15,363.0	15,363.0	15,363.0	15,363.0	15,363.0	15,363.0	15,363.0
Cargo (Lading) Tonnage6	40,268.3	42,671.5	45,074.6	47,477.8	49,881.0	52,284.2	54,687.4	57,090.5	59,493.7	60,014.1	60,014.1
DWT Remaining7	28,741.5	25,243.5	21,745.5	18,247.5	14,749.5	11,251.5	7,753.5	4,255.5	757.5	0.0	0.0
Deadweight Tonnage (DWT); Rating (Maximum at MXSLLD) 8	103,816.8	103,816.8	103,816.8	103,816.8	103,816.8	103,816.8	103,816.8	103,816.8	103,816.8	103,816.8	103,816.8

[1] Draft refers to the actual loaded draft of the particular vessel.

[2] Variable ballast is used to describe the amount of ballast used to trim or balance the vessel and to provide sufficient draft to maneuver the vessel. As vessels are loaded more fully, they often require additional ballast water.

[3] Cargo (lading) carriage tonnage refers to the aggregate weight of the containers that are carrying cargo inside them.

[4] Carriage tonnage refers to the aggregate weight of the empty containers.

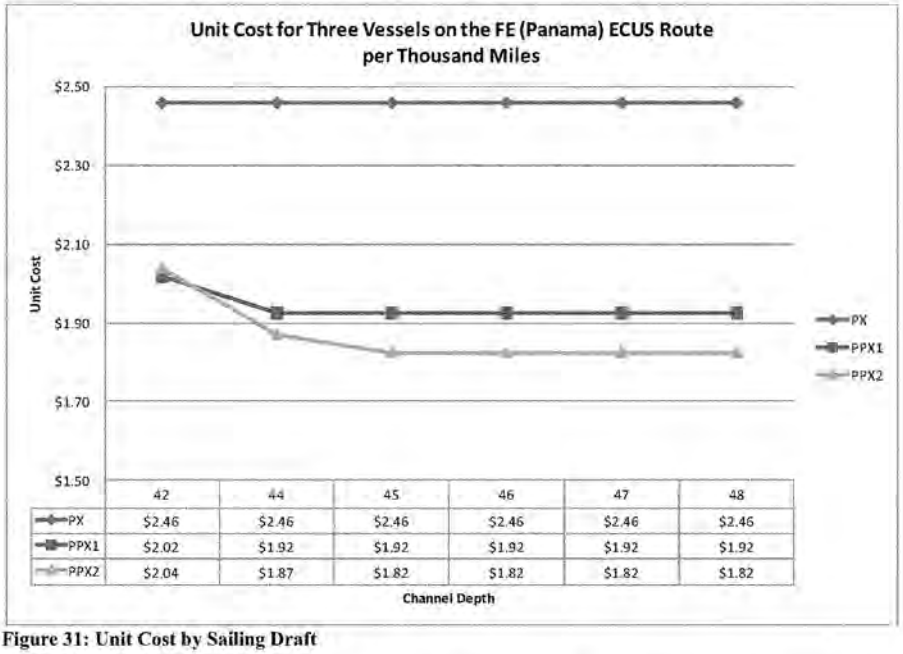
[5] Operations includes the weight for crew, equipment, stores, fuel (bunkerage), and other non-cargo related items on a vessel.

[6] Cargo (lading) tonnage refers to the aggregate weight of all the cargo (and excluding the weight of the containers themselves). Most ports only compile the weight of the cargo itself.

[7] DWT remaining refers to the amount of available weight left on the vessel. As vessels are loaded more fully, the remaining available DWT drops until it approaches the vessel's maximum deadweight tonnage

[8] This refers to the maximum DWT tonnage allowable on the vessel. It is calculated as the sum of the previous items on the vessel.

The final step in this process is to calculate the unit cost per metric ton. The vessel operating cost for a 1,000-mile journey is estimated by considering the vessel speed and its hourly vessel operating cost. The cargo weight previously calculated for each sailing draft is then divided into the voyage cost, yielding a cost per metric ton (unit cost) at each sailing draft.



	42	44	45	46	47	48
PX	$2.46	$2.46	$2.46	$2.46	$2.46	$2.46
PPX1	$2.02	$1.92	$1.92	$1.92	$1.92	$1.92
PPX2	$2.04	$1.87	$1.82	$1.82	$1.82	$1.82

Figure 31: Unit Cost by Sailing Draft

Figure 31 compares the changes in unit costs for PX, PPX1 and PPX2 vessels. It is apparent from Figure 31 that as a channel is deepened, vessel operators are able to load more cargo, which reduces the unit cost per ton. At some point, the gains in efficiency level off, since the vessels are no longer constrained by the channel or are unable to load any more cargo onto them. For the Panamax vessel, the unit costs are minimized at 42 feet on this route; for the Post-Panamax vessels, unit costs are minimized at 45 feet and beyond. This provides useful insight as to deployment decisions.

3.4.5. Deployment by Channel Depth

The PDT then evaluated the impact project depths would have on unit costs and ultimately vessel deployment. In doing so, the team factored under keel clearance requirements for each vessel class as well as the available tide.

3.4.5.1. Maximum Practicable Sailing Draft

The MPD is a concept that describes a vessel's *expected* deviation from design draft during operations. A vessel will only sail at its design draft when it has reached its capacity for bunkerage, cargo, ship's stores and other incidentals. Vessels rarely sail with full bunkerage and for container vessels, the maximum cargo weight can be limited by the weight of each container.

As mentioned previously, a LFA was conducted for each vessel class by service route and by haul direction. The LFA considered average box weight, loaded container weight; percent empty boxes, slot vacancies, bunkerage and ballast, which were based on empirical data and/or expert elicitation. This analysis identified the cargo weight carried at each sailing draft as well as the MPD for each vessel class on each route service.

All vessels on all routes, including the largest ones, reach their MPD with a 47-foot channel. At channel depths shallower than 47 feet, some vessel's MPDs are restricted by inadequate water depth when considering tide and under keel requirements. Changes in the MPD across project depths can be seen on the routes services that have heavier average container box weight.

Table 36 displays the results of the LFA, which provide the maximum practicable sailing drafts by type of vessel, trade route and channel depth. The results can vary significantly, largely as a result of the varying cargo weights but also as a result of percent empties and unused slots. For example, the PPX1 vessels on the FE (Panama) ECUS route reach their MPD with a channel depth of 42 feet. This is because the route's relatively light average container box weight causes the vessel to "volume out" ("cube out") at 42.5 feet. That same vessel on the RTW service reaches a MPD of 46.05 feet simply because its average box weight is greater. This is particularly important for this study as the majority of forecasted commodities are on the FE (Panama) ECUS route service. The PPX1 vessels on the FE (Panama) ECUS route service are not restricted at any project depth.

Table 36: Maximum Practicable Sailing Draft (feet) by Project Depth Alternative

World Region Service	Vessel Class	Sailing Draft (feet)					
		42	44	45	46	47	48
FE (Suez) ECUS	PX	40.51	40.51	40.51	40.51	40.51	40.51
	PPX1	42.80	44.80	45.40	45.40	45.40	45.40
	PPX2	42.70	44.70	45.70	46.70	46.94	46.94
ECUS MED	PX[20]	43.00	44.02	44.02	44.02	44.02	44.02
	PPX1	42.80	44.80	45.80	46.05	46.05	46.05
	PPX2	42.70	44.70	45.70	46.70	47.64	47.64
FE (Panama) ECUS	PX	39.20	39.20	39.20	39.20	39.20	39.20
	PPX1	42.80	43.91	43.91	43.91	43.91	43.91
	PPX2	42.70	44.70	45.35	45.35	45.35	45.35
FE ECUS EU PEN	PX	39.90	39.90	39.90	39.90	39.90	39.90
	PPX1	42.80	44.71	44.71	44.71	44.71	44.71
	PPX2	42.70	44.70	45.70	46.20	46.20	46.20
FE ECUS MED PEN	PX	40.90	40.90	40.90	40.90	40.90	40.90
	PPX1	42.80	44.80	45.80	45.84	45.84	45.84
	PPX2	42.70	44.70	45.70	46.70	47.41	47.41
RTW	PX	42.42	42.42	42.42	42.42	42.42	42.42
	PPX1	42.80	44.80	45.80	46.05	46.05	46.05
	PPX2	42.70	44.70	45.70	46.70	47.64	47.64
ECUS EU GULF PEN	PX	43.00	43.21	43.21	43.21	43.21	43.21
	PPX1	42.80	44.80	45.80	46.05	46.05	46.05
	PPX2	42.70	44.70	45.70	46.70	47.64	47.64

[20] It should be noted that a sizable number of vessels that fall under the "Panamax" category in the world fleet have design drafts greater than the depth of the Panama Canal itself. These vessels are often categorized by their length and breadth, which are not easily adjustable (in contrast to draft). Also note that many of these larger Panamax vessels are dedicated to routes that bypass the Canal.

3.4.5.2. Operating Cost per Thousand Miles

Unit costs were calculated based on a hypothetical 1,000-nautical mile route, which is a commonly-used metric used to measure unit costs in manageable terms for navigation studies. The costs per thousand nautical miles were based on USACE-published vessel operating costs and adjusted for vessel operating speeds of 17 knots. Table 37 shows the vessel operating cost per 1,000 nautical miles as well as the adjusted hourly at sea operating cost.

Table 37: Vessel Operating Costs for Three Vessel Classes

Vessel Class	Operating Cost per Thousand Nautical Miles	Vessel Speed (knots)	Operating Cost at Sea per hour
Panamax	$101,999	17	$1,733.98
PPX1	$104,391	17	$1,774.64
PPX2	$138,722	17	$2,358.27

3.4.5.3. Unit Cost in Tonnes per Thousand Miles

Unit costs in tonnes per thousand nautical miles were calculated by dividing the operating cost per a thousand nautical miles by the tonnes carried. The load factor analysis calculates capacity available for cargo at each sailing draft. Table 38 shows the estimated unit cost by vessel class by channel depth. Entries shaded in yellow identify the breakpoints or depth where it makes economic sense for a shipper to deploy a larger vessel to the route.

Table 38: Unit Cost in Tonnes per Thousand Miles

World Region Route	Vessel Classes	Channel Depths (feet)					
		42	44	45	46	47	48
FE (Suez) ECUS	PX MPD	$ 2.31	$ 2.31	$ 2.31	$ 2.31	$ 2.31	$ 2.31
	PPX1 MPD	$ 2.02	$ 1.85	$ 1.81	$ 1.81	$ 1.81	$ 1.81
	PPX2 MPD	$ 2.04	$ 1.87	$ 1.80	$ 1.73	$ 1.72	$ 1.72
ECUS MED	PX MPD	$ 2.07	$ 1.99	$ 1.99	$ 1.99	$ 1.99	$ 1.99
	PPX1 MPD	$ 2.02	$ 1.85	$ 1.78	$ 1.76	$ 1.76	$ 1.76
	PPX2 MPD	$ 2.04	$ 1.87	$ 1.80	$ 1.73	$ 1.67	$ 1.67
FE (Panama) ECUS	PX MPD	$ 2.46	$ 2.46	$ 2.46	$ 2.46	$ 2.46	$ 2.46
	PPX1 MPD	$ 2.02	$ 1.92	$ 1.92	$ 1.92	$ 1.92	$ 1.92
	PPX2 MPD	$ 2.04	$ 1.87	$ 1.82	$ 1.82	$ 1.82	$ 1.82
FE ECUS EU PEN	PX MPD	$ 2.38	$ 2.38	$ 2.38	$ 2.38	$ 2.38	$ 2.38
	PPX1 MPD	$ 2.02	$ 1.86	$ 1.86	$1.86	$ 1.86	$ 1.86
	PPX2 MPD	$ 2.04	$ 1.87	$ 1.80	$ 1.76	$ 1.76	$ 1.76
FE ECUS MED PEN	PX MPD	$ 2.27	$ 2.27	$ 2.27	$ 2.27	$ 2.27	$ 2.27
	PPX1 MPD	$ 2.02	$ 1.85	$ 1.78	$ 1.78	$ 1.78	$ 1.78
	PPX2 MPD	$ 2.04	$ 1.87	$ 1.80	$ 1.73	$ 1.69	$ 1.69
RTW	PX MPD	$ 2.07	$ 2.00	$ 2.00	$ 2.00	$ 2.00	$ 2.00
	PPX1 MPD	$ 2.02	$ 1.85	$ 1.78	$ 1.76	$ 1.76	$ 1.76
	PPX2 MPD	$ 2.04	$ 1.87	$ 1.80	$ 1.73	$ 1.67	$ 1.67
ECUS EU GULF PEN	PX MPD	$ 2.07	$ 2.06	$ 2.06	$ 2.06	$ 2.06	$ 2.06
	PPX1 MPD	$ 2.02	$ 1.85	$ 1.78	$ 1.76	$ 1.76	$ 1.76
	PPX2 MPD	$ 2.04	$ 1.87	$ 1.80	$ 1.73	$ 1.67	$ 1.67

3.4.5.4. Considerations for Deployment

In terms of model results, the deployment scenario is a very sensitive decision made by the economics team. The unit cost estimates provide the strongest empirical rationale supporting the deployment scenario[21]. Shippers are assumed to follow the cost advantage indicated by the unit cost analysis when making their deployments on every route. Recently, beginning in the fall of 2010, PPX 2 vessels began to call in limited numbers at Savannah. In early 2011, Maersk announced plans to begin deploying PPX2 vessels at Savannah, in spite of the apparent slight increase in unit costs shown by the Load Factor Analysis. This supports the argument that carriers base their deployment decisions over an entire route and rarely on a port-by-port basis. In addition, carriers may not have the choice or availability of a PPX 1 versus PPX 2 vessel given "just in time delivery" practices and a large number of port calls per rotation. In summary, the economic evaluation recognizes and therefore projects that both PPX1 and PPX 2 vessels will call Savannah in the without (42 foot channel) condition. However, because of the cost advantages of PPX1 vessels in the 42 foot channel, the PDT assumed that 50% of the PPX 2 vessels in an unconstrained condition will be deployed on all benefiting trade routes in the without project condition.

The final consideration in the deployment scenario was determining the number of PPX2 vessels to replace the PPX1 vessels. Initially, the PDT assumed that the total number of Post-Panamax vessel calls (PPX1 and PPX2s) would remain the same, but the number of PPX2 vessel calls that were forecasted in MSI's unconstrained condition would replaced by the same number of PPX1 vessel calls. However, as PPX 1 and 2 vessels are both less expensive on a per TEU and tonnage basis, and upon discussion with reviewers the PDT changed the assumption by applying a 140 percent replacement ratio of PPX1 vessels. The 140 percent a TEU capacity equivalency derived by dividing the TEU capacity of the PPX2 vessels by the TEU capacity of the PPX1 (8700/6200).

Table 39 shows the final PPX vessel call forecast for the FE (Panama) ECUS route service. It depicts how at the 42-foot channel depth (the without project condition), both PPX1 and PPX2 vessels call in the without project donation. However, beyond 42 feet, there are expected to be greater numbers of PPX2 calls and fewer PPX1 calls. For this particular route, PPX2 deploy to their full allocation at 44 feet. The vessels could load a little deeper in a 45-foot channel and the Transportation Cost Savings Model picks that up and calculates a "deepening" benefit using the same number of trips but more Savannah cargo. Table 40 and Table 41 show the PPX vessel calls for the ECUS MED and FE (Suez) ECUS services respectively.

[21] To avoid over-claiming benefits, the PDT assumed that vessel operators would only deploy to the threshold of vessels determined by MSI in their vessel forecast for Savannah Harbor, even if the cost analysis shows it clearly advantageous to replace an entire fleet with Post-Panamax vessels.

Table 39: FE (Panama) ECUS Vessel Calls by Class by Year (with 140% replacement ratio)

Vessel Class – Project Depth	2017	2020	2025	2030
PPX1-42	153	349	410	587
PPX2-42	40	109	156	218
PPX1-44	97	196	192	282
PPX2-44	79	218	311	435
PPX1-45	97	196	192	282
PPX2-45	79	218	311	435
PPX1-46	97	196	192	282
PPX2-46	79	218	311	435
PPX1-47	97	196	192	282
PPX2-47	79	218	311	435
PPX1-48	97	196	192	282
PPX2-48	79	218	311	435

Table 40: ECUS MED Vessel Calls by Class by Year

Vessel Class – Project Depth	2017	2020	2025	2030
PPX1-42	13	19	21	27
PPX2-42	3	6	8	10
PPX1-44	8	11	10	13
PPX2-44	6	12	16	20
PPX1-45	8	11	10	13
PPX2-45	6	12	16	20
PPX1-46	8	11	10	13
PPX2-46	6	12	16	20
PPX1-47	8	11	10	13
PPX2-47	6	12	16	20
PPX1-48	8	11	10	13
PPX2-48	6	12	16	20

Table 41: FE (Suez) ECUS Vessel Calls by Class by Year

Vessel Class – Project Depth	2017	2020	2025	2030
PPX1-42	147	234	266	368
PPX2-42	36	73	101	137
PPX1-44	97	122	124	165
PPX2-44	72	137	200	255
PPX1-45	97	118	120	160
PPX2-45	72	132	192	246
PPX1-46	97	116	117	156
PPX2-46	72	129	188	241
PPX1-47	97	116	115	154
PPX2-47	72	129	188	238
PPX1-48	97	116	115	154
PPX2-48	72	129	188	238

3.4.5.5. The Transportation Cost Savings Model

The TCSM combines inputs from the LFA, as well as the cargo and vessel forecasts in determining the total transportation costs (sum of all voyages for all years in the period of analysis) for each project depth.

In running the TCSM, the PDT needed to first disaggregate tonnages carried on Sub-Panamax vessels from the model, though these vessels would not be significantly impacted by any channel deepening. The number of vessel calls required to carry this allocated amount was based on 67% of the historical utilization of Panamax vessels of Savannah's share of vessel capacity for this class.

Next, the PDT allocated the forecasted Post-Panamax cargo volumes to the forecasted Post-Panamax fleet using the forecast of the number of Post-Panamax calls in an unconstrained channel. At certain depths it becomes economically advantageous to switch from a PPX1 vessel to a PPX2 vessel. The number of PPX calls that was predicted by MSI for its unconstrained channel could then be applied. For the 42 foot without condition channel depth, 50% of the unconstrained PPX2 vessels were deployed at Savannah for all benefiting trade routes. In the 42 foot channel, they were replaced by 1.4 PPX 1 vessels as discussed above to account for comparable capacity.

Table 42 shows the average tonnage of Savannah cargo allocated to each Post-Panamax vessel call for the FE (Panama) ECUS and the ECUS EU GULF PEN trade routes by project depth. The average tonnages allocated per call were based on the maximum practicable capacity by vessel class by channel depth (based on the MPD) and the historical share of vessel capacity used for Savannah cargo by vessels calling at Savannah. For most services, the Post-Panamax vessels

are able to carry more cargo as the channel depth increases until the vessel capacity is no longer constrained by channel depth. Thus, a PPX2 vessel on the FE-(Panama)-ECUS trade route reaches its maximum average *share* of capacity[22] (10,293 tonnes for imports) at a 45-foot channel depth while on the ECUS-EU-GULF route the maximum share of capacity is not reached until 47 feet. This reflects the differences in trade weight per TEU.

Table 42: Average Metric Tons Carried per Call by Channel Depth - Imports

Vessel Type	Draft (feet)					
	42	44	45	46	47	48
Route: FE-(Panama)-ECUS						
PPX1	6,978	7,344	7,344	7,344	7,344	7,344
PPX2	9,214	10,039	10,293	10,293	10,293	10,293
Route: ECUS-EU-GULF						
PPX1	2,629	2,866	2,984	3,020	3,020	3,020
PPX2	3,472	3,783	3,938	4,093	4,233	4,233
Route: FE (Suez) ECUS						
PPX1	8,557	9,328	9,577	9,577	9,577	9,577
PPX2	11,300	12,311	12,817	13,322	13,423	13,423

The total tons allocated to the PPX class of vessels are then estimated by multiplying the ton per vessel class by the number of the calls per vessel class. This is repeated for each channel depth and for each route service.

The residual forecasted tonnages left after allocation to the Sub-Panamax and PPX vessel classes were then allocated to the Panamax fleet. The number of vessel calls required by this class was based on historical averages of Savannah's share of vessel capacity for the Panamax vessel class.

To summarize, the Sub-Panamax calls reflect historical shares of total tonnage and Savannah's historical share of vessel capacity for this class. The Post-Panamax vessel calls were imputed based on a commodity forecast developed by the PDT and by modifying a methodology applied by MSI in determining the fleet of Post-Panamax vessels calling at Savannah. The Panamax vessel calls reflect the residual forecasted commodities allocated to Panamax vessels based on the historical utilization of Panamax vessel capacity used for Savannah cargo. The flowchart details the many steps used in deriving the transportation savings (Attachment 2).

Table 43 shows the forecasted Savannah calls by vessel class, project year and depth for all route services. This information illustrates how the composition shifts for subsequent project increments. The number and composition of vessel trips remains constant at project depths of 47 and above.

[22] Maximum share of capacity, not the total maximum capacity of the vessel

Table 43: Forecast Vessel Calls by Vessel Size Class, Channel Depth, and Year

42-Foot Depth	2017	2020	2025	2030
SPX	497	593	758	947
PX	1,196	778	1,122	1,196
PPX1	479	866	1,006	1,421
PPX2	120	271	382	527
Total	*2,292*	*2,509*	*3,267*	*4,092*
44-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,135	700	992	1,067
PPX1	312	478	471	672
PPX2	239	533	761	1,035
Total	*2,183*	*2,304*	*2,982*	*3,720*
45-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,109	671	952	1,007
PPX1	312	474	467	666
PPX2	239	527	753	1,027
Total	*2,157*	*2,265*	*2,930*	*3,647*
46-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,096	658	932	982
PPX1	312	471	465	662
PPX2	239	524	749	1,021
Total	*2,144*	*2,247*	*2,903*	*3,613*
47-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,092	649	924	975
PPX1	312	471	462	661
PPX2	239	524	749	1,018
Total	*2,140*	*2,238*	*2,892*	*3,601*
48-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,092	649	924	975
PPX1	312	471	462	661
PPX2	239	524	749	1,018
Total	*2,140*	*2,238*	*2,892*	*3,601*

3.5 Summary Information and Assumptions

1. Post-Panamax Generation 1 ships currently call at Savannah on the FE (Suez) ECUS, ECUS MED, and ECUS EU GULF PEN trade routes that do not transit the Panama Canal.

2. When the expanded Panama Canal opens (estimated to be 2015), PPX ships will call on the Savannah Harbor in both the without- and with-project conditions on the larger trade routes which are currently constrained by the canal - FE (Panama) ECUS, FE ECUS MED PEN, FE ECUS EU PEN and RTW.

3. If Savannah Harbor is deepened, there will be a shift toward PPX2 vessels (47.6 ft. design draft) on routes currently utilizing PPX1 vessels as well as on those routes which transit the Panama Canal.

4. Carrier lines tend to deploy larger vessels on trade routes with deeper channels and large volumes of trade and due to propensity of fewer constraints on operations.

5. Usable tide is based on the tide characteristics of the Savannah River. Pilots are assumed to use tide to their advantage.

6. The required vessel underkeel clearances for safety range from 2.7 feet to 3.0 feet, depending on the size of vessel. These figures were based on present operating practices and validated by pilots. There were also additional clearances for fresh water sinkage, which range from 0.7 to 1.3 feet, again depending on the size of the vessel. The total vessel underkeel clearance requirements range from 3.5 to 4.3 feet.

7. It is assumed that the Garden City Terminal will have a maximum capacity of 6.5 million TEUs, as described by the Garden City Terminal's Master Plan. This estimate was found to be reasonable given the long term commitments from importers at nearby distribution centers, the rapid growth in the U.S. Southeast, and the current throughput rate of nearly 3 million TEUs (and well below its actual capacity) as well as good STS crane and berth productivity. The 6.5 million TEU terminal capacity is forecasted to be reached by 2030; therefore, cargo volumes were held constant beyond this project year.

8. Initially, there was insufficient information available to precisely determine the average weight of those containers that did not originate in or were destined for Savannah. However, PIERS data was compiled for the East Coast according to the traded services and reconciled with data for Savannah for 2007. This analysis enabled reasonable estimation of the average weight per container on board the vessel as it served the East Coast and Savannah. Therefore, an average weight per container was applied for evaluation although it is recognized that some containers are lighter or heavier than the average. Upon discovering that for some trade routes, some vessels ended up exceeding their MPD more than 15% of the time, the PDT calibrated the model using average cargo weights that would not exceed the 85% assumption."

9. Economic speed for vessel cost data by class was about 85% to 90% of service speed capability. Transit speeds for all classes of vessel were adjusted to be uniform for maintenance of schedule and based on current surveys of trading and employment of vessels. Costs were adjusted based on a service speed of 17 knots for all Panamax and Post-Panamax.

10. Estimates of total cargo carried on each vessel class were imputed based on observed sailing drafts and the application of load factor evaluations. Subject evaluations were based on certain critical assumptions including allowances for vacant slots, a minimum number empties, weight, and weight per TEU.

11. The model allocates the forecasted cargo to the PPX classes and the Sub-Panamax class first, based on the PPX capacity forecast, with the residual forecasted cargo allocated to the Panamax class.

12. Over the long term, there are no assumed barriers in the form of limitations on shipyard capacity, availability to finance, etc. It is clear that fleet growth and trade growth are highly correlated. The new building must be ordered to meet net fleet growth and replace those vessels that are scrapped. Over the long term sufficient vessels will be ordered and delivered but the pattern of ordering will not be even. This process is determined by market conditions.

13. Base year of 2017; Federal Discount Rate of 4.125%

14. The capital improvement plan at Garden City terminal would be consistently applied to the without and with project condition.

4. TRANSPORTATION COST SAVINGS BENEFIT ANALYSIS

NED benefits were estimated by calculating the reduction in transportation cost for each project depth. Channel deepening reduces transportation cost by allowing a more efficient future fleet mix. The TCSM reflects the decisions of vessel fleet owners to allocate their largest vessels to routes that have adequate traffic and reliable project depth. Savannah Harbor is the second largest container port on the east coast and is expected to continue to outperform competing ports. As the Savannah Harbor channel is deepened, the reliability of the channel depth increases. The increased reliability is expected to encourage shippers to replace smaller less efficient vessels with the larger more efficient vessels on Savannah route services.

There are three primary impacts from channel deepening that cause changes in the future fleet at Savannah. The first is increases in a vessel's maximum practicable loading capacity[23]. Channel restrictions limit a vessels capacity by limiting its draft. Deepening the channel reduces this constraint and the vessel's maximum practicable capacity increases towards its design capacity. This increase in vessel capacity results in fewer vessel trips being required to transport the forecasted cargo. The second impact of increased channel depth is the increased reliability of water depth, which encourages the deployment of larger vessels to Savannah. The third impact is a consequence of the second. The increase in Post-Panamax vessels displaces the less economically efficient Panamax class vessels.

Forecasted commodities were allocated to the future fleet in the following manner. First, a share of future tonnage was allocated to the sub-Panamax vessel class. As this fleet was not constrained by the existing depth (the maximum design draft was less than 35 feet), additional project depth would not affect the future fleet for this class of vessels and market. The allocation of future traffic to this vessel class was based on its historical share at Savannah and with an expected drop in SPX capacity of approximately 33 percent between now and 2015. The allocation varies by route and overall accounts for about a small percentage of the forecasted traffic.

The second allocation was to the forecasted Post-Panamax container fleet. Traditional Corps' analysis for bulk commodities would require the analyst to "load" each vessel to a specific channel-constrained depth and compute the transportation costs. This was not done in the TCSM. Container vessels are not characterized by "there and back again" routes common to the bulk cargo trade. Container vessels are deployed on liner service routes which often serve 5 to 15 ports, with some routes serving as many as 20 ports. The sailing drafts into and out of each port can vary widely. The TCSM model does not explicitly account for vessel sailing drafts. Rather, based on historical data, the share of a vessel's capacity that is used to load and off load cargo at Savannah was calculated for the existing Panamax class fleet for each trade route. Table

[23] The practicable loading capacity is more fully explained in the "Load Factor Analysis" section.

44 shows the share of vessel capacity used for imports and exports by route service. The FE (Suez) ECUS and FE (Panama) ECUS services received and delivered the highest share of cargo and thus their share of the future capacity is higher.

Table 44: Savannah Share of Vessel Capacity Utilized by Route[24]

Route Service	Share
FE (Panama) ECUS	17.15%
FE (Suez) ECUS	20.87%
FE ECUS EU PEN	16.04%
FE ECUS MED PEN	15.82%
AU ECUS EU PEN	7.83%
ECUS AU PEN	6.05%
ECUS EU GULF PEN	6.24%
ECUS MED	7.17%
ECUS WCSA-ECSA	16.64%
RTW	9.02%

This percent of vessel capacity utilized by Savannah trade was applied to the maximum practicable vessel capacity of the forecasted Post-Panamax vessels. Table 45 shows the maximum practicable capacity for PPX1 vessels by route service and channel depth. Table 46 shows the same information for the PPX2 vessel class, which are designed to carry more tonnage.

Table 45: Maximum Practicable Capacity by Service Route - PPX1 - Metric Tons

World Region Route	Channel Depth (feet)					
	42	44	45	46	47	48
RTW	42,153	45,951	47,850	48,419	48,419	48,419
FE (Suez) ECUS	41,001	44,694	45,888	45,888	45,888	45,888
FE (Panama) ECUS	40,685	42,820	42,820	42,820	42,820	42,820
FE ECUS MED PEN	41,511	45,250	47,120	47,284	47,284	47,284
FE ECUS EU PEN	41,044	44,673	44,673	44,673	44,673	44,673
ECUS AU PEN	42,651	46,493	48,414	48,991	48,991	48,991
ECUS EU GULF PEN	42,160	45,958	47,857	48,427	48,427	48,427
ECUS MED	42,457	46,282	48,195	48,769	48,769	48,679
ECUS WCSA-ECSA	41,296	45,016	46,803	46,803	46,803	46,803
AU ECUS EU PEN	42,891	46,755	48,687	49,267	49,267	49,267

[24] Used for allocating Savannah's share of tonnage on Post-Panamax vessels

Table 46: Maximum Practicable Capacity by Service Route - PPX2 - Metric Tons

World Region Service	Channel Depth (feet)					
	42	44	45	46	47	48
RTW	55,665	60,645	63,135	65,624	67,865	67,865
FE (Suez) ECUS	54,143	58,986	61,408	63,830	64,313	64,313
FE (Panama) ECUS	53,726	58,532	60,014	60,014	60,014	60,014
FE ECUS MED PEN	54,816	59,720	62,172	64,624	66,271	66,271
FE ECUS EU PEN	54,199	59,048	61,473	62,611	62,611	62,611
ECUS AU PEN	56,322	61,360	63,879	66,399	68,666	68,666
ECUS EU GULF PEN	55,673	60,654	63,144	65,634	67,876	67,876
ECUS MED	56,066	61,082	63,590	66,098	68,355	68,355
ECUS WCSA-ECSA	54,533	59,411	61,851	64,290	65,596	65,596
AU ECUS EU PEN	56,639	61,706	64,240	66,773	69,053	69,503

Table 47 shows the estimated tonnage carried per call for the Post-Panamax fleet by project depth for imports on the FE (Panama) ECUS route service and the ECUS EU GULF PEN route service. For example, given a 44-foot channel, a PPX2 vessel on the FE (Panama) ECUS route service, would carry 10,039 metric tons of Savannah cargo. This is the product of 58,532 (from Table 46) times 17.15% (from Table 44).

Table 47: Average Tonnage Carried Per Call by Channel Depth - Imports

Vessel Class	Draft (feet)					
	42	44	45	46	47	48
Route: FE (Panama) ECUS						
PPX1	6,978	7,344	7,344	7,344	7,344	7,344
PPX2	9,214	10,039	10,293	10,293	10,293	10,293
Route: ECUS EU GULF PEN						
PPX1	2,629	2,866	2,984	3,020	3,020	3,020
PPX2	3,472	3,783	3,935	4,093	4,233	4,233
Route: FE (Suez) ECUS						
PPX1	8,557	9,328	9,577	9,577	9,577	9,577
PPX2	11,300	12,311	12,817	13,322	13,423	13,423

These average tonnages per trip were then multiplied by the forecasted number of trips for each Post-Panamax vessel fleet in order to calculate the share of the forecasted tonnages carried by this vessel class. The remaining, unallocated forecasted cargo was then assigned to the Panamax class fleet (Figure 32).

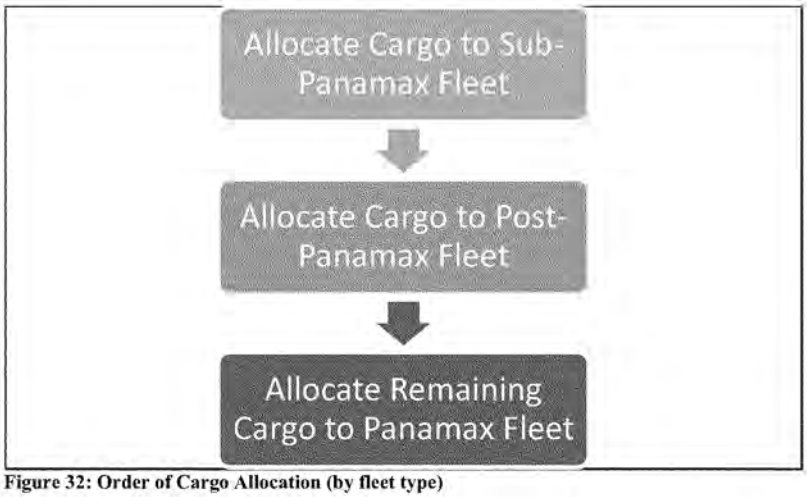


Figure 32: Order of Cargo Allocation (by fleet type)

Table 48 shows the corresponding number of trips required to move the allocated cargo, by vessel class, channel depth and forecast year.

Table 48: Vessel Trips by Year, Vessel Class, and Channel Depth

42-Foot Depth	2017	2020	2025	2030
SPX	497	593	758	947
PX	1,196	778	1,122	1,196
PPX1	479	866	1,006	1,421
PPX2	120	271	382	527
Total	*2,292*	*2,509*	*3,267*	*4,092*
44-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,135	700	992	1,067
PPX1	312	478	471	672
PPX2	239	533	761	1,035
Total	*2,183*	*2,304*	*2,982*	*3,720*
45-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,109	671	952	1,007
PPX1	312	474	467	666
PPX2	239	527	753	1,027
Total	*2,157*	*2,265*	*2,930*	*3,647*
46-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,096	658	932	982
PPX1	312	471	465	662
PPX2	239	524	749	1,021
Total	*2,144*	*2,247*	*2,903*	*3,613*
47-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,092	649	924	975
PPX1	312	471	462	661
PPX2	239	524	749	1,018
Total	*2,140*	*2,238*	*2,892*	*3,601*
48-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,092	649	924	975
PPX1	312	471	462	661
PPX2	239	524	749	1,018
Total	*2,140*	*2,238*	*2,892*	*3,601*

4.1. Estimated Share of World Fleet

The previous table provided the number of vessel calls forecast for the Savannah Harbor. The estimated number of vessels required to transport the forecast cargo is shown in the following tables. The values for number of vessels shown in Table 49 and 50 are approximate, or equivalent number of vessels, assuming an average string (service) of vessels is made up of 9 vessels calling weekly. These equivalent vessel numbers are a result of dividing the number of vessel calls in table 48 by 52 weeks and multiplying by 9 vessels per service. While some services have fewer than 9 vessels and some have more depending upon the frequency of service and the distance of the trade route, 9 vessels is a general average as is the weekly service calls.

The percent of world fleet values shown in the table is derived by simply dividing the equivalent number of vessels in given year by the number of vessels in the respective classes by the historic and projected world fleet presented earlier in this appendix.

The purpose of this analysis and presentation is to serve as a cross check on the reasonableness of the projected number of vessel calls by comparing them to the historic and future world fleet. As shown in table 49, in 2007 PMX vessels (3900 to 5200 TEUs) calling Savannah amounted to a historic high of about 37% of the world fleet. As PPX vessels began calling Savannah in 2006, the percent share of PMX vessels calling Savannah began to decline to about 27% in 2010. As shown in Table 50, In the without project, 42 foot channel conditions, PPX 1 vessels (5200 to 7600 TEUs) are projected to call in greater numbers and become the most common vessel class calling in both total number of equivalent vessels calling and as a percent of the world fleet of that class of vessels reaching about 29% in 2030. For the 47 foot channel with project condition PPX2 vessels (7600 to 12000 TEUs) become the most common vessels reaching about 24% of the world fleet of that class. For the combined number of PPX1 and PPX2 vessels calling in 2030, they would be about 20 percent of the combined number of vessels projected in the world fleet.

The conclusion of this "backcheck" confirms that the projected vessel calls do not result in an inordinate amount of world fleet projected to call Savannah in the without or with project conditions, and supports the reasonableness of the TCSM results regarding vessel calls.

Table 49: Historic Percent of World Fleet Calling Once Per Week on Savannah [25]

	2000		2005		2007		2010	
42 ft. depth	Vessels	% World Fleet	Vessels	% World Fleet	Vessels	% World Fleet	Vessels	% World Fleet
SPX	100	4%	102	4%	121	4%	90	3%
PX	20	10%	125	34%	178	37%	190	27%
PPX1	0	0%	0	0%	13	4%	37	8%
PPX2	0	0%	0	0%	0	0%	1	0%
Total	158	4%	227	6%	312	7%	318	7%

[25] It is assumed that there are 9 vessels calling weekly on each 'string.'

Table 50: Percent of World Fleet Utilized on Average Calling Savannah Once Per Week

	2017		2020		2025		2030	
	Vessels	% World Fleet	Vessels	% World Fleet	Vessels	% World Fleet	Vessels	% World Fleet
42 ft. depth								
SPX	86	2%	91	2%	117	2%	146	3%
PX	207	25%	120	14%	173	19%	184	19%
PPX1	83	15%	133	23%	155	24%	219	29%
PPX2	21	4%	42	8%	59	9%	81	11%
Total	397	7%	386	6%	503	6%	629	9%
44 ft. depth								
SPX	86	2%	103	3%	131	2%	164	4%
PX	196	24%	121	15%	172	19%	185	19%
PPX1	54	10%	83	14%	81	12%	116	16%
PPX2	41	9%	92	18%	132	21%	179	24%
Total	378	7%	399	7%	516	6%	644	9%
45 ft. depth								
SPX	86	2%	103	3%	131	2%	164	4%
PX	192	23%	116	14%	165	18%	174	18%
PPX1	54	10%	82	14%	81	12%	115	15%
PPX2	41	9%	91	18%	130	21%	178	24%
Total	373	7%	392	6%	507	6%	631	9%
46-foot depth								
SPX	86	2%	103	3%	131	2%	164	4%
PX	190	23%	114	14%	161	18%	170	17%
PPX1	54	10%	82	14%	80	12%	115	15%
PPX2	41	9%	91	18%	130	21%	177	24%
Total	371	7%	389	6%	503	6%	625	9%
47 ft. depth								
SPX	86	2%	103	3%	131	2%	164	4%
PX	189	23%	112	14%	160	18%	169	17%
PPX1	54	10%	82	14%	80	12%	114	15%
PPX2	41	9%	91	18%	130	21%	176	24%
Total	370	7%	387	6%	501	6%	623	9%

4.2. Calculation of Transportation Costs

The transportation costs are calculated for each route service by project year for each project depth. The lowest level calculation multiplies the number of calls by vessel class by route service (by year by project depth) times the voyage cost per 1,000 nautical miles by vessel class, times the Savannah portion of the total route service distance/1,000. This is done across all vessel classes and all project depths and all route services for forecast years, 2017, 2020, 2025 and 2030.

4.2.1. Voyage Cost by Vessel Class

The TCSM model disaggregates the four vessel classes used in this report (SPX, PX, PPX1, and PPX2) into even smaller, sub-categories. For example, there are 7 sub-categories within the Panamax vessel class. Table 51 presents each vessel class broken down with its associated voyage cost per 1000 nautical miles. The voyage costs are based on EGM 08-04: Deep Draft vessel operating cost adjusted for a 17 knot operating speed.

Table 51: Voyage Cost per 1000 Nautical Miles and Other Selected Statistics

	Vessel Class Number	Voyage Cost per 1000 Nautical Miles	TEU Rating Homogeneous (14THM)	TEU Rating Nominal	Aggregate MXSLLD Draft-Feet	Aggregate Length Overall (Feet)	Aggregate Length Between Perpendiculars (feet)	Aggregate Breadth (Feet)	Deadweight Tonnage (DWT; Metric)
Sub-Panamax	4	$26,172	838	907	26.2	466	435	73	11,726
	5	$30,728	1,066	1,090	28.9	499	466	79	14,924
	6	$35,733	1,317	1,388	30.3	535	502	85	18,438
	7	$38,874	1,474	1,447	31.3	571	534	87	20,643
	8	$41,070	1,585	1,529	32.5	576	540	84	22,184
	9	$44,059	1,734	1,618	33.5	585	549	90	24,283
	10	$44,814	1,772	1,778	34.6	596	559	92	24,812
	11	$45,608	1,812	1,894	35.6	603	566	92	25,370
	12	$53,826	2,224	2,268	36.2	657	621	98	31,139
	13	$57,740	2,420	2,470	37.6	676	636	99	33,887
Panamax	14	$69,558	3,013	3,084	38.5	777	729	105	42,183
	15	$71,165	3,094	3,188	39.4	766	723	104	43,311
	16	$73,558	3,214	3,389	40.3	794	753	106	44,991
	17	$80,794	3,576	3,841	41.2	846	801	106	50,070
	18	$90,369	4,057	4,125	42.5	907	859	106	56,792
	19	$87,652	3,920	3,993	43.4	887	839	104	54,885
	20	$101,999	4,640	4,729	44.4	959	921	106	64,956
PPX1	27	$104,391	5,291	6,186	46.0	954	905	132	74,069
PPX2	41	$138,722	7,415	8,670	47.6	1,106	1,060	143	103,817

4.2.2. Calculation of Distances for Each Route

Voyage distance is another factor considered when determining the transportation costs and was calculated for each benefiting service. Since there may be many individual services within each trade route, the itineraries for each of the 47 services calling on the Savannah Harbor were determined. The vessel call list included over 20 domestic and foreign ports for some of the pendulum services and as few as 5 ports on smaller service routes. After identifying the port rotation for each individual service, the distance between the respective ports on each list was determined. As an example, the itinerary for the four individual services which comprise the

ECUS EU GULF PEN world region service is shown in Table 52. The sum of the distances between all of the ports comprises what is known as "circuit miles.

Table 52: ECUS EU GULF PEN World Region Service - Individual Service Rotations

GAX		TA2		MSEUF		MSCEU	
Port Rotation	**Distance from Previous Port**	**Port Rotation**	**Distance from Previous Port**	**Port Rotation**	**Distance from Previous Port**	**Port Rotation**	**Distance from Previous Port**
Savannah		Savannah		Antwerp		Savannah	
Norfolk	480	Mobile	1,067	Hamburg	351	Charleston	72
Antwerp	3,463	Houston	434	Bremerhaven	90	Antwerp	3,754
Thamesport	134	Miami	935	Felixstowe	290	Felixstowe	116
Bremerhaven	325	Norfolk	759	Le Havre	174	Bremerhaven	290
Charleston	3,887	Rotterdam	3,491	Valencia	1,533	LeHavre	441
Miami	423	Felixstowe	125	Charleston	3,987	Charleston	3,587
Houston	935	Bremerhaven	290	Savannah	72	Savannah	72
Savannah	1,316	New York/NJ	3,419	Port Everglades	362	Port Everglades	362
Total Distance	**10,963**	Charleston	618	Freeport	76	Freeport	76
		Savannah	72	Vera Cruz	1,066	Veracruz	1,066
		Total Distance	**11,210**	Altamira	237	Altamira	237
				Houston	466	Houston	466
				New Orleans	399	New Orleans	399
				Freeport	816	Freeport	816
				Savannah	353	Savannah	353
				Chas	72	**Total Distance**	**12,107**
				Antwerp	3,754		
				Total Distance	**14,098**		

Once the voyage distances were determined, the TEU capacity of each service was determined. First, the number of vessels on each service was multiplied by the average TEU capacity of the vessels utilized on that service. Next, the TEU capacities of each individual service were summed to establish the TEU capacity of the world region service. The total TEU capacity of the world region service was then divided by individual service capacity to determine what percent of world region service's TEU capacity could be attributed to each individual service. The percent share for each individual service was then multiplied by the total distance for that service to establish the weighted mileage for that service. This calculation process was repeated for each service on the world region service; the distances were then summed to establish the total distance to be used for the world region service. This process is illustrated in Table 53 below.

Table 53: ECUS EU GULF PEN World Region Service - Distance Calculation

Service	Number of Vessels	Avg TEU Capacity/ Vessel	Total TEU Capacity	Percent Share	Circuit Miles	Weighted Mileage
GAX	5	3,200	16,000	12%	10,963	1,304
TA2	5	4,100	20,500	15%	11,210	1,708
MSEUF	8	6,567	52,536	39%	14,098	5,505
MSCEU	7	6,500	45,500	34%	12,107	4,095
ECUS EU GULF PEN			**134,536**			**12,612**

The weighted mileage calculation was performed for each world region service, following the steps identified above. Table 54 shows the results of this evaluation.

Table 54: World Region Service - Total Trip Distance

World Region Service	Total Trip Distance
ECUS Africa	discontinued in 2006
FE (Panama) ECUS	22,653
FE (Suez) ECUS	24,196
FE ECUS EU PEN	31,356
FE ECUS MED PEN	34,321
AU ECUS EU PEN	28,526
ECUS AU PEN	21,614
ECUS EU GULF PEN	12,612
ECUS MED	10,568
ECUS WCSA-ECSA	11,701
RTW	25,753

4.2.3. Savannah Portion of the Total Route Service Distance and Share of Voyage Costs

The basic transportation cost model computes the costs per thousand miles for the forecasted vessel calls for the without and with project condition. The savings in costs between the without and with project condition make up the transportation cost savings benefits per thousand miles. The total trade route distance is then determined based on the weighted average origin-to-destination distances as discussed above. It should be noted that improvements at Savannah Harbor which result in fewer container vessel trips to the port does not necessarily translate into similar reductions in vessel trips for the entire trades routes that service Savannah harbor. Port rotations are constantly changing. Therefore, to estimate actual transportation cost savings attributable to changes at Savannah Harbor, the amount of total round trip vessel cost savings is multiplied ***by Savannah's cargo share of vessel utilization when calling at Savannah***. In essence, the voyage cost is "allocated" based on Savannah's share of all cargo on vessels calling at Savannah.

To determine how much "weight" or vessel cost "allocation" to attribute to Savannah Harbor improvements, the study team first examined Savannah's historical share of cargo for each trade route, specifically the 2005/2007 cargo plus weight of all laden and empty boxes The historical data for vessel calls at Savannah provided information as to number of TEUs and cargo weight,

expressed in tons, of laden TEUs off loaded (Inbound/Import) and on loaded (Outbound/Export) at Savannah, but it unfortunately did not include total number of TEUs or weight (tons) of carried on the vessels when they sailed in and out of Savannah. In addition, the historical data did not include total TEUs or weight of cargo on the entire trade route. Therefore, to estimate Savannah's share of trade route cargo, the study team needed to use proxies derived from the LFA and the analysis of sailing draft relative to design draft.

Recall that the container vessels contained a mix of cargo originating from and going to multiple ports and that a certain share of each vessel's cargo was exclusive to Savannah.

The total tonnage is imputed by using the total carriage weight from the LFA for each vessel by sailing draft relative to design draft from the historical calls.

Equation 3: Percent of Savannah Cargo on All Vessels and Trips for Each Route

% of Savannah Cargo on All Vessels and Trips for Each Route =

(Total tons of Savannah cargo, carriage, etc. from all calls on route)/
(Total tons of cargo, carriage, etc. for all calls to Savannah on route

Table 55: Percent of Vessel Cargo Allocated to Savannah

Service Route	Calculated % Savannah Tonnage of All	Savannah Cargo (tons) - Numerator	Est. Total Cargo for all Vessels @ Savannah - Denominator
FE (Panama) ECUS	24.48%	10,327,722	42,182,468
FE (Suez) ECUS	32.45%	2,562,763	7,897,620
FE ECUS EU PEN	20.21%	2,141,636	10,595,409
FE ECUS MED PEN	20.38%	1,452,782	7,128,748
AU ECUS EU PEN	16.00%	699,835	4,373,929
ECUS AU PEN	15.99%	50,805	317,775
ECUS EU GULF PEN	9.40%	377,601	4,014,935
ECUS MED	15.31%	855,804	5,590,178
ECUS WCSA-ECSA	11.49%	213,813	1,860,444
RTW	11.86%	216,005	1,820,758
Total		**18,898,766**	**85,782,264**

The following table shows the weighted average estimated Savannah share of trade route cargo carried by Panamax ships on each trade route when the vessels call the Savannah port[26].

Table 56: Savannah Share of Voyage Cost

Service Route	Weight	Route Service Distance	Savannah Proportion
FE (Panama) ECUS	24.48%	22,653	5,572
FE (Suez) ECUS	32.45%	24,196	7,852
FE ECUS EU	20.21%	31,356	6,337
FE ECUS MED PEN	20.38%	34,321	6,994
AU ECUS EU	16.00%	28,526	4,564
ECUS AU PEN	15.99%	21,614	3,456
ECUS EU GULF PEN	9.40%	12,612	1,185
ECUS MED	15.31%	10,568	1,618
ECUS WCSA-ECSA	11.49%	11,701	1,344
RTW	11.86%	25,753	3,054

4.3. Transportation Cost Savings Benefits by Project Depth

The total transportation cost savings benefits were estimated for a 50-year period of analysis for the years 2017 through 2066. Transportation cost savings were estimated using the TCSM for the years 2017, 2020, 2025 and 2030. Since Garden City terminal capacity of 6.5 million TEUs is expected to be reached by 2030, the transportation cost savings were held constant beyond 2030. The present value was estimated by interpolating between the aforementioned dates and discounting at the current FY 2011 Federal Discount rate of 4.125 percent. Estimates were determined for each alternative project depth. Table 57 shows the average annual equivalent transportation cost savings by project depth by trade service route. The FE (Panama) ECUS, the FE ECUS EU PEN, and the FE ECUS MED PEN are all services that transit the Panama Canal. Combined with the FE (Suez) ECUS service, which transits the Suez Canal, these 4 trade route services comprise more than ninety percent of the total transportation cost savings. For the FE (Panama) ECUS world region service, the savings do not increase beyond a 45-foot project as the vessels on this route are generally expected to "cube" out by that depth due to relatively light cargo. On the FE ECUS EU PEN savings do not increase beyond a 46-foot project depth. The FE (Suez) ECUS service, with its large make-up of heavier imports as well as a large forecasted contingent of Post-Panamax vessels, will continue to reap cost savings as the channel is deepened to 47 feet. For five services, transportation savings continue to accrue with a 47-project depth due to the fact that vessels are expected draft deeper and, at times, attain full design draft.

[26] Note the FE (Suez) ECUS and ECUS EU GULF account for both Post-Panamax and Panamax vessels in the weighted average.

Table 57: AAE Transportation Cost Savings by Project Depth

Service Route	42 feet	44 feet	45 feet	46 feet	47 feet	48 feet
FE (Panama) ECUS	$ -	$ 37,020,000	$ 46,520,000	$ 46,520,000	$ 46,520,000	$ 46,520,000
FE (Suez) ECUS	$ -	$ 31,670,000	$ 44,230,000	$ 53,560,000	$ 54,500,000	$ 54,500,000
FE ECUS EU PEN	$ -	$ 14,740,000	$ 19,900,000	$ 22,330,000	$ 22,330,000	$ 22,330,000
FE ECUS MED PEN	$ -	$ 10,720,000	$ 16,340,000	$ 20,210,000	$ 22,700,000	$ 22,700,000
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 600,000	$ 910,000	$ 1,150,000	$ 1,330,000	$ 1,330,000
ECUS MED	$ -	$ 550,000	$ 830,000	$ 1,050,000	$ 1,220,000	$ 1,220,000
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 2,910,000	$ 4,420,000	$ 5,560,000	$ 6,450,000	$ 6,450,000
Total AAE Benefits	$ -	$ 98,210,000	$ 133,150,000	$ 150,370,000	$ 155,040,000	$ 155,040,000
Present Value End of Period Basis		$ 2,065,320,000	$ 2,800,050,000	$ 3,162,200,000	$ 3,260,590,000	$ 3,260,590,000

Table 58 shows the incremental average annual equivalent transportation cost savings by project and route service. The savings increase at a decreasing rate for each incremental project depth. There were small additional savings at 47 feet but no incremental savings beyond that depth. This is due primarily to the size of vessels anticipated to make use of the Savannah Harbor on a regular basis.

Table 58: Incremental Transportation Cost Savings by Project Depth

Service Route	42 feet	44 feet	45 feet	46 feet	47 feet	48 feet
FE (Panama) ECUS	$ -	$ 37,020,000	$ 9,500,000	$ -	$ -	$ -
FE (Suez) ECUS	$ -	$ 31,670,000	$ 12,560,000	$ 9,330,000	$ 950,000	$ -
FE ECUS EU PEN	$ -	$ 14,740,000	$ 5,170,000	$ 2,430,000	$ -	$ -
FE ECUS MED PEN	$ -	$ 10,720,000	$ 5,620,000	$ 3,870,000	$ 2,490,000	$ -
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 600,000	$ 310,000	$ 230,000	$ 180,000	$ -
ECUS MED	$ -	$ 550,000	$ 290,000	$ 220,000	$ 170,000	$ -
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 2,910,000	$ 1,500,000	$ 1,150,000	$ 890,000	$ -
Total AAE Benefits	*$ -*	*$ 98,210,000*	*$ 34,940,000*	*$ 17,220,000*	*$ 4,680,000*	*$ -*
Present Value End of Period Basis		*$ 2,065,320,000*	*$ 734,730,000*	*$ 362,150,000*	*$ 98,390,000*	*$ -*

5. SENSITIVITY ANALYSES

The Principles & Guidelines and subsequent ER1105-2-100 recognize the inherent variability to water resources planning. Navigation projects and container studies in particular are fraught with uncertainty about future conditions. A sensitivity analysis is a useful technique that addresses uncertainty by systematically adjusting parameters in a model to determine the effects of such changes.

After completing the transportation cost model for the base condition, the study team performed sensitivity analysis by varying major input assumptions of the base condition (i.e., to explore analysis sensitivity and resultant changes in benefits and vessel calls). The types of sensitivity analyses were developed by the PDT to address specific areas of uncertainty and issues and questions raised during review of the draft report. Some sensitivities which had been presented

in the draft report were dropped either because they were redundant and did not provide additional insights, or because they were determined to be no longer relevant. In addition, some sensitivities have been added to address specific questions raised and/or because of recognition of particular areas of uncertainty not considered in prior evaluations. The sensitivities have also been reorganized from the draft report and are grouped by the general categories of: sensitivities to the commodity forecasts, sensitivities to vessel availability and loadings, and other sensitivities. The following is a listing of the sensitivity analyses:

Sensitivities to Commodity Forecasts

1. Increase annual commodity growth by 1%
2. Increase annual commodity growth by 3%
3. Decrease annual commodity growth by 1%
4. Decrease annual commodity growth by 3%
5. No growth in commodity forecast

Sensitivities to Vessel Availability and Loadings

6. Historical Sub-Panamax share of Capacity Calling
7. Reduce future Sub-Panamax share of Capacity Calling
8. Increase amount of Savannah Cargo carried on Post-Panamax Vessels
9. Full deployment of Post-Panamax Vessels in Without (42 ft) Project Condition
10. Reduce Post-Panamax Vessel Calls by 25%
11. Deployment of Post-Panamax Vessels by Unit Costs
12. Increase Post-Panamax Vessel Loading beyond Maximum Practicable Capacity
13. Reduce PPX 1 Replacement of PPX2 Vessels, Use historical Sub-Panamax share of capacity calling, and Deploy PPX Vessels by unit costs

Other Sensitivities

14. Increase Cargo density
15. Increase Savannah Share of Trade Route Cargo by 25%
16. Decrease Savannah Share of Trade Route Cargo by 25%
17. Draft Report Values – for comparison purposes

5.1. Sensitivities to Commodity Forecast

5.1.1. Sensitivity 1: Increase Annual Commodity Growth by 1%

For this sensitivity analysis, the commodity growth forecast was adjusted upward by 1 percent per year. If, for example, on a particular route the rate of growth in the base line forecast was 3 percent between two particular years, 4 percent was used for that period in this analysis. With this adjustment, the resultant TEU forecast for 2030 is 7.8 million, compared to 6.5 million in the baseline, an increase of about 20 percent. Table 59 shows the results of the TCSM benefits with the higher growth rate. Average annual equivalent transportation cost savings are about 19 percent greater than the baseline. These benefits are attainable only if this increased growth rate occurs AND throughput capacity of the container terminal is sufficient to handle 7.8 million TEUS in 2030. Otherwise, with a 6.5 million TEU throughput capacity limitation the benefits

are over stated. Table 60 shows vessels calls by year, alternative channel depth, and vessel class. They too are substantially higher than the baseline.

Table 59: Sensitivity 1 – Increase Annual Commodity Growth by 1% - AAE Transportation Cost Savings

Service Route	42 feet	44 feet	45 feet	46 feet	47 feet	48 feet
Transportation Cost Savings						
FE (Panama) ECUS	$ -	$ 43,890,000	$ 55,160,000	$ 55,160,000	$ 55,160,000	$ 55,160,000
FE (Suez) ECUS	$ -	$ 38,200,000	$ 53,080,000	$ 63,520,000	$ 65,150,000	$ 65,150,000
FE ECUS EU PEN	$ -	$ 17,460,000	$ 23,590,000	$ 26,460,000	$ 26,460,000	$ 26,460,000
FE ECUS MED PEN	$ -	$ 12,700,000	$ 19,360,000	$ 23,950,000	$ 26,900,000	$ 26,900,000
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 720,000	$ 1,080,000	$ 1,360,000	$ 1,570,000	$ 1,570,000
ECUS MED	$ -	$ 650,000	$ 990,000	$ 1,240,000	$ 1,440,000	$ 1,440,000
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 3,450,000	$ 5,230,000	$ 6,590,000	$ 7,650,000	$ 7,650,000
Total AAE Benefits	*$ -*	*$ 117,060,000*	*$ 158,490,000*	*$ 178,290,000*	*$ 184,340,000*	*$ 184,340,000*
Service Route	**42 feet**	**44 feet**	**45 feet**	**46 feet**	**47 feet**	**48 feet**
Incremental Transportation Cost Savings						
FE (Panama) ECUS	$ -	$ 43,890,000	$ 11,270,000	$ -	$ -	$ -
FE (Suez) ECUS	$ -	$ 38,200,000	$ 14,890,000	$ 10,440,000	$ 1,630,000	$ -
FE ECUS EU PEN	$ -	$ 17,460,000	$ 6,130,000	$ 2,880,000	$ -	$ -
FE ECUS MED PEN	$ -	$ 12,700,000	$ 6,660,000	$ 4,590,000	$ 2,950,000	$ -
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 720,000	$ 370,000	$ 280,000	$ 220,000	$ -
ECUS MED	$ -	$ 650,000	$ 340,000	$ 260,000	$ 200,000	$ -
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 3,450,000	$ 1,780,000	$ 1,360,000	$ 1,060,000	$ -
Total	*$ -*	*$ 117,060,000*	*$ 41,430,000*	*$ 19,800,000*	*$ 6,050,000*	*$ -*

Table 60: Sensitivity 1 - Increase Annual Commodity Growth by 1% - Forecast Vessel Calls

42-Foot Depth	2017	2020	2025	2030
SPX	531	652	873	1,144
PX	1,284	854	1,290	1,449
PPX1	509	952	1,159	1,714
PPX2	127	298	440	636
Total	*2,451*	*2,756*	*3,762*	*4,943*
44-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	531	652	873	1,144
PX	1,219	768	1,141	1,285
PPX1	331	525	542	811
PPX2	254	586	877	1,251
Total	*2,335*	*2,531*	*3,433*	*4,491*
45-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	531	652	873	1,144
PX	1,192	737	1,095	1,213
PPX1	331	520	538	805
PPX2	254	579	868	1,241
Total	*2,307*	*2,489*	*3,374*	*4,403*
46-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	531	652	873	1,144
PX	1,178	723	1,075	1,186
PPX1	331	518	534	798
PPX2	254	576	863	1,234
Total	*2,294*	*2,469*	*3,344*	*4,363*
47-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	531	652	873	1,144
PX	1,173	715	1,063	1,174
PPX1	331	516	532	798
PPX2	254	576	863	1,231
Total	*2,289*	*2,460*	*3,331*	*4,347*
48-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	531	652	873	1,144
PX	1,173	715	1,063	1,174
PPX1	331	516	532	798
PPX2	254	576	863	1,231
Total	*2,289*	*2,460*	*3,331*	*4,347*

5.1.2. Sensitivity 2: Increase Annual Commodity Growth by 3%

For Sensitivity Analysis 2, the commodity forecast was adjusted upward by 3 percent per year. If, for example on a particular route the rate of growth in the baseline forecast was 3 percent between two particular years, 6 percent was used for that same period with this analysis. With this adjustment, the resultant TEU forecast for 2030 is 11.4 million, substantially higher than the anticipated Garden City Terminal capacity of 6.5 million TEUs. Table 61 shows the results of the TCSM benefits with the higher growth rate. Average annual equivalent transportation cost savings are about 67 percent greater than the baseline. These benefits are attainable only if this increased growth rate occurs AND if throughput capacity of the Garden City container terminal is sufficient to handle 11.4 million TEUS in 2030. Otherwise, with a 6.5 million TEU throughput capacity limitation the benefits are over stated. Table 62 shows vessels calls by year, alternative channel depth, and vessel class. Forecast vessel calls are substantially higher than the baseline and likely greater than harbor capacity regardless of TEU throughput capabilities.

Table 61: Sensitivity 2 – Increase Annual Commodity Growth by 3% - AAE Transportation Cost Savings

Service Route	42 feet	44 feet	45 feet	46 feet	47 feet	48 feet
Transportation Cost Savings						
FE (Panama) ECUS	$ -	$ 61,620,000	$ 77,460,000	$ 77,460,000	$ 77,460,000	$ 77,460,000
FE (Suez) ECUS	$ -	$ 53,440,000	$ 74,340,000	$ 88,990,000	$ 91,240,000	$ 91,240,000
FE ECUS EU PEN	$ -	$ 24,480,000	$ 33,090,000	$ 37,140,000	$ 37,140,000	$ 37,140,000
FE ECUS MED PEN	$ -	$ 17,800,000	$ 27,140,000	$ 33,590,000	$ 37,740,000	$ 37,740,000
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 1,010,000	$ 1,520,000	$ 1,910,000	$ 2,210,000	$ 2,210,000
ECUS MED	$ -	$ 910,000	$ 1,390,000	$ 1,750,000	$ 2,030,000	$ 2,030,000
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 4,840,000	$ 7,340,000	$ 9,240,000	$ 10,730,000	$ 10,730,000
Total AAE Benefits	*$ -*	*$ 164,090,000*	*$ 222,280,000*	*$ 250,090,000*	*$ 258,560,000*	*$ 258,560,000*
Service Route	**42 feet**	**44 feet**	**45 feet**	**46 feet**	**47 feet**	**48 feet**
Incremental Transportation Cost Savings						
FE (Panama) ECUS	$ -	$ 61,620,000	$ 15,840,000	$ -	$ -	$ -
FE (Suez) ECUS	$ -	$ 53,440,000	$ 20,900,000	$ 14,650,000	$ 2,250,000	$ -
FE ECUS EU PEN	$ -	$ 24,480,000	$ 8,610,000	$ 4,040,000	$ -	$ -
FE ECUS MED PEN	$ -	$ 17,800,000	$ 9,340,000	$ 6,450,000	$ 4,150,000	$ -
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 1,010,000	$ 510,000	$ 390,000	$ 300,000	$ -
ECUS MED	$ -	$ 910,000	$ 480,000	$ 360,000	$ 280,000	$ -
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 4,840,000	$ 2,500,000	$ 1,910,000	$ 1,490,000	$ -
Total	*$ -*	*$ 164,090,000*	*$ 58,190,000*	*$ 27,800,000*	*$ 8,480,000*	*$ -*

Table 62: Sensitivity 2 - Increase Annual Commodity Growth by 3% - Forecast Vessel Calls

42-Foot Depth	2017	2020	2025	2030
SPX	605	786	1,154	1,662
PX	1,477	1,027	1,701	2,091
PPX1	572	1,146	1,533	2,491
PPX2	143	358	581	923
Total	*2,797*	*3,317*	*4,970*	*7,167*
44-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	605	786	1,154	1,662
PX	1,403	924	1,504	1,853
PPX1	372	632	717	1,179
PPX2	286	705	1,160	1,817
Total	*2,666*	*3,046*	*4,535*	*6,511*
45-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	605	786	1,154	1,662
PX	1,372	886	1,442	1,748
PPX1	372	627	712	1,169
PPX2	286	698	1,147	1,802
Total	*2,635*	*2,995*	*4,456*	*6,382*
46-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	605	786	1,154	1,662
PX	1,356	869	1,416	1,710
PPX1	372	623	706	1,160
PPX2	286	694	1,141	1,793
Total	*2,619*	*2,972*	*4,417*	*6,324*
47-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	605	786	1,154	1,662
PX	1,351	860	1,399	1,691
PPX1	372	621	704	1,160
PPX2	286	694	1,141	1,788
Total	*2,614*	*2,961*	*4,399*	*6,300*
48-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	605	786	1,154	1,662
PX	1,351	860	1,399	1,691
PPX1	372	621	704	1,160
PPX2	286	694	1,141	1,788
Total	*2,614*	*2,961*	*4,399*	*6,300*

5.1.3. Sensitivity 3: Decrease Annual Commodity Growth by 1%

For this sensitivity analysis, the commodity forecast was adjusted downward by 1 percent per year. For example, if on a particular route the rate of growth in the baseline forecast was 3 percent between two years, only 2 percent was used for that period in this analysis. With this adjustment, the resultant TEU forecast for 2030 is 5.3 million, compared to 6.5 million in the baseline, a reduction of about 18 percent. With this lower growth rate, the Garden City Terminal does not reach it's build out capacity of 6.5 million TEUs until 2037.

Table 63 shows the results of the TCSM benefits with the lower growth rate. Average annual equivalent transportation cost savings are about 5 percent less than the baseline. There is, however, a small understatement in the benefits presented. Since the TCSM is set to compute benefits for growth up to 2035, approximately 2 years in additional growth and benefits are not included. The results, likewise, show a small increase in incremental benefits between 46 and 47 feet. This is due to the computation of benefits between 2030 and 2035 compared to the base condition which held benefits constant after 2030. Overall, expected annual benefits remain high ranging from about $94 to $147 million for the alternative plans. Table 64 shows vessel calls for each alternative through 2030. As expected, vessel calls for each vessel class are lower than the baseline condition.

Table 63: Sensitivity 3 – Decrease Annual Commodity Growth by 1% - AAE Transportation Cost Savings

Service Route	42 feet	44 feet	45 feet	46 feet	47 feet	48 feet
Transportation Cost Savings						
FE (Panama) ECUS	$ -	$ 35,010,000	$ 43,960,000	$ 43,960,000	$ 43,960,000	$ 43,960,000
FE (Suez) ECUS	$ -	$ 30,700,000	$ 42,420,000	$ 50,900,000	$ 52,570,000	$ 52,570,000
FE ECUS EU PEN	$ -	$ 13,950,000	$ 18,820,000	$ 21,100,000	$ 21,100,000	$ 21,100,000
FE ECUS MED PEN	$ -	$ 10,140,000	$ 15,460,000	$ 19,110,000	$ 21,460,000	$ 21,460,000
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 540,000	$ 820,000	$ 1,030,000	$ 1,190,000	$ 1,190,000
ECUS MED	$ -	$ 490,000	$ 740,000	$ 930,000	$ 1,080,000	$ 1,080,000
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 2,760,000	$ 4,180,000	$ 5,260,000	$ 6,100,000	$ 6,100,000
Total AAE Benefits	$ -	$ 93,580,000	$ 126,390,000	$ 142,290,000	$ 147,470,000	$ 147,470,000
Service Route	**42 feet**	**44 feet**	**45 feet**	**46 feet**	**47 feet**	**48 feet**
Incremental Transportation Cost Savings						
FE (Panama) ECUS	$ -	$ 35,010,000	$ 8,950,000	$ -	$ -	$ -
FE (Suez) ECUS	$ -	$ 30,700,000	$ 11,720,000	$ 8,480,000	$ 1,680,000	$ -
FE ECUS EU PEN	$ -	$ 13,950,000	$ 4,870,000	$ 2,290,000	$ -	$ -
FE ECUS MED PEN	$ -	$ 10,140,000	$ 5,320,000	$ 3,650,000	$ 2,340,000	$ -
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 540,000	$ 280,000	$ 210,000	$ 160,000	$ -
ECUS MED	$ -	$ 490,000	$ 250,000	$ 190,000	$ 150,000	$ -
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 2,760,000	$ 1,420,000	$ 1,080,000	$ 840,000	$ -
Total	$ -	$ 93,580,000	$ 32,810,000	$ 15,900,000	$ 5,180,000	$ -

Table 64: Sensitivity 3 - Decrease Annual Commodity Growth by 1% - Forecast Vessel Calls

42-Foot Depth	2017	2020	2025	2030
SPX	465	540	657	782
PX	1,114	708	973	991
PPX1	451	788	872	1,174
PPX2	113	246	331	436
Total	*2,142*	*2,282*	*2,833*	*3,383*
44-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	465	540	657	782
PX	1,056	636	861	884
PPX1	294	434	408	555
PPX2	225	485	660	855
Total	*2,040*	*2,095*	*2,586*	*3,076*
45-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	465	540	657	782
PX	1,032	610	826	834
PPX1	294	431	405	550
PPX2	225	480	653	848
Total	*2,015*	*2,060*	*2,541*	*3,015*
46-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	465	540	657	782
PX	1,020	599	809	814
PPX1	294	428	403	547
PPX2	225	477	649	844
Total	*2,003*	*2,044*	*2,518*	*2,987*
47-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	465	540	657	782
PX	1,015	590	802	808
PPX1	294	428	401	546
PPX2	225	477	649	841
Total	*1,999*	*2,036*	*2,508*	*2,977*
48-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	465	540	657	782
PX	1,015	590	802	808
PPX1	294	428	401	546
PPX2	225	477	649	841
Total	*1,999*	*2,036*	*2,508*	*2,977*

5.1.4. Sensitivity 4: Decrease Annual Commodity Growth by 3%

For this sensitivity analysis, the commodity growth forecast was adjusted downward by a maximum of 3 percent per year. If, for example, on a particular route the rate of growth in the baseline forecast was 5 percent between two years only 2 percent was used for that period. However, if the rate of growth was 2 percent, a 0 percent rate of change was applied. In other words, no negative growth between any two years was assumed. With this adjustment, the resultant TEU forecast for 2030 is 3.6 million TEUs, compared to 6.5 million in the baseline, a reduction of about 45 percent. With this lower growth rate, the number of TEUs in 2035 is 3.9 million TEUs and the Garden City Terminal does not reach it's build out capacity of 6.5 million for a number of years. Table 65 shows the results of the TCSM analysis with the lower growth rate. Average annual equivalent transportation cost savings are about 36 percent less than the baseline. However, the benefits presented are substantially understated as the TCSM is set to compute benefits for growth up to 2035. Therefore, several years of additional growth and benefits are not included. The results show a decrease in incremental benefits between 46 and 47 feet of about 26 percent. Overall, estimated benefits range from about $63 to $99 million for the alternative plans. Table 66 shows vessel calls for each alternative through 2030. As expected, vessel calls for each vessel class are substantially lower than the baseline condition.

Table 65: Sensitivity 4 – Decrease Annual Commodity Growth by 3% - AAE Transportation Cost Savings

Service Route	42 feet	44 feet	45 feet	46 feet	47 feet	48 feet
Transportation Cost Savings						
FE (Panama) ECUS	$ -	$ 23,450,000	$ 29,430,000	$ 29,430,000	$ 29,430,000	$ 29,430,000
FE (Suez) ECUS	$ -	$ 20,690,000	$ 28,560,000	$ 34,260,000	$ 35,390,000	$ 35,390,000
FE ECUS EU PEN	$ -	$ 9,360,000	$ 12,610,000	$ 14,140,000	$ 14,140,000	$ 14,140,000
FE ECUS MED PEN	$ -	$ 6,810,000	$ 10,380,000	$ 12,820,000	$ 14,390,000	$ 14,390,000
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 360,000	$ 550,000	$ 690,000	$ 800,000	$ 800,000
ECUS MED	$ -	$ 330,000	$ 500,000	$ 630,000	$ 730,000	$ 730,000
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 1,850,000	$ 2,810,000	$ 3,530,000	$ 4,090,000	$ 4,090,000
Total AAE Benefits	*$ -*	*$ 62,860,000*	*$ 84,840,000*	*$ 95,500,000*	*$ 98,970,000*	*$ 98,970,000*
Service Route	**42 feet**	**44 feet**	**45 feet**	**46 feet**	**47 feet**	**48 feet**
Incremental Transportation Cost Savings						
FE (Panama) ECUS	$ -	$ 23,450,000	$ 5,980,000	$ -	$ -	$ -
FE (Suez) ECUS	$ -	$ 20,690,000	$ 7,870,000	$ 5,700,000	$ 1,130,000	$ -
FE ECUS EU PEN	$ -	$ 9,360,000	$ 3,250,000	$ 1,530,000	$ -	$ -
FE ECUS MED PEN	$ -	$ 6,810,000	$ 3,570,000	$ 2,440,000	$ 1,570,000	$ -
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 360,000	$ 190,000	$ 140,000	$ 110,000	$ -
ECUS MED	$ -	$ 330,000	$ 170,000	$ 130,000	$ 100,000	$ -
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 1,850,000	$ 960,000	$ 720,000	$ 560,000	$ -
Total	*$ -*	*$ 62,860,000*	*$ 21,990,000*	*$ 10,660,000*	*$ 3,470,000*	*$ -*

Table 66: Sensitivity 4 - Decrease Annual Commodity Growth by 3% -Forecast Vessel Calls

42-Foot Depth	2017	2020	2025	2030
SPX	406	445	491	531
PX	962	584	729	675
PPX1	400	650	653	797
PPX2	100	203	248	296
Total	*1,868*	*1,882*	*2,121*	*2,299*
44-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	406	445	491	531
PX	911	525	645	602
PPX1	260	358	306	377
PPX2	200	400	494	581
Total	*1,777*	*1,728*	*1,936*	*2,091*
45-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	406	445	491	531
PX	890	503	619	568
PPX1	260	356	303	374
PPX2	200	396	489	576
Total	*1,755*	*1,699*	*1,902*	*2,049*
46-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	406	445	491	531
PX	879	494	607	554
PPX1	260	354	301	372
PPX2	200	394	486	573
Total	*1,745*	*1,686*	*1,885*	*2,030*
47-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	406	445	491	531
PX	876	487	601	550
PPX1	260	354	300	371
PPX2	200	394	486	572
Total	*1,741*	*1,679*	*1,878*	*2,024*
48-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	406	445	491	531
PX	876	487	601	550
PPX1	260	354	300	371
PPX2	200	394	486	572
Total	*1,741*	*1,679*	*1,878*	*2,024*

5.1.5. Sensitivity 5: No Growth in Commodity Forecast

As an extreme case sensitivity analysis, the TCSM was run with no change in commodities imported or exported over the base year tonnage of 18,155,938 metric tons and 2,618,487 loaded and empty TEUs. Average annual equivalent transportation cost savings range from about $37 to $59 million (

Table 67), or about 62 percent lower than the baseline. Savings are solely attributable to changes in the fleet of vessels calling and the ability to carry more Savannah cargo with channel improvements. Incremental benefits between 46 and 47 feet at $2.2 million are about 53 percent lower than the baseline. As shown in Table 68, over time and with additional depth, Sub-Panamax vessels remain the same, Panamax vessel calls decrease, and Post-Panamax vessel calls increase.

Table 67: Sensitivity 5 – No Growth in Commodity Forecast - AAE Transportation Cost Savings

Service Route	42 feet	44 feet	45 feet	46 feet	47 feet	48 feet
Transportation Cost Savings						
FE (Panama) ECUS	$ -	$ 13,100,000	$ 16,270,000	$ 16,270,000	$ 16,270,000	$ 16,270,000
FE (Suez) ECUS	$ -	$ 12,580,000	$ 17,820,000	$ 21,470,000	$ 22,210,000	$ 22,210,000
FE ECUS EU PEN	$ -	$ 5,640,000	$ 7,470,000	$ 8,260,000	$ 8,260,000	$ 8,260,000
FE ECUS MED PEN	$ -	$ 4,210,000	$ 6,200,000	$ 7,440,000	$ 8,300,000	$ 8,300,000
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 360,000	$ 540,000	$ 680,000	$ 790,000	$ 790,000
ECUS MED	$ -	$ 320,000	$ 480,000	$ 600,000	$ 700,000	$ 700,000
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 1,230,000	$ 1,860,000	$ 2,340,000	$ 2,720,000	$ 2,720,000
Total AAE Benefits	*$ -*	*$ 37,430,000*	*$ 50,640,000*	*$ 57,060,000*	*$ 59,250,000*	*$ 59,250,000*
Service Route	**42 feet**	**44 feet**	**45 feet**	**46 feet**	**47 feet**	**48 feet**
Incremental Transportation Cost Savings						
FE (Panama) ECUS	$ -	$ 13,100,000	$ 3,170,000	$ -	$ -	$ -
FE (Suez) ECUS	$ -	$ 12,580,000	$ 5,240,000	$ 3,650,000	$ 750,000	$ -
FE ECUS EU PEN	$ -	$ 5,640,000	$ 1,830,000	$ 790,000	$ -	$ -
FE ECUS MED PEN	$ -	$ 4,210,000	$ 1,990,000	$ 1,240,000	$ 860,000	$ -
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 360,000	$ 180,000	$ 140,000	$ 110,000	$ -
ECUS MED	$ -	$ 320,000	$ 160,000	$ 120,000	$ 100,000	$ -
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 1,230,000	$ 630,000	$ 480,000	$ 370,000	$ -
Total	*$ -*	*$ 37,430,000*	*$ 13,200,000*	*$ 6,430,000*	*$ 2,190,000*	*$ -*

Table 68: Sensitivity 5 - No Growth in Commodity Forecast - Forecast Vessel Calls

42-Foot Depth	2017	2020	2025	2030
SPX	348	348	348	348
PX	774	383	376	286
PPX1	342	513	486	534
PPX2	85	161	184	198
Total	*1,548*	*1,404*	*1,395*	*1,365*
44-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	348	348	348	348
PX	730	337	331	272
PPX1	222	283	224	244
PPX2	171	316	362	377
Total	*1,471*	*1,283*	*1,265*	*1,242*
45-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	348	348	348	348
PX	712	317	311	263
PPX1	222	281	222	239
PPX2	171	313	359	371
Total	*1,452*	*1,259*	*1,240*	*1,220*
46-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	348	348	348	348
PX	702	310	303	258
PPX1	222	279	221	236
PPX2	171	311	357	367
Total	*1,443*	*1,248*	*1,228*	*1,209*
47-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	348	348	348	348
PX	699	306	297	254
PPX1	222	279	220	235
PPX2	171	311	357	366
Total	*1,439*	*1,243*	*1,222*	*1,203*
48-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	348	348	348	348
PX	699	306	297	254
PPX1	222	279	220	235
PPX2	171	311	357	366
Total	*1,439*	*1,243*	*1,222*	*1,203*

5.2. Sensitivities to Vessel Availability and Loadings

5.2.1. Sensitivity 6: Historical Sub-Panamax Share of Capacity Calling

For this sensitivity analysis, the TCSM was run using the historical average of Sub-Panamax capacity of total capacity calling from data years 2005 and 2007 (source: port and pilot records). This resulted in less total cargo available for Panamax and Post-Panamax vessels. The purpose of this sensitivity analysis is to test the reasonableness of the baseline condition assumption that the amount of total cargo carried on small vessels will decline over time, even if no improvements are made to the Savannah Harbor. The results are shown in Table 69, and reflect an increase in benefits of about 2 percent, but a 4 percent decrease in incremental benefits between 46 and 47 feet. It may appear that the small increase in benefits is counterintuitive. However, upon further examination the results make sense in the construct of the overall TCSM. Post-Panamax vessel calls are initially determined by relating the total commodity forecast to total capacity calling. Post-Panamax vessel calls are then determined by a percentage of total capacity. Next, they are allocated to the various routes in proportion to the amount of cargo not carried on Sub-Panamax vessels. It so happens that a higher proportion of historical cargo was carried on Sub-Panamax vessels on the non-benefiting and relatively small benefiting trade routes. Therefore, when Sub-Panamax vessel calls are increased on these routes, more Post-Panamax vessels are allocated to the larger benefiting routes such as the FE (Panama) ECUS and the FE (Suez) ECUS routes and their benefits increase. The overall result is a slight increase in total benefits. As shown in Table 70, Post-Panamax vessel calls are the same as in the without project condition, while Sub-Panamax vessel calls increase significantly and Panamax vessel calls decline from baseline estimates. A large portion of the changes in vessel calls occur on the non-benefiting trade routes.

Table 69: Sensitivity 6 – Historical SPX Share of Capacity Calling - AAE Transportation Cost Savings

Service Route	42 feet	44 feet	45 feet	46 feet	47 feet	48 feet
Transportation Cost Savings						
FE (Panama) ECUS	$ -	$ 37,990,000	$ 47,740,000	$ 47,740,000	$ 47,740,000	$ 47,740,000
FE (Suez) ECUS	$ -	$ 32,660,000	$ 45,610,000	$ 55,220,000	$ 56,200,000	$ 56,200,000
FE ECUS EU PEN	$ -	$ 15,260,000	$ 20,600,000	$ 23,110,000	$ 23,110,000	$ 23,110,000
FE ECUS MED PEN	$ -	$ 11,090,000	$ 16,910,000	$ 20,920,000	$ 23,500,000	$ 23,500,000
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 540,000	$ 810,000	$ 1,020,000	$ 1,180,000	$ 1,180,000
ECUS MED	$ -	$ 330,000	$ 510,000	$ 640,000	$ 740,000	$ 740,000
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 2,130,000	$ 3,230,000	$ 4,070,000	$ 4,720,000	$ 4,720,000
Total AAE Benefits	$ -	$ 100,000,000	$135,410,000	$152,730,000	$157,200,000	$157,200,000
Service Route	**42 feet**	**44 feet**	**45 feet**	**46 feet**	**47 feet**	**48 feet**
Incremental Transportation Cost Savings						
FE (Panama) ECUS	$ -	$ 37,990,000	$ 9,750,000	$ -	$ -	$ -
FE (Suez) ECUS	$ -	$ 32,660,000	$ 12,950,000	$ 9,620,000	$ 980,000	$ -
FE ECUS EU PEN	$ -	$ 15,260,000	$ 5,350,000	$ 2,510,000	$ -	$ -
FE ECUS MED PEN	$ -	$ 11,090,000	$ 5,820,000	$ 4,010,000	$ 2,580,000	$ -
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 540,000	$ 270,000	$ 210,000	$ 160,000	$ -
ECUS MED	$ -	$ 330,000	$ 170,000	$ 130,000	$ 100,000	$ -
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 2,130,000	$ 1,100,000	$ 840,000	$ 650,000	$ -
Total	***$ -***	**$ 100,000,000**	**$ 35,410,000**	**$ 17,310,000**	**$ 4,470,000**	**$ -**

Table 70: Sensitivity 6 - Historical SPX Share of Capacity Calling - Forecast Vessel Calls

42-Foot Depth	2017	2020	2025	2030
SPX	741	886	1,131	1,413
PX	1,004	545	827	833
PPX1	477	866	1,006	1,421
PPX2	119	271	382	527
Total	2,342	2,568	3,346	4,194
44-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	741	886	1,131	1,413
PX	943	468	698	705
PPX1	310	477	471	671
PPX2	239	533	761	1,034
Total	2,234	2,364	3,061	3,824
45-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	741	886	1,131	1,413
PX	918	441	660	648
PPX1	310	473	467	665
PPX2	239	527	753	1,026
Total	2,208	2,327	3,010	3,752
46-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	741	886	1,131	1,413
PX	905	430	641	625
PPX1	310	471	464	662
PPX2	239	524	749	1,020
Total	2,196	2,310	2,985	3,720
47-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	741	886	1,131	1,413
PX	901	422	634	620
PPX1	310	471	462	660
PPX2	239	524	749	1,017
Total	2,192	2,302	2,975	3,710
48-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	741	886	1,131	1,413
PX	901	422	634	620
PPX1	310	471	462	660
PPX2	239	524	749	1,017
Total	2,192	2,302	2,975	3,710

5.2.2. Sensitivity 7: Reduce Future Sub-Panamax Share of Capacity Calling

For Sensitivity Analysis 7, the percent of capacity calling on Sub-Panamax vessels (i.e., the amount of Savannah cargo) was reduced by 65% from the 2005-07 historical records, as compared to the 33% reduction in the baseline condition. The reason being is that it was observed in some of the MSI fleet forecast information, the Sub-Panamax percentage of the world fleet, and the anticipated share of capacity calling at Savannah is expected to continue to decline beyond the 2017 base year, to about 65 percent by 2030. Table 71 shows the results of this further reduction in the capacity calling and amount of Savannah cargo carried on Sub-Panamax vessels, which increases the amount of cargo to be forecast to be carried on Panamax and Sub-Panamax vessels. The results show a decrease in annual benefits of about 2 percent but an increase in incremental benefits between 46 and 47 feet of about 4 percent. As in Sensitivity 6, these results are explained by the fact that the largest trade routes, historically, have less cargo carried on Sub-Panamax vessels than the smaller trade routes, and are therefore affected by this change in assumption by losing Post-Panamax vessels calls to the lower benefiting routes. Table 72 shows vessel calls by vessel class and alternative project depths. Note that Post-Panamax vessel calls are the same as the baseline condition while Sub-Panamax vessel calls are reduced considerably.

The overall results of sensitivities 6 and 7 show that the benefits derived from the TCSM are not very sensitive to assumptions regarding amount of capacity and cargo carried on Sub-Panamax vessels, but the overall number of vessel calls are sensitive.

Table 71: Sensitivity 7 – Reduce Future SPX Share of Capacity Calling - AAE Transportation Cost Savings

Service Route	42 feet	44 feet	45 feet	46 feet	47 feet	48 feet
Transportation Cost Savings						
FE (Panama) ECUS	$ -	$ 36,140,000	$ 45,410,000	$ 45,410,000	$ 45,410,000	$ 45,410,000
FE (Suez) ECUS	$ -	$ 30,780,000	$ 42,980,000	$ 52,040,000	$ 52,960,000	$ 52,960,000
FE ECUS EU PEN	$ -	$ 14,260,000	$ 19,260,000	$ 21,610,000	$ 21,610,000	$ 21,610,000
FE ECUS MED PEN	$ -	$ 10,370,000	$ 15,810,000	$ 19,560,000	$ 21,970,000	$ 21,970,000
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 660,000	$ 1,000,000	$ 1,260,000	$ 1,460,000	$ 1,460,000
ECUS MED	$ -	$ 740,000	$ 1,130,000	$ 1,420,000	$ 1,650,000	$ 1,650,000
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 3,620,000	$ 5,490,000	$ 6,920,000	$ 8,030,000	$ 8,030,000
Total AAE Benefits	**$ -**	**$ 96,580,000**	**$131,090,000**	**$ 148,230,000**	**$ 153,090,000**	**$153,090,000**
Service Route	**42 feet**	**44 feet**	**45 feet**	**46 feet**	**47 feet**	**48 feet**
Incremental Transportation Cost Savings						
FE (Panama) ECUS	$ -	$ 36,140,000	$ 9,270,000	$ -	$ -	$ -
FE (Suez) ECUS	$ -	$ 30,780,000	$ 12,200,000	$ 9,060,000	$ 920,000	$ -
FE ECUS EU PEN	$ -	$ 14,260,000	$ 5,000,000	$ 2,350,000	$ -	$ -
FE ECUS MED PEN	$ -	$ 10,370,000	$ 5,440,000	$ 3,750,000	$ 2,410,000	$ -
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 660,000	$ 340,000	$ 260,000	$ 200,000	$ -
ECUS MED	$ -	$ 740,000	$ 390,000	$ 290,000	$ 230,000	$ -
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 3,620,000	$ 1,870,000	$ 1,420,000	$ 1,110,000	$ -
Total	**$ -**	**$ 96,580,000**	**$ 34,510,000**	**$ 17,140,000**	**$ 4,870,000**	**$ -**

Table 72: Sensitivity 7 - Reduce Future SPX Share of Capacity Calling - Forecast Vessel Calls

42-Foot Depth	2017	2020	2025	2030
SPX	260	310	396	495
PX	1,383	1,003	1,407	1,549
PPX1	481	866	1,006	1,421
PPX2	120	271	382	527
Total	*2,244*	*2,451*	*3,190*	*3,992*
44-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	260	310	396	495
PX	1,322	924	1,277	1,417
PPX1	313	478	471	672
PPX2	240	534	761	1,036
Total	*2,134*	*2,245*	*2,905*	*3,620*
45-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	260	310	396	495
PX	1,295	894	1,236	1,356
PPX1	313	474	467	667
PPX2	240	528	753	1,028
Total	*2,108*	*2,206*	*2,852*	*3,545*
46-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	260	310	396	495
PX	1,282	880	1,214	1,329
PPX1	313	472	465	663
PPX2	240	525	749	1,022
Total	*2,094*	*2,187*	*2,824*	*3,509*
47-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	260	310	396	495
PX	1,277	870	1,205	1,319
PPX1	313	472	462	661
PPX2	240	525	749	1,020
Total	*2,089*	*2,177*	*2,812*	*3,495*
48-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	260	310	396	495
PX	1,277	870	1,205	1,319
PPX1	313	472	462	661
PPX2	240	525	749	1,020
Total	*2,089*	*2,177*	*2,812*	*3,495*

5.2.3. Sensitivity 8: Increase Amount of Savannah Cargo Carried on Post-Panamax Vessels

In this sensitivity analysis, the amount of Savannah cargo carried on Post-Panamax vessels was increased by 5 percent relative to their Maximum Practicable Capacity. This is generally reflective of the notion that in future years, as trade increases, the number of calls at ECUS ports may change, particularly in the manner of reducing the number of ECUS ports of calls for the largest vessels in operations on the trade routes. According to many in the shipping industry, continued consolidation of shipping companies is possible while they may have incentives to reduce the number of ports on an entire rotation. The results of this sensitivity analysis for benefits and vessel calls are shown in Table 73 and Table 74 . This sensitivity results in an increases in annual benefits of about 5 and 1 percent respectively for channel depths of 44 and 45 feet while no change in benefits for depths of 46 feet and greater. However, the number of Panamax vessels decline from the base line as more cargo is carried on Post-Panamax vessels.

Table 73: Sensitivity 8 – Increase Amount of Savannah Cargo Carried on PPX Vessels - AAE Transportation Cost Savings

Service Route	42 feet	44 feet	45 feet	46 feet	47 feet	48 feet
Transportation Cost Savings						
FE (Panama) ECUS	$ -	$ 41,040,000	$ 48,410,000	$ 48,410,000	$ 48,410,000	$ 48,410,000
FE (Suez) ECUS	$ -	$ 29,530,000	$ 41,480,000	$ 50,050,000	$ 51,290,000	$ 51,290,000
FE ECUS EU PEN	$ -	$ 16,140,000	$ 21,910,000	$ 24,620,000	$ 24,620,000	$ 24,620,000
FE ECUS MED PEN	$ -	$ 12,090,000	$ 16,860,000	$ 20,100,000	$ 21,860,000	$ 21,860,000
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 660,000	$ 1,000,000	$ 1,260,000	$ 1,460,000	$ 1,460,000
ECUS MED	$ -	$ 580,000	$ 890,000	$ 1,120,000	$ 1,310,000	$ 1,310,000
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 2,930,000	$ 4,440,000	$ 5,590,000	$ 6,490,000	$ 6,490,000
Total AAE Benefits	*$ -*	*$ 102,980,000*	*$ 135,000,000*	*$ 151,160,000*	*$ 155,440,000*	*$ 155,440,000*
Service Route	**42 feet**	**44 feet**	**45 feet**	**46 feet**	**47 feet**	**48 feet**
Incremental Transportation Cost Savings						
FE (Panama) ECUS	$ -	$ 41,040,000	$ 7,370,000	$ -	$ -	$ -
FE (Suez) ECUS	$ -	$ 29,530,000	$ 11,950,000	$ 8,570,000	$ 1,240,000	$ -
FE ECUS EU PEN	$ -	$ 16,140,000	$ 5,770,000	$ 2,710,000	$ -	$ -
FE ECUS MED PEN	$ -	$ 12,090,000	$ 4,770,000	$ 3,240,000	$ 1,760,000	$ -
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 660,000	$ 340,000	$ 260,000	$ 200,000	$ -
ECUS MED	$ -	$ 580,000	$ 310,000	$ 230,000	$ 180,000	$ -
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 2,930,000	$ 1,510,000	$ 1,150,000	$ 900,000	$ -
Total	*$ -*	*$ 102,980,000*	*$ 32,020,000*	*$ 16,160,000*	*$ 4,280,000*	*$ -*

Table 74: Sensitivity 8 – Increase Amount of Savannah Cargo Carried on PPX Vessels - Forecast Vessel Calls

42-Foot Depth	2017	2020	2025	2030
SPX	497	593	758	947
PX	1,104	618	891	916
PPX1	479	855	1,006	1,402
PPX2	120	267	382	520
Total	*2,200*	*2,333*	*3,036*	*3,786*
44-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,037	532	782	769
PPX1	312	471	465	662
PPX2	239	526	751	1,023
Total	*2,084*	*2,122*	*2,755*	*3,401*
45-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,008	502	735	748
PPX1	312	466	460	648
PPX2	239	520	745	1,002
Total	*2,056*	*2,081*	*2,697*	*3,346*
46-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	994	492	719	730
PPX1	312	462	457	643
PPX2	239	516	739	995
Total	*2,042*	*2,064*	*2,673*	*3,314*
47-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	989	489	708	724
PPX1	312	462	456	642
PPX2	239	514	738	990
Total	*2,037*	*2,058*	*2,660*	*3,303*
48-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	989	489	708	724
PPX1	312	462	456	642
PPX2	239	514	738	990
Total	*2,037*	*2,058*	*2,660*	*3,303*

5.2.4. Sensitivity 9: Full Deployment of Post-Panamax Vessels in Without (42 ft) Project Condition

The baseline condition assumed that 50 percent of the "unconstrained" PPX2 vessels would call in the without project (42-foot) condition. This sensitivity analysis assumes that essentially the same number of PPX 2 vessels would call Savannah Harbor in a 42-foot channel as would call in a 47- or 48- foot channel, but obviously carry less cargo due to the channel constraints. The results are shown in Table 75 and Table 76. Average annual benefits are about 5 to 8 percent higher than the baseline. This is due to the fact that with full deployment of PPX2 vessels in the without condition, due to their loading constraints in a 42-foot channel, round trip vessel costs are actually higher than they would be under the baseline condition. Note additionally that incremental benefits are the same as the baseline for depths greater than 44 feet, and vessel calls are the same as the baseline for all depths except 42 feet.

Table 75: Sensitivity 9 – Full Deployment of PPX Vessels in Without Project Condition - AAE Transportation Cost Savings

Service Route	42 feet	44 feet	45 feet	46 feet	47 feet	48 feet
Transportation Cost Savings						
FE (Panama) ECUS	$ -	$ 40,040,000	$ 49,540,000	$ 49,540,000	$ 49,540,000	$ 49,540,000
FE (Suez) ECUS	$ -	$ 34,870,000	$ 47,420,000	$ 56,750,000	$ 57,700,000	$ 57,700,000
FE ECUS EU PEN	$ -	$ 15,580,000	$ 20,740,000	$ 23,170,000	$ 23,170,000	$ 23,170,000
FE ECUS MED PEN	$ -	$ 11,240,000	$ 16,860,000	$ 20,740,000	$ 23,220,000	$ 23,220,000
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 620,000	$ 920,000	$ 1,160,000	$ 1,340,000	$ 1,340,000
ECUS MED	$ -	$ 570,000	$ 860,000	$ 1,070,000	$ 1,240,000	$ 1,240,000
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 3,010,000	$ 4,510,000	$ 5,660,000	$ 6,550,000	$ 6,550,000
Total AAE Benefits	*$ -*	*$ 105,920,000*	*$ 140,860,000*	*$ 158,080,000*	*$ 162,760,000*	*$ 162,760,000*
Service Route	**42 feet**	**44 feet**	**45 feet**	**46 feet**	**47 feet**	**48 feet**
Incremental Transportation Cost Savings						
FE (Panama) ECUS	$ -	$ 40,040,000	$ 9,500,000	$ -	$ -	$ -
FE (Suez) ECUS	$ -	$ 34,870,000	$ 12,560,000	$ 9,330,000	$ 950,000	$ -
FE ECUS EU PEN	$ -	$ 15,580,000	$ 5,170,000	$ 2,430,000	$ -	$ -
FE ECUS MED PEN	$ -	$ 11,240,000	$ 5,620,000	$ 3,870,000	$ 2,490,000	$ -
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 620,000	$ 310,000	$ 230,000	$ 180,000	$ -
ECUS MED	$ -	$ 570,000	$ 290,000	$ 220,000	$ 170,000	$ -
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 3,010,000	$ 1,500,000	$ 1,150,000	$ 890,000	$ -
Total	*$ -*	*$ 105,920,000*	*$ 34,940,000*	*$ 17,220,000*	*$ 4,680,000*	*$ -*

Table 76: Sensitivity 9 - Full Deployment of PPX Vessels in Without Project Condition - Forecast Vessel Calls

42-Foot Depth	2017	2020	2025	2030
SPX	497	593	758	947
PX	1,210	809	1,165	1,257
PPX1	312	487	472	682
PPX2	239	542	763	1,055
Total	*2,258*	*2,431*	*3,158*	*3,941*
44-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,135	700	992	1,067
PPX1	312	478	471	672
PPX2	239	533	761	1,035
Total	*2,183*	*2,304*	*2,982*	*3,720*
45-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,109	671	952	1,007
PPX1	312	474	467	666
PPX2	239	527	753	1,027
Total	*2,157*	*2,265*	*2,930*	*3,647*
46-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,096	658	932	982
PPX1	312	471	465	662
PPX2	239	524	749	1,021
Total	*2,144*	*2,247*	*2,903*	*3,613*
47-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,092	649	924	975
PPX1	312	471	462	661
PPX2	239	524	749	1,018
Total	*2,140*	*2,238*	*2,892*	*3,601*
48-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,092	649	924	975
PPX1	312	471	462	661
PPX2	239	524	749	1,018
Total	*2,140*	*2,238*	*2,892*	*3,601*

5.2.5. Sensitivity 10: Reduce Post-Panamax Vessel Calls by 25%

This sensitivity tests how much the benefits and number of vessel calls would be impacted by a reduction in the availability and number of Post-Panamax Vessel calls. The world fleet forecast and the amount of that fleet available to call at Savannah could be highly undercertain. This sensitivity assumes that only 75% of the base line forecast of Post-Panamax vessel calls at Savannah are actually realized. The results are shown in Table 77 and Table 78 . Average annual benefits would be about 13 to 17 percent lower than the baseline. The total number of vessel calls at Savannah would increase over the baseline as more Panamax vessels would call to make up for the lost capacity from fewer Post-Panamax vessels.

Table 77: Sensitivity 10 – Reduce PPX Vessel Calls by 25% - AAE Transportation Cost Savings

Service Route	42 feet	44 feet	45 feet	46 feet	47 feet	48 feet
Transportation Cost Savings						
FE (Panama) ECUS	$ -	$ 27,770,000	$ 34,890,000	$ 34,890,000	$ 34,890,000	$ 34,890,000
FE (Suez) ECUS	$ -	$ 31,400,000	$ 46,270,000	$ 57,420,000	$ 59,640,000	$ 59,640,000
FE ECUS EU PEN	$ -	$ 11,050,000	$ 14,930,000	$ 16,740,000	$ 16,740,000	$ 16,740,000
FE ECUS MED PEN	$ -	$ 8,040,000	$ 12,250,000	$ 15,160,000	$ 17,020,000	$ 17,020,000
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 450,000	$ 680,000	$ 860,000	$ 1,000,000	$ 1,000,000
ECUS MED	$ -	$ 410,000	$ 620,000	$ 790,000	$ 910,000	$ 910,000
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 2,180,000	$ 3,310,000	$ 4,170,000	$ 4,840,000	$ 4,840,000
Total AAE Benefits	$ -	$ 81,300,000	$ 112,960,000	$ 130,020,000	$ 135,050,000	$ 135,050,000
Service Route	**42 feet**	**44 feet**	**45 feet**	**46 feet**	**47 feet**	**48 feet**
Incremental Transportation Cost Savings						
FE (Panama) ECUS	$ -	$ 27,770,000	$ 7,120,000	$ -	$ -	$ -
FE (Suez) ECUS	$ -	$ 31,400,000	$ 14,870,000	$ 11,140,000	$ 2,220,000	$ -
FE ECUS EU PEN	$ -	$ 11,050,000	$ 3,870,000	$ 1,820,000	$ -	$ -
FE ECUS MED PEN	$ -	$ 8,040,000	$ 4,220,000	$ 2,900,000	$ 1,870,000	$ -
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 450,000	$ 230,000	$ 180,000	$ 140,000	$ -
ECUS MED	$ -	$ 410,000	$ 210,000	$ 160,000	$ 130,000	$ -
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 2,180,000	$ 1,130,000	$ 860,000	$ 670,000	$ -
Total	$ -	$ 81,300,000	$ 31,660,000	$ 17,060,000	$ 5,020,000	$ -

Table 78: Sensitivity 10 - Reduce PPX Vessel Calls by 25% - Forecast Vessel Calls

42-Foot Depth	2017	2020	2025	2030
SPX	497	593	758	947
PX	1,424	1,218	1,664	1,941
PPX1	359	650	755	1,073
PPX2	90	203	286	398
Total	*2,370*	*2,664*	*3,462*	*4,359*
44-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,378	1,133	1,562	1,797
PPX1	234	365	354	516
PPX2	179	407	572	795
Total	*2,288*	*2,498*	*3,246*	*4,055*
45-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,358	1,095	1,513	1,729
PPX1	234	365	354	516
PPX2	179	407	572	795
Total	*2,269*	*2,460*	*3,197*	*3,987*
46-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,349	1,076	1,487	1,693
PPX1	234	365	354	516
PPX2	179	407	572	795
Total	*2,259*	*2,442*	*3,171*	*3,951*
47-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,345	1,069	1,477	1,680
PPX1	234	365	354	516
PPX2	179	407	572	795
Total	*2,255*	*2,435*	*3,161*	*3,938*
48-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,345	1,069	1,477	1,680
PPX1	234	365	354	516
PPX2	179	407	572	795
Total	*2,255*	*2,435*	*3,161*	*3,938*

5.2.6. Sensitivity 11: Deployment of Post-Panamax Vessels by Unit Costs

This sensitivity analysis employs the same basic assumptions as were presented in the draft report published in December 2010. The primary assumption being that PPX 2 vessels would deploy in accordance a strict unit cost comparison by trade route, as shown in Table 38. The results for benefits are shown in Table 79 and vessel calls are shown in Table 80. Average annual benefits would be about 3 to 4 percent lower than the baseline, and there would be no change in incremental benefits between 46 and 47 feet. Vessel calls change due to the differing assumptions regarding PPX2 deployment by channel depth. This sensitivity is most similar to what is presented later for Sensitivity 17 which are actually the values presented in the draft report.

Table 79: Sensitivity 11 – Deployment of PPX Vessels by Unit Costs - AAE Transportation Cost Savings

Service Route	42 feet	44 feet	45 feet	46 feet	47 feet	48 feet
Transportation Cost Savings						
FE (Panama) ECUS	$ -	$34,000,000	$ 43,500,000	$ 43,500,000	$ 43,500,000	$ 43,500,000
FE (Suez) ECUS	$ -	$33,000,000	$ 43,230,000	$ 52,560,000	$ 53,510,000	$ 53,510,000
FE ECUS EU PEN	$ -	$13,890,000	$ 19,060,000	$ 21,480,000	$ 21,480,000	$ 21,480,000
FE ECUS MED PEN	$ -	$10,190,000	$ 15,810,000	$ 19,680,000	$ 22,170,000	$ 22,170,000
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 640,000	$ 960,000	$ 1,130,000	$ 1,310,000	$ 1,310,000
ECUS MED	$ -	$ 600,000	$ 890,000	$ 1,030,000	$ 1,200,000	$ 1,200,000
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 3,140,000	$ 4,710,000	$ 5,470,000	$ 6,360,000	$ 6,360,000
Total AAE Benefits	*$ -*	*$95,470,000*	*$128,170,000*	*$144,850,000*	*$149,530,000*	*$149,530,000*
Service Route	**42 feet**	**44 feet**	**45 feet**	**46 feet**	**47 feet**	**48 feet**
Incremental Transportation Cost Savings						
FE (Panama) ECUS	$ -	$34,000,000	$ 9,500,000	$ -	$ -	$ -
FE (Suez) ECUS	$ -	$33,000,000	$ 10,230,000	$ 9,330,000	$ 950,000	$ -
FE ECUS EU PEN	$ -	$13,890,000	$ 5,170,000	$ 2,430,000	$ -	$ -
FE ECUS MED PEN	$ -	$10,190,000	$ 5,620,000	$ 3,870,000	$ 2,490,000	$ -
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 640,000	$ 320,000	$ 170,000	$ 180,000	$ -
ECUS MED	$ -	$ 600,000	$ 300,000	$ 130,000	$ 170,000	$ -
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 3,140,000	$ 1,570,000	$ 750,000	$ 890,000	$ -
Total	*$ -*	*$95,470,000*	*$ 32,700,000*	*$ 16,680,000*	*$ 4,680,000*	*$ -*

Table 80: Sensitivity 11 - Deployment of PPX Vessels by Unit Costs - Forecast Vessel Calls

42-Foot Depth	2017	2020	2025	2030
SPX	497	593	758	947
PX	1,183	759	1,078	1,154
PPX1	647	1,238	1,540	2,148
PPX2	0	0	0	0
Total	*2,326*	*2,590*	*3,376*	*4,248*
44-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,122	694	982	1,048
PPX1	457	745	854	1,171
PPX2	136	334	476	666
Total	*2,211*	*2,366*	*3,070*	*3,832*
45-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,105	663	941	993
PPX1	356	561	586	826
PPX2	208	465	668	912
Total	*2,166*	*2,282*	*2,953*	*3,678*
46-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,096	658	932	982
PPX1	312	471	465	662
PPX2	239	524	749	1,021
Total	*2,144*	*2,247*	*2,903*	*3,613*
47-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,092	649	924	975
PPX1	312	471	462	661
PPX2	239	524	749	1,018
Total	*2,140*	*2,238*	*2,892*	*3,601*
48-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,092	649	924	975
PPX1	312	471	462	661
PPX2	239	524	749	1,018
Total	*2,140*	*2,238*	*2,892*	*3,601*

5.2.7. Sensitivity 12: Increase Post-Panamax Vessel Loading Beyond Maximum Practicable Loading

For sensitivity analysis 12, it was assumed that vessel loadings would respond to having a larger tidal window due to deeper channel depths by having average loadings greater than the estimated Maximum Practicable Capacity by loading on average more cargo. It reflects a further change in overall sailing draft distributions with deeper channels. To run this sensitivity, the PDT assumed that for a 1 foot channel depth beyond which PPX vessels can attain their MPC on each trade route, they would load 2/3rds more cargo (tonnes), on average, than they would load at one foot less than it's MPC. And for 2 feet of additional channel they would load on average 1/3rd more cargo. For example, on the FE (Panama) ECUS route, it is estimated that on average, PPX 1 vessels would carry 6,978 tonnes of Savannah cargo in a 42 foot channel and 7,344 tonnes in a channel of 44 to 48 feet (Table 42). In this sensitivity, it is assumed that the PPX1 vessels, on average would carry 7,600 tonnes in a 45 ft channel and 7,690 tonnes in a 46-foot channel. The results on benefits are shown in Table 81 . Average annual benefits are the same at 44 feet, but begin to increase substantially at 45 feet, when the effects of the increased loading assumption begin to take effect. Note that the results show an increase in benefits from 47 to 48 feet such that the 48 foot alternative in this analysis has over $4 million in incremental benefits. This sensitivity analysis also reflects, at least in a general sense, the effects on project benefits and channel depth optimization that would likely occur if vessels with drafts greater than 48 ft called on Savannah on a regular basis. Also note the reduction in vessel calls for depths greater than 44 feet from the baseline, and the reduction in number of calls between 47 and 48 feet.

Table 81: Sensitivity 12 - Increase PPX Vessel Loading Beyond MPC - AAE Transportation Cost Savings

Service Route	42 feet	44 feet	45 feet	46 feet	47 feet	48 feet
Transportation Cost Savings						
FE (Panama) ECUS	$ -	$ 37,020,000	$ 53,030,000	$ 61,780,000	$ 63,970,000	$ 63,970,000
FE (Suez) ECUS	$ -	$ 31,670,000	$ 44,230,000	$ 54,770,000	$ 58,020,000	$ 59,140,000
FE ECUS EU PEN	$ -	$ 14,740,000	$ 23,730,000	$ 27,490,000	$ 29,140,000	$ 29,700,000
FE ECUS MED PEN	$ -	$ 10,720,000	$ 16,340,000	$ 20,210,000	$ 22,810,000	$ 24,560,000
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 600,000	$ 910,000	$ 1,150,000	$ 1,350,000	$ 1,480,000
ECUS MED	$ -	$ 550,000	$ 830,000	$ 1,050,000	$ 1,240,000	$ 1,360,000
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 2,910,000	$ 4,420,000	$ 5,560,000	$ 6,560,000	$ 7,210,000
Total AAE Benefits	*$ -*	*$ 98,210,000*	*$ 143,480,000*	*$ 172,010,000*	*$ 183,080,000*	*$ 187,420,000*
Service Route	**42 feet**	**44 feet**	**45 feet**	**46 feet**	**47 feet**	**48 feet**
Incremental Transportation Cost Savings						
FE (Panama) ECUS	$ -	$ 37,020,000	$ 16,010,000	$ 8,750,000	$ 2,190,000	$ -
FE (Suez) ECUS	$ -	$ 31,670,000	$ 12,560,000	$ 10,550,000	$ 3,240,000	$ 1,130,000
FE ECUS EU PEN	$ -	$ 14,740,000	$ 8,990,000	$ 3,760,000	$ 1,650,000	$ 560,000
FE ECUS MED PEN	$ -	$ 10,720,000	$ 5,620,000	$ 3,870,000	$ 2,600,000	$ 1,750,000
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 600,000	$ 310,000	$ 230,000	$ 200,000	$ 130,000
ECUS MED	$ -	$ 550,000	$ 290,000	$ 220,000	$ 190,000	$ 120,000
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 2,910,000	$ 1,500,000	$ 1,150,000	$ 1,000,000	$ 650,000
Total	*$ -*	*$ 98,210,000*	*$ 45,280,000*	*$ 28,530,000*	*$ 11,070,000*	*$ 4,340,000*

Table 82: Sensitivity 12 - Increase PPX Vessel Loading Beyond MPC - Forecast Vessel Calls

42-Foot Depth	2017	2020	2025	2030
SPX	497	593	758	947
PX	1,196	778	1,122	1,196
PPX1	479	866	1,006	1,421
PPX2	120	271	382	527
Total	*2,292*	*2,509*	*3,267*	*4,092*
44-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,135	700	992	1,067
PPX1	312	478	471	672
PPX2	239	533	761	1,035
Total	*2,183*	*2,304*	*2,982*	*3,720*
45-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,100	655	936	984
PPX1	312	474	467	666
PPX2	239	527	753	1,027
Total	*2,148*	*2,249*	*2,914*	*3,624*
46-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,078	628	900	940
PPX1	312	470	462	661
PPX2	239	524	749	1,018
Total	*2,126*	*2,215*	*2,869*	*3,566*
47-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,070	615	884	911
PPX1	312	470	462	661
PPX2	239	523	747	1,018
Total	*2,118*	*2,202*	*2,851*	*3,537*
48-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,067	611	877	901
PPX1	312	468	461	659
PPX2	239	523	747	1,018
Total	*2,114*	*2,196*	*2,842*	*3,525*

5.2.8. Sensitivity 13: Reduce PPX1 Replacement of PPX2 Vessels, Use Historical SPX Share of Capacity Calling, and Deployment of PPX by Unit Costs

This sensitivity analysis employs some basic assumptions that were originally used when the TCSM was developed for the Savannah study. First it assumes the deployment by unit cost depths as presented in Sensitivity 11 and presented in the draft report. Secondly, it assumes the historic Sub-Panamax share of capacity calling as presented in Sensitivity 6. And finally, it assumes that when PPX2 vessels do not call on a particular route due to channel constraints, they will be replaced on a vessels for vessel basis rather than a capacity for capacity basis as included in the baseline condition. These were all assumptions used prior to refinements that have evolved throughout the SHEP study as more information became available. The results are shown in Table 83 and Table 84. Annual benefits and vessel calls increase substantially over the baseline ranging from 28 to 35 percent greater. The number of vessel calls also increase primarily due to the high number of Sub-Panama vessels, and the increase in PPX1 calls.

Table 83: Sensitivity 13 – Reduce PPX1 Replacement of PPX2 Vessels, Use Historical SPX Share of Capacity Calling, and Deployment of PPX by Unit Costs - AAE Transportation Cost Savings

Service Route	42 feet	44 feet	45 feet	46 feet	47 feet	48 feet
Transportation Cost Savings						
FE (Panama) ECUS	$ -	$ 57,200,000	$66,940,000	$ 66,940,000	$66,940,000	$ 66,940,000
FE (Suez) ECUS	$ -	$ 39,240,000	$59,870,000	$ 68,950,000	$70,770,000	$ 70,770,000
FE ECUS EU PEN	$ -	$ 19,950,000	$25,300,000	$ 27,810,000	$27,810,000	$ 27,810,000
FE ECUS MED PEN	$ -	$ 13,630,000	$19,450,000	$ 23,460,000	$26,030,000	$ 26,030,000
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 460,000	$ 700,000	$ 990,000	$ 1,150,000	$ 1,150,000
ECUS MED	$ -	$ 290,000	$ 440,000	$ 690,000	$ 800,000	$ 800,000
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 1,860,000	$ 2,780,000	$ 4,210,000	$ 4,860,000	$ 4,860,000
Total AAE Benefits	*$ -*	*$132,630,000*	*$175,480,000*	*$193,050,000*	*$198,370,000*	*$198,370,000*
Service Route	**42 feet**	**44 feet**	**45 feet**	**46 feet**	**47 feet**	**48 feet**
Incremental Transportation Cost Savings						
FE (Panama) ECUS	$ -	$ 57,200,000	$ 9,750,000	$ -	$ -	$ -
FE (Suez) ECUS	$ -	$ 39,240,000	$ 20,630,000	$ 9,080,000	$ 1,830,000	$ -
FE ECUS EU PEN	$ -	$ 19,950,000	$ 5,350,000	$ 2,510,000	$ -	$ -
FE ECUS MED PEN	$ -	$ 13,630,000	$ 5,820,000	$ 4,010,000	$ 2,580,000	$ -
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 460,000	$ 230,000	$ 300,000	$ 160,000	$ -
ECUS MED	$ -	$ 290,000	$ 150,000	$ 250,000	$ 100,000	$ -
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 1,860,000	$ 930,000	$ 1,420,000	$ 650,000	$ -
Total	*$ -*	*$132,630,000*	*$ 42,850,000*	*$ 17,570,000*	*$ 5,320,000*	*$ -*

Table 84: Sensitivity 13 - Reduce PPX1 Replacement of PPX2 Vessels, Use Historical SPX Share of Capacity Calling, and Deployment of PPX by Unit Costs - Forecast Vessel Calls

42-Foot Depth	2017	2020	2025	2030
SPX	741	886	1,131	1,413
PX	1,127	826	1,223	1,362
PPX1	549	1,029	1,235	1,748
PPX2	-	-	-	-
Total	*2,417*	*2,741*	*3,588*	*4,523*
44-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	741	886	1,131	1,413
PX	994	535	833	815
PPX1	409	685	745	1,063
PPX2	140	344	490	685
Total	*2,284*	*2,450*	*3,198*	*3,976*
45-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	741	886	1,131	1,413
PX	929	481	712	720
PPX1	334	517	528	746
PPX2	215	475	682	931
Total	*2,220*	*2,359*	*3,052*	*3,810*
46-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	741	886	1,131	1,413
PX	905	447	665	655
PPX1	310	467	459	656
PPX2	239	519	742	1,011
Total	*2,196*	*2,319*	*2,997*	*3,736*
47-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	741	886	1,131	1,413
PX	901	442	659	643
PPX1	310	465	459	654
PPX2	239	519	740	1,011
Total	*2,192*	*2,312*	*2,989*	*3,722*
48-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	741	886	1,131	1,413
PX	901	442	659	643
PPX1	310	465	459	654
PPX2	239	519	740	1,011
Total	*2,192*	*2,312*	*2,989*	*3,722*

5.3. Other Sensitivities

5.3.1. Sensitivity 14: Increase Cargo Density

Sensitivity 14 tests what would occur if, as has been suggested by some, that cargo may become more dense in the future as shippers look for ways to cut costs by reducing packing materials and putting more product/commodity weight in containers. Additionally, this sensitivity test assumes that average cargo weight per TEU on each trade route would be such that the MPC of PPX vessels would be equal to the design draft of the vessels. For cargo densification, the PDT added ½ ton per TEU to the average cargo weight for Savannah imports on each trade route, as it is the import cargo that would be most subject to densification. In addition, the PDT replaced the load factor analysis for each trade route by a load factor analysis for a trade route that had the heaviest cargo and fewest minimal empty TEUs and vacant slots. The results are shown in Table 85 and Table 86. Average annual benefits increase from 2 to 37 percent with the greater increases being with greater depths as the effects of the Load Factor Analysis come more and more in to effect. The reason for the increase is the overall heavier loading of PPX vessels particularly at deeper drafts. However, the number of vessel calls also increase. This is primarily due to the need for more Panamax vessels as the number of PPX vessel decrease, and can accommodate fewer Savannah TEUs because of the additional average cargo weight they would carry. There are fewer PPX vessel calls because they are developed based on the TEU forecast. With increased import cargo weight per TEU, the Savannah TEU forecast is actually slightly lower and the 6.5 million TEU capacity is not reached until 2031.

Table 85: Sensitivity 14 – Increase Cargo Density - AAE Transportation Cost Savings

Service Route	42 feet	44 feet	45 feet	46 feet	47 feet	48 feet
Transportation Cost Savings						
FE (Panama) ECUS	$ -	$ 35,750,000	$ 54,190,000	$ 68,240,000	$ 79,190,000	$ 79,190,000
FE (Suez) ECUS	$ -	$ 37,960,000	$ 56,020,000	$ 67,240,000	$ 75,880,000	$ 75,880,000
FE ECUS EU PEN	$ -	$ 12,670,000	$ 19,190,000	$ 24,150,000	$ 28,010,000	$ 28,010,000
FE ECUS MED PEN	$ -	$ 9,530,000	$ 14,430,000	$ 18,160,000	$ 21,070,000	$ 21,070,000
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 570,000	$ 870,000	$ 1,090,000	$ 1,260,000	$ 1,260,000
ECUS MED	$ -	$ 520,000	$ 800,000	$ 1,000,000	$ 1,160,000	$ 1,160,000
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 2,740,000	$ 4,150,000	$ 5,220,000	$ 6,050,000	$ 6,050,000
Total AAE Benefits	*$ -*	*$ 99,750,000*	*$ 149,630,000*	*$ 185,090,000*	*$ 212,620,000*	*$ 212,620,000*
Service Route	**42 feet**	**44 feet**	**45 feet**	**46 feet**	**47 feet**	**48 feet**
Incremental Transportation Cost Savings						
FE (Panama) ECUS	$ -	$ 35,750,000	$ 18,430,000	$ 14,050,000	$ 10,950,000	$ -
FE (Suez) ECUS	$ -	$ 37,960,000	$ 18,060,000	$ 11,220,000	$ 8,630,000	$ -
FE ECUS EU PEN	$ -	$ 12,670,000	$ 6,510,000	$ 4,960,000	$ 3,860,000	$ -
FE ECUS MED PEN	$ -	$ 9,530,000	$ 4,900,000	$ 3,730,000	$ 2,910,000	$ -
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 570,000	$ 290,000	$ 220,000	$ 170,000	$ -
ECUS MED	$ -	$ 520,000	$ 270,000	$ 210,000	$ 160,000	$ -
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 2,740,000	$ 1,410,000	$ 1,070,000	$ 830,000	$ -
Total	*$ -*	*$ 99,750,000*	*$ 49,880,000*	*$ 35,460,000*	*$ 27,520,000*	*$ -*

Table 86: Sensitivity 14 - Increase Cargo Density - Forecast Vessel Calls

42-Foot Depth	2017	2020	2025	2030
SPX	497	593	758	947
PX	1,323	1,040	1,451	1,648
PPX1	464	838	971	1,377
PPX2	116	262	368	511
Total	*2,400*	*2,733*	*3,547*	*4,483*
44-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,265	934	1,326	1,472
PPX1	302	471	456	662
PPX2	232	524	736	1,021
Total	*2,296*	*2,523*	*3,275*	*4,102*
45-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,230	870	1,245	1,375
PPX1	302	470	456	659
PPX2	232	524	736	1,016
Total	*2,261*	*2,457*	*3,195*	*3,997*
46-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,208	836	1,182	1,314
PPX1	302	467	456	654
PPX2	232	520	736	1,008
Total	*2,239*	*2,417*	*3,132*	*3,923*
47-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,192	812	1,133	1,265
PPX1	302	465	456	650
PPX2	232	517	736	1,002
Total	*2,223*	*2,387*	*3,082*	*3,864*
48-Foot Depth	**2017**	**2020**	**2025**	**2030**
SPX	497	593	758	947
PX	1,192	812	1,133	1,265
PPX1	302	465	456	650
PPX2	232	517	736	1,002
Total	*2,223*	*2,387*	*3,082*	*3,864*

5.3.2. Sensitivity 15: Increase Savannah Share of Trade Route Cargo by 25%

The base line estimate of benefits used 2005 and 2007 vessel calls, Savannah cargo and empty containers, and sailing draft information combined with the Load Factor Analysis to estimate the amount of vessel capacity utilized when vessels called at Savannah Harbor. This information was then used to "allocate" the total round trip vessel costs to estimate benefits attributable to improving Savannah Harbor. It is recognized that this assumption is highly uncertain, because the amount of Savannah cargo carried varies considerably from trip to trip and year to year. Additionally, vessel itineraries change over time. While a number of variables in the analysis were updated from the 2005/07 base years used in the draft report by incorporating information from 2008 and 2010, sailing drafts were not analyzed for these years, therefore newer estimates of total cargo carried has not been revised. The amount of Savannah cargo carried as a percent of total cargo carried could vary considerable. For this sensitivity analysis, it was assumed that the amount of Savannah cargo carried relative to total cargo is 25% greater than observed and calculated from the 2005 and 2007 estimates. The results for average annual benefits are shown in Table 87. As expected, the annual benefits are 25 percent greater than the base line. This is because this is a straight linear relationship in the model. Thus a 10 percent or even a 50 percent change in amount of Savannah cargo carried relative to total cargo would result in 10 and 50 percent changes in benefits respectively.

Table 87: Sensitivity 15 – Increase Savannah Share of Trade Route Cargo by 25% - AAE Transportation Cost Savings

Service Route	42 feet	44 feet	45 feet	46 feet	47 feet	48 feet
Transportation Cost Savings						
FE (Panama) ECUS	$ -	$ 46,280,000	$ 58,150,000	$ 58,150,000	$ 58,150,000	$ 58,150,000
FE (Suez) ECUS	$ -	$ 39,590,000	$ 55,280,000	$ 66,940,000	$ 68,130,000	$ 68,130,000
FE ECUS EU PEN	$ -	$ 18,420,000	$ 24,880,000	$ 27,910,000	$ 27,910,000	$ 27,910,000
FE ECUS MED PEN	$ -	$ 13,390,000	$ 20,420,000	$ 25,260,000	$ 28,370,000	$ 28,370,000
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 750,000	$ 1,140,000	$ 1,430,000	$ 1,660,000	$ 1,660,000
ECUS MED	$ -	$ 680,000	$ 1,040,000	$ 1,310,000	$ 1,520,000	$ 1,520,000
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 3,640,000	$ 5,520,000	$ 6,950,000	$ 8,070,000	$ 8,070,000
Total AAE Benefits	*$ -*	*$122,760,000*	*$166,430,000*	*$187,960,000*	*$193,810,000*	*$193,810,000*
Service Route	**42 feet**	**44 feet**	**45 feet**	**46 feet**	**47 feet**	**48 feet**
Incremental Transportation Cost Savings						
FE (Panama) ECUS	$ -	$ 46,280,000	$ 11,870,000	$ -	$ -	$ -
FE (Suez) ECUS	$ -	$ 39,590,000	$ 15,700,000	$ 11,660,000	$ 1,180,000	$ -
FE ECUS EU PEN	$ -	$ 18,420,000	$ 6,460,000	$ 3,030,000	$ -	$ -
FE ECUS MED PEN	$ -	$ 13,390,000	$ 7,030,000	$ 4,840,000	$ 3,110,000	$ -
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 750,000	$ 380,000	$ 290,000	$ 230,000	$ -
ECUS MED	$ -	$ 680,000	$ 360,000	$ 270,000	$ 210,000	$ -
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 3,640,000	$ 1,880,000	$ 1,430,000	$ 1,120,000	$ -
Total	*$ -*	*$122,760,000*	*$ 43,670,000*	*$ 21,530,000*	*$ 5,850,000*	$ -

5.3.3. Sensitivity 16: Decrease Savannah Share of Trade Route Cargo by 25%

For this sensitivity, the estimated amount of Savannah cargo relative to total cargo was decreased by 25%. The purpose of this analysis is the same as described in Sensitivity 15; it is a highly uncertain parameter in the analysis of benefits. Table 88 shows the results on average annual benefits and as expected the results in both annual benefits and incremental benefits are a decrease of 25 percent from the base line. For this sensitivity and sensitivity 15, vessel calls are not shown because they are the same as in the base line condition. Only the amount of Savannah cargo to total cargo carried for purposes of allocated round trip distance cost changes.

Table 88: Sensitivity 16 – Decrease Savannah Share of Trade Route Cargo by 25% - AAE Transportation Cost Savings

Service Route	42 feet	44 feet	45 feet	46 feet	47 feet	48 feet
Transportation Cost Savings						
FE (Panama) ECUS	$ -	$27,770,000	$34,890,000	$ 34,890,000	$ 34,890,000	$ 34,890,000
FE (Suez) ECUS	$ -	$23,750,000	$33,170,000	$ 40,170,000	$ 40,880,000	$ 40,880,000
FE ECUS EU PEN	$ -	$11,050,000	$14,930,000	$ 16,740,000	$ 16,740,000	$ 16,740,000
FE ECUS MED PEN	$ -	$ 8,040,000	$12,250,000	$ 15,160,000	$ 17,020,000	$ 17,020,000
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 450,000	$ 680,000	$ 860,000	$ 1,000,000	$ 1,000,000
ECUS MED	$ -	$ 410,000	$ 620,000	$ 790,000	$ 910,000	$ 910,000
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 2,180,000	$ 3,310,000	$ 4,170,000	$ 4,840,000	$ 4,840,000
Total AAE Benefits	*$ -*	*$73,660,000*	*$99,860,000*	*$112,770,000*	*$116,280,000*	*$116,280,000*
Service Route	**42 feet**	**44 feet**	**45 feet**	**46 feet**	**47 feet**	**48 feet**
Incremental Transportation Cost Savings						
FE (Panama) ECUS	$ -	$27,770,000	$ 7,120,000	$ -	$ -	$ -
FE (Suez) ECUS	$ -	$23,750,000	$ 9,420,000	$ 7,000,000	$ 710,000	$ -
FE ECUS EU PEN	$ -	$11,050,000	$ 3,870,000	$ 1,820,000	$ -	$ -
FE ECUS MED PEN	$ -	$ 8,040,000	$ 4,220,000	$ 2,900,000	$ 1,870,000	$ -
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 450,000	$ 230,000	$ 180,000	$ 140,000	$ -
ECUS MED	$ -	$ 410,000	$ 210,000	$ 160,000	$ 130,000	$ -
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 2,180,000	$ 1,130,000	$ 860,000	$ 670,000	$ -
Total	*$ -*	*$73,660,000*	*$26,200,000*	*$ 12,920,000*	*$ 3,510,000*	*$ -*

5.3.4. Sensitivity 17: December 2010 Draft Report Values

Sensitivity 17 is presented primarily for comparison purposes. It is simply a display of the TCSM baseline results that were presented in the draft report on SHEP. The draft report values are shown in Table 89 and Table 90. The average annual benefits are 5 to 10 percent lower than the current baseline in this final report. While the overall commodity forecast in tonnes is lower in the final report than what was presented in the draft report, the forecast number of TEUs is higher due primarily to increased numbers of empty containers and changes in cargo weights that resulting from incorporating 2008 – 2010 actual shipments at Savannah. Also, the new Post-Panamax vessel call forecast resulted in an increase in the number of PPX 2 vessels in the early years of the analysis period. Additionally, a 2017 base year is used in the final report baseline compared to a 2015 year base year in the draft report, resulting in higher early year benefits. The discount rate of 4.125 percent for FY 2011 likewise results in an upward adjustment of benefits. And finally, changes in assumptions regarding deployment of PPX 2 vessels in the without

project condition, as is occurring presently, results in an increase in benefits. Sensitivity 11 shown and discussed above, used the same deployment by depth assumption as was used in the draft report analysis, and resulted in values closer to the draft report numbers shown in the following table.

Table 89: Sensitivity 17 – December 2010 Draft Report Values - AAE Transportation Cost Savings

Service Route	42 feet	44 feet	45 feet	46 feet	47 feet	48 feet
Transportation Cost Savings						
FE (Panama) ECUS	$ -	$ 47,030,000	$ 59,830,000	$ 59,830,000	$ 59,830,000	$ 59,830,000
FE (Suez) ECUS	$ -	$ 18,810,000	$ 23,260,000	$ 29,010,000	$ 30,150,000	$ 30,150,000
FE ECUS EU PEN	$ -	$ 14,490,000	$ 19,700,000	$ 22,150,000	$ 22,150,000	$ 22,150,000
FE ECUS MED PEN	$ -	$ 10,610,000	$ 16,440,000	$ 20,360,000	$ 22,860,000	$ 22,860,000
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 190,000	$ 280,000	$ 330,000	$ 390,000	$ 390,000
ECUS MED	$ -	$ 1,280,000	$ 1,920,000	$ 2,210,000	$ 2,560,000	$ 2,560,000
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 600,000	$ 910,000	$ 1,050,000	$ 1,220,000	$ 1,220,000
Total AAE Benefits	*$ -*	*$ 93,010,000*	*$ 122,350,000*	*$ 134,930,000*	*$ 139,150,000*	*$ 139,150,000*
Service Route	**42 feet**	**44 feet**	**45 feet**	**46 feet**	**47 feet**	**48 feet**
Incremental Transportation Cost Savings						
FE (Panama) ECUS	$ -	$ 47,030,000	$ 12,810,000	$ -	$ -	$ -
FE (Suez) ECUS	$ -	$ 18,810,000	$ 4,450,000	$ 5,740,000	$ 1,150,000	$ -
FE ECUS EU PEN	$ -	$ 14,490,000	$ 5,210,000	$ 2,450,000	$ -	$ -
FE ECUS MED PEN	$ -	$ 10,610,000	$ 5,830,000	$ 3,920,000	$ 2,510,000	$ -
AU ECUS EU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS AU PEN	$ -	$ -	$ -	$ -	$ -	$ -
ECUS EU GULF PEN	$ -	$ 190,000	$ 100,000	$ 50,000	$ 50,000	$ -
ECUS MED	$ -	$ 1,280,000	$ 640,000	$ 280,000	$ 350,000	$ -
ECUS WCSA-ECSA	$ -	$ -	$ -	$ -	$ -	$ -
RTW	$ -	$ 600,000	$ 300,000	$ 140,000	$ 170,000	$ -
Total	*$ -*	*$ 93,010,000*	*$ 29,340,000*	*$ 12,580,000*	*$ 4,220,000*	*$ -*

Table 90: Sensitivity 17 - December 2010 Draft Report Values - Forecast Vessel Calls

42-Foot Depth	2015	2020	2025	2030	2032
SPX	324	390	485	584	633
PX	1,540	788	759	1,112	1,290
PPX1	308	1,188	1,704	2,058	2,226
PPX2	-	-	-	-	-
Total	*2,172*	*2,367*	*2,948*	*3,754*	*4,148*
44-Foot Depth	**2015**	**2020**	**2025**	**2030**	**2032**
SPX	324	390	485	584	633
PX	1,512	700	641	970	1,137
PPX1	260	647	755	906	977
PPX2	34	386	677	823	892
Total	*2,131*	*2,124*	*2,559*	*3,284*	*3,639*
45-Foot Depth	**2015**	**2020**	**2025**	**2030**	**2032**
SPX	324	390	485	584	633
PX	1,507	669	596	912	1,074
PPX1	252	564	614	737	795
PPX2	40	446	777	943	1,022
Total	*2,123*	*2,069*	*2,472*	*3,177*	*3,524*
46-Foot Depth	**2015**	**2020**	**2025**	**2030**	**2032**
SPX	324	390	485	584	633
PX	1,505	658	579	891	1,051
PPX1	248	524	548	662	716
PPX2	43	475	824	997	1,078
Total	*2,121*	*2,047*	*2,436*	*3,134*	*3,478*
47-Foot Depth	**2015**	**2020**	**2025**	**2030**	**2032**
SPX	324	390	485	584	633
PX	1,505	653	570	880	1,040
PPX1	248	524	548	662	716
PPX2	43	475	824	997	1,078
Total	*2,120*	*2,042*	*2,426*	*3,124*	*3,467*
48-Foot Depth	**2015**	**2020**	**2025**	**2030**	**2032**
SPX	324	390	485	584	633
PX	1,505	653	570	880	1,040
PPX1	248	524	548	662	716
PPX2	43	475	824	997	1,078
Total	*2,120*	*2,042*	*2,426*	*3,124*	*3,467*

5.4. Sensitivity Summary

Table 91 and Table 92 show an overall summary of the baseline benefits from the TCSM and the sensitivity tests run on various assumptions employed in the model. Table 91 shows annual costs, annual benefits, and net annual benefits (benefits minus costs) by alternative channel depth for all sensitivities. The table also shows the percent change in annual benefits from baseline estimates. This table is used to provide information and insight as to the overall justification of the alternatives. Table 92 provides incremental annual costs, incremental annual benefits, as well as incremental cost minus incremental net benefits. This table provides information as to the maximization of net incremental benefits to provide insight into the identification of the NED plan (e.g., that plan which provides maximum net benefits).

These analyses are presented using the circuit distance benefits computed for the project from the TCSM for container ships and do not reflect the effects of tidal delays and additional benefits which may be derived from reductions in tidal delays and non-container cargo which are discussed and presented in the next section of this appendix. However, circuit distance benefits far outweigh the benefits measured for tidal delay and other cargo savings, which are additive to the benefit shown herein. The magnitude of the benefits is such that they do not have a major impact on overall economic justification and plan optimization.

The baseline and sensitivities have been run testing various assumptions employed in the analysis. While this is not a fully exhaustive list of all future conditions or combinations of assumptions which could potentially be realized, it is sufficient for the analyst, interested parties, and decision makers to make informed judgments and inferences regarding overall plan justification and optimization.

As shown in Table 91 all plans have benefits which exceed costs for all channel depths, including Sensitivity 5 (no growth in tonnage and TEUs imported and exported at Savannah). With a no tonnage commodity growth, the 47 foot alternative has a benefit to cost ration of 1.8 to 1.0. Table 91 also shows that maximum net benefits are attained at a channel depth of 47 feet for all but one of the scenarios. Sensitivity 12 shows maximum net benefits at 48 feet. Sensitivity 12 also demonstrates that there are two factors which could lead to maximization of net benefits for most all sensitivities at 48 feet: 1) a reaction by carriers to take advantage of the larger tide window afforded by the 48-foot alternative by carrying more overall cargo when calling at Savannah and/or 2) larger PPX2 vessels than the 47.6 feet design draft vessel used in this analysis. Another conjecture can be made regarding what factors and circumstances could result in plan optimization at channel depths lower than 47 feet. Such circumstances could include fewer PPX2 vessels deployed on the heavier cargo trade routes (RTW, ECUS MED, ECUS EU GULF, FE SUEZ ECUS, and FE ECUS MED) which could lead to optimization at 46-foot channel depth. Additionally, in conducting these sensitivity analyses, one can conjecture that port rotation matters. When Savannah is a first or early port of call on the East Coast United States, there seems to be a tendency for vessels to carry generally lighter cargo overall as they would be carrying mostly imports which are lighter than exports and vessel would tend to sail at shallower drafts. Conversely, when Savannah is the last or near the end of the ECUS portion of their itinerary, they would tend to carry proportionally more of the heavier export cargo and thus tend to sail deeper and make greater use of available channel depths.

Table 91: Sensitivity Summary Table – Net Benefits

Sensitivity Analysis - Summary

5.4.1 Transportation Cost Savings ($1,000) and Sensitivity Ratio under the Baseline Condition

		Project Depth (design dimensions)					Maximum Absolute Deviation
		44	45	46	47	48	
	Annual Costs	$29,370,000	$31,640,000	$33,750,000	$35,800,000	$37,970,000	
Commodity Projections	Baseline:	$98,210,000	$133,150,000	$150,370,000	$155,040,000	$155,040,000	
	Net benefits	$68,840,000	$101,510,000	$116,620,000	$119,240,000	$117,220,000	
	1-Increase Annual Commod. Growth by 1%	$117,060,000	$158,490,000	$178,290,000	$184,340,000	$184,340,000	
	Deviation from the baseline in %	19.19%	19.03%	18.57%	18.90%	18.90%	19.00%
	Net benefits	$87,690,000	$126,850,000	$144,540,000	$148,540,000	$146,520,000	
	2-Incr Annual Commod. Grwth by 3%	$164,090,000	$222,280,000	$250,090,000	$258,560,000	$258,560,000	
	Deviation from the baseline in %	67.08%	66.94%	66.32%	66.77%	66.77%	67.00%
	Net benefits	$134,720,000	$190,640,000	$216,340,000	$222,760,000	$220,740,000	
	3-Decrease Annual Commod Growth by 1%	$93,580,000	$126,390,000	$142,290,000	$147,470,000	$147,470,000	
	Deviation from the baseline in %	-4.71%	-5.08%	-5.37%	-4.88%	-4.88%	5.00%
	Net benefits	$64,210,000	$94,750,000	$108,540,000	$111,670,000	$109,650,000	
	4-Decrease Annual Commod Grwth by 3%	$62,860,000	$84,840,000	$95,500,000	$98,970,000	$98,970,000	
	Deviation from the baseline in %	-35.99%	-36.28%	-36.49%	-36.16%	-36.16%	36.00%
	Net benefits	$33,490,000	$53,200,000	$61,750,000	$63,170,000	$61,150,000	
	5 - No Growth in Commodity Forecast	$37,430,000	$50,640,000	$57,060,000	$59,250,000	$59,250,000	
	Deviation from the baseline in %	-61.89%	-61.97%	-62.05%	-61.78%	-61.78%	62.00%
	Net benefits	$8,060,000	$19,000,000	$23,310,000	$23,450,000	$21,430,000	
Vessel Availability and Loading	6-Historical SPX Share of Capacity Calling	$100,000,000	$135,410,000	$152,730,000	$157,200,000	$157,200,000	
	Deviation from the baseline in %	1.82%	1.70%	1.57%	1.39%	1.39%	2.00%
	Net benefits	$70,630,000	$103,770,000	$118,980,000	$121,400,000	$119,380,000	
	7-Red Future SPX Share of Capacity Call	$96,580,000	$131,090,000	$148,230,000	$153,090,000	$153,090,000	
	Deviation from the baseline in %	-1.66%	-1.55%	-1.42%	-1.26%	-1.26%	2.00%
	Net benefits	$67,210,000	$99,450,000	$114,480,000	$117,290,000	$115,270,000	
	8-Incr. Amnt of Sav Cargo Carr on PPX	$102,980,000	$135,000,000	$151,160,000	$155,440,000	$155,440,000	
	Deviation from the baseline in %	4.86%	1.39%	0.53%	0.26%	0.26%	5.00%
	Net benefits	$73,610,000	$103,360,000	$117,410,000	$119,640,000	$117,620,000	
	9 - Full Deployment of PPX in W/O	$105,920,000	$140,860,000	$158,080,000	$162,760,000	$162,760,000	
	Deviation from the baseline in %	7.85%	5.79%	5.13%	4.98%	4.98%	8.00%
	Net benefits	$76,550,000	$109,220,000	$124,330,000	$126,960,000	$124,940,000	
	10 - Reduce PPX Vessel Calls by 25%	$81,300,000	$112,960,000	$130,020,000	$135,050,000	$135,050,000	
	Deviation from the baseline in %	-17.22%	-15.16%	-13.53%	-12.89%	-12.89%	13.00%
	Net benefits	$51,930,000	$81,320,000	$96,270,000	$99,250,000	$97,230,000	
	11 - Deploy PPX Vessels by Unit Costs	$95,470,000	$128,170,000	$144,850,000	$149,530,000	$149,530,000	
	Deviation from the baseline in %	-2.79%	-3.74%	-3.67%	-3.55%	-3.55%	4.00%
	Net benefits	$66,100,000	$96,530,000	$111,100,000	$113,730,000	$111,710,000	
	12 - Incr PPX Load Beyond MPC	$98,210,000	$143,480,000	$172,010,000	$183,080,000	$187,420,000	
	Deviation from the baseline in %	0.00%	7.76%	14.39%	18.09%	20.86%	21.00%
	Net benefits	$68,840,000	$111,840,000	$136,260,000	$147,280,000	$149,600,000	
	13 - Red PPX1 Repl of PPX2, Hist SPX Share Cap Call and Deploy PPX by Unit $	$132,630,000	$175,480,000	$193,050,000	$198,370,000	$198,370,000	
	Deviation from the baseline in %	35.05%	31.79%	28.38%	27.95%	27.95%	35.00%
	Net benefits	$103,260,000	$143,840,000	$159,300,000	$162,570,000	$160,550,000	
Other	14 - Increase Cargo Density	$99,750,000	$149,630,000	$185,090,000	$212,620,000	$212,620,000	
	Deviation from the baseline in %	1.57%	12.38%	23.09%	37.14%	37.14%	37.00%
	Net benefits	$70,380,000	$117,990,000	$151,340,000	$176,820,000	$174,800,000	
	15 - Increase Savannah Share of Trade Route Cargo by 25%	$122,760,000	$166,430,000	$187,960,000	$193,810,000	$193,810,000	
	Deviation from the baseline in %	25.00%	24.99%	25.00%	25.01%	25.01%	25.00%
	Net benefits	$93,390,000	$134,790,000	$154,210,000	$158,010,000	$155,990,000	
	16 - Decrease Savannah Share of Trade Route Cargo by 25%	$73,660,000	$99,860,000	$112,770,000	$116,280,000	$116,280,000	
	Deviation from the baseline in %	-25.00%	-25.00%	-25.00%	-25.00%	-25.00%	25.00%
	Net benefits	$44,290,000	$68,220,000	$79,020,000	$80,480,000	$78,460,000	
	17 - Draft Report Values	$93,010,000	$122,360,000	$134,930,000	$139,150,000	$139,150,000	
	Deviation from the baseline in %	-5.29%	-8.11%	-10.27%	-10.25%	-10.25%	10.00%
	Net benefits	$63,640,000	$90,710,000	$101,180,000	$103,350,000	$101,330,000	

Table 92: Sensitivity Summary – Net Incremental Benefits

Sensitivity Analyses - Summary						
Net Incremental Benefits						
		Project Depth (design dimensions)				
		44	45	46	47	48
	Incremental Annual Costs	$29,370,000	$32,270,000	$32,110,000	$32,050,000	$32,020,000
Commodity Projections	Baseline	$98,210,000	$34,940,000	$17,220,000	$4,670,000	$0
	Net Incremental benefits	$68,840,000	$32,670,000	$15,110,000	$2,620,000	-$2,020,000
	1 - Increase Annual Commodity Growth by 1%	$117,060,000	$41,430,000	$19,800,000	$6,050,000	$0
	Net Incremental benefits	$87,690,000	$39,160,000	$17,690,000	$4,000,000	-$2,020,000
	2 - Increase Annual Commodity Growth by 3%	$164,090,000	$58,190,000	$27,810,000	$8,470,000	$0
	Net Incremental benefits	$134,720,000	$56,090,000	$25,700,000	$6,420,000	-$2,020,000
	3 - Decrease Annual Commodity Growth by 1%	$93,580,000	$32,810,000	$15,900,000	$5,180,000	$0
	Net Incremental benefits	$64,210,000	$30,710,000	$13,790,000	$3,130,000	-$2,020,000
	4 - Decrease Annual Commodity Growth by 3%	$62,860,000	$21,980,000	$10,660,000	$3,470,000	$0
	Net Incremental benefits	$33,490,000	$19,710,000	$8,550,000	$1,420,000	-$2,020,000
	5 - No Growth in Commodity Forecast	$37,430,000	$13,210,000	$6,420,000	$2,190,000	$0
	Net Incremental benefits	$8,060,000	$10,940,000	$4,310,000	$140,000	-$2,020,000
Vessel Availability and Loading	6 - Historical SPX Share of Capacity Calling	$100,000,000	$35,410,000	$17,320,000	$4,470,000	$0
	Net Incremental benefits	$70,630,000	$33,140,000	$15,210,000	$2,420,000	-$2,020,000
	7-Red Future SPX Share of Capacity Call	$96,580,000	$34,510,000	$17,140,000	$4,860,000	$0
	Net Incremental benefits	$67,210,000	$32,240,000	$15,030,000	$2,810,000	-$2,020,000
	8–Incr. Amnt of Sav Cargo Carr on PPX	$102,980,000	$32,020,000	$16,160,000	$4,280,000	$0
	Net Incremental benefits	$73,610,000	$29,750,000	$14,050,000	$2,230,000	-$2,020,000
	9 - Full Deployment of PPX in W/O	$105,920,000	$34,940,000	$17,220,000	$4,680,000	$0
	Net Incremental benefits	$76,550,000	$32,670,000	$15,110,000	$2,630,000	-$2,020,000
	10 - Reduce PPX Vessel Calls by 25%	$81,300,000	$31,660,000	$17,060,000	$5,030,000	$0
	Net Incremental benefits	$51,930,000	$29,390,000	$14,950,000	$2,980,000	-$2,020,000
	11 - Deploy PPX Vessels by Unit Costs	$95,470,000	$32,700,000	$16,680,000	$4,680,000	$0
	Net Incremental benefits	$66,100,000	$30,430,000	$14,570,000	$2,630,000	-$2,020,000
	12 - Incr PPX Load Beyond MPC	$98,210,000	$45,270,000	$28,530,000	$11,070,000	$4,340,000
	Net Incremental benefits	$68,840,000	$43,000,000	$26,420,000	$9,020,000	$2,320,000
	13 - Red PPX1 Repl of PPX2, Hist SPX Share Cap Call and Deploy PPX by Unit S	$132,630,000	$42,850,000	$17,570,000	$5,320,000	$0
	Net Incremental benefits	$103,260,000	$40,580,000	$15,460,000	$3,270,000	-$2,020,000
Other	14 - Increase Cargo Density	$99,750,000	$49,880,000	$35,460,000	$27,530,000	$0
	Net Incremental benefits	$70,380,000	$47,610,000	$33,350,000	$25,480,000	-$2,020,000
	15 - Increase Savannah Share of Trade Route Cargo by 25%	$122,760,000	$43,670,000	$21,530,000	$5,850,000	$0
	Net Incremental benefits	$93,390,000	$41,400,000	$19,420,000	$3,800,000	-$2,020,000
	16 - Decrease Savannah Share of Trade Route Cargo by 25%	$73,660,000	$26,200,000	$12,910,000	$3,510,000	$0
	Net Incremental benefits	$44,290,000	$23,930,000	$10,800,000	$1,460,000	-$2,020,000
	17 - Draft Report Values	$93,010,000	$29,340,000	$12,580,000	$4,220,000	$0
	Net Incremental benefits	$63,640,000	$27,070,000	$10,470,000	$2,170,000	-$2,020,000

6. MEETING AREA AND TIDE DELAY ANALYSES

The purpose of this analysis is to describe the benefits associated with the reduction in transit time required to navigate Savannah Harbor as a result of channel modifications which will reduce congestion within the harbor. The study involves an evaluation of the navigation constraints associated with the harbor. Transportation cost savings were estimated in terms of the reduction in harbor transit times and consequent vessel delays. Transit costs were estimated by analyzing the condition that is most likely to occur in the absence of channel deepening or a meeting area located within Savannah Harbor and comparing those results to the transit times/costs that were derived when including the channel deepening and different meeting area alternatives. The economic benefits were determined using the HarborSym model developed by the IWR.

6.1. HarborSym Model

The IWR developed HarborSym as a planning level, general purpose model to analyze the economic impacts of various waterway modifications within a harbor. HarborSym is a Monte Carlo simulation model of vessel movements at a port for use in economic analyses. While many harbor simulation models focus on landside operations, such as detailed terminal management, HarborSym instead concentrates on specific vessel movements and transit rules on the waterway.

HarborSym represents a port as a tree-structured network of reaches, docks, anchorages, and turning areas. Vessel movements are simulated along the reaches, moving from the bar to one or more docks, and then exiting the port. Features of the model include intra-harbor vessel movements, tidal influence, the ability to model complex shipments, incorporation of turning areas and anchorages, and within-simulation visualization. The driving parameter for the HarborSym model is a vessel call at the port. A HarborSym analysis revolves around the factors that characterize or affect a vessel movement within the harbor.

6.1.1. Inputs

The data required to run HarborSym are separated into six categories:

- Simulation Parameters. Parameters include start date, the duration of the iteration, the number of iterations, the level of detail of the result output, and the wait time before rechecking rule violations when a vessel experiences a delay. These inputs were included in the model runs for the Savannah Harbor Expansion Project. The base year for the model was 2017, due to the 2016 estimated finish date of construction. A model run was performed for each year of the project life in four increments until 2030, at which time the forecast number of TEUs was held constant until the end of the period of analysis. Each model run consisted of 50 iterations. The number of iterations was determined to be sufficient when comparing the average time of the fleet in the system. The following graph illustrates that initially 100 iterations were used; however, variability in system time stabilized with fewer iterations and 50 iterations was determined sufficient for this analysis.

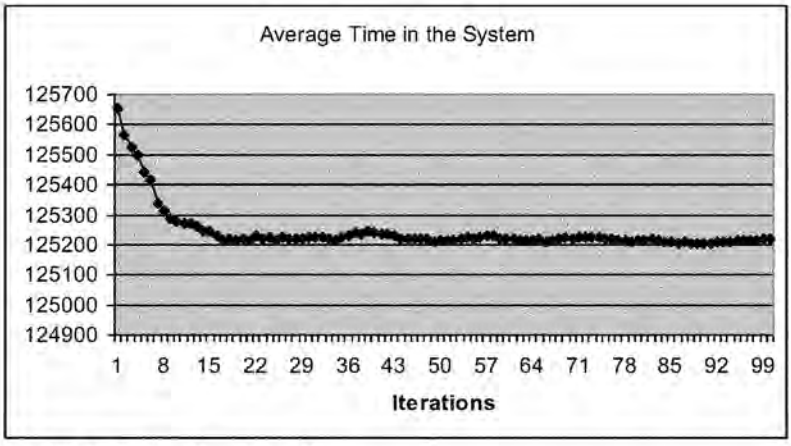


Figure 33: HarborSym Iterations - Hours

- Specific physical and descriptive characteristics of the Savannah Harbor. These data inputs include the specific network of Savannah Harbor such as the node location and type, reach length, width, and depth, in addition to tide and current stations. This also includes information about the docks in the harbor such as length and the maximum number of vessel the dock can accommodate at any given time. Figure 34 displays the Node network used for Savannah Harbor.

- General Information. General information used as inputs to the model include: specific vessel and commodity classes, commodity transfer rates at each dock, specifications of turning area usage at each dock, and specifications of anchorage use within the harbor.

- Vessel speeds. With the assistance of the Savannah Bar Pilots and the Georgia Ports Authority, the speeds at which vessels operate in the harbor, by vessel class both loaded and light loaded, were determined for each channel segment.

- Transit rules for each reach. Vessel transit rules for each reach reflect restrictions on passing, overtaking, and meeting in particular segments of Savannah Harbor, and are used to evaluate delays in the system. Underkeel clearance requirements are also used along with tide to determine if a vessel can enter the system.

- Vessels calls: the vessel call lists are made up of vessel calls forecast for a given year. Each call is given a movement number based on its date and time of entry into the harbor. The vessel call list is imported into HarborSym using an excel spreadsheet.

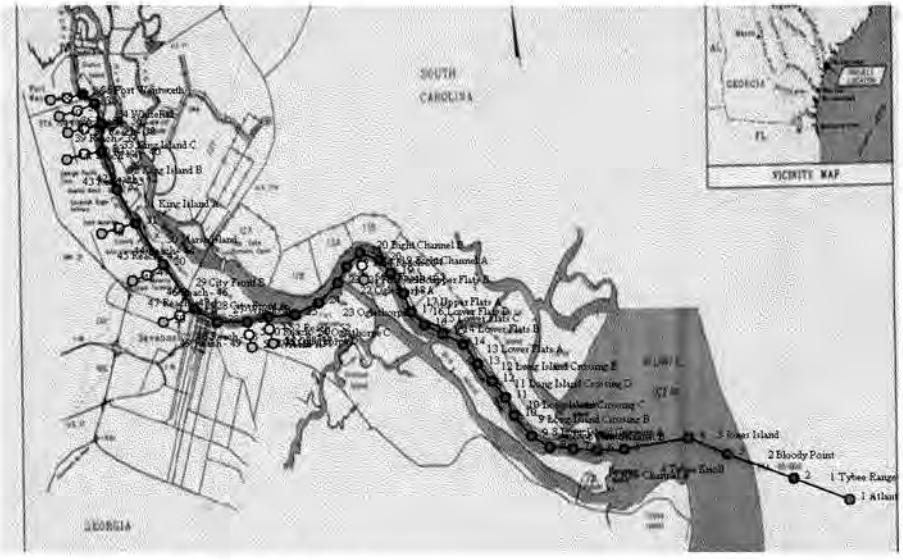


Figure 34: Savannah Harbor Node Network

6.1.2. Outputs

A number of parameters are collected and stored in HarborSym after the model runs are completed. Among these parameters are the number of vessels entering/exiting the harbor, the average time a vessel class spends in the system (hours), the average transit cost of a vessel for each class, the total transit cost of the annual fleet, vessel time and location (e.g., entry, dock, turning basin, etc.) spent waiting in the, vessel times in anchorage areas, vessel times docking and undocking, vessel times loading and unloading, commodity quantities transferred, and total commodity statistics at the port. These outputs are then used to quantify delay reduction benefits.

6.2. Savannah Harbor Expansion Project – Meeting Area Analysis

6.2.1. Meeting Area Alternatives

The need for meeting areas was expressed by the Savannah Harbor Bar Pilots subsequent to preliminary channel design. Meeting areas provide locations for two Post-Panamax vessels to be able to meet in transit to avoid delays that would otherwise be incurred if a vessel had to either wait at the entrance channel or at dock until another Post-Panamax vessel had exited the channel.

The Pilots indicated that they currently "can meet all vessel classes using the harbor now including two Post-Panamax vessels, but that is rare and it would take a significant amount of

coordination". Also, the pilots felt uncertain as to how the Post-Panamax vessels would handle with the increase in channel depth given the narrower bottom configuration of the proposed channel and the increase in vessel draft due to being more fully loaded. Because of these changes in condition, the pilots felt that meeting areas within the harbor were needed to ensure greater flexibility in vessel movement.

During the beginning stages of the SHEP navigation study, the pilots initially suggested the Long Island Range (Station 16+500 to 19+500) as a long straight reach that would be appropriate. During the simulation runs the pilots typically met in the Fort Jackson range using a widened potion of the design channel as a meeting area. As a result, Pilots requested, and the navigation study recommended that the Oglethorpe Range (Station 55+000 to 58+000) be considered as a meeting area being centrally located on a long straight reach.

In a subsequent meeting with the pilots, a need was expressed for a meeting area across from the CITGO dock as pilots experienced delays when vessels are anchored at the CITGO dock. Initial design was a meeting area that ran through Marsh Island Turning Basin (Station 89+134 to 92.000). This area was eventually removed from consideration as attempts to provide more adequate length for a meeting area produced considerable upland taking of real estate.

After the ship simulations were completed the optimum lengths of the meeting areas were determined. For use in HarborSym, the Long Island meeting area was modeled with a length of 8,000 feet and the Oglethorpe meeting area a length of 4,000 feet. Additional details are provided in the following sections.

For the future without-project condition at Savannah Harbor, the current channel configuration was modeled for each potential project depth ranging from 44 to 48 feet in one foot increments. For the meeting area analysis, the current channel alignment is considered to be the existing condition for each channel depth being modeled for the deepening study. Given current channel dimensions (500 foot width), two Post-Panamax vessels are not allowed to meet (pass or overtake) while transiting the harbor. As a result, a Post-Panamax vessel exiting the harbor would cause a transit delay for an arriving Post-Panamax vessel. This would also occur for the reverse scenario. All other vessel classes in the system are allowed to pass/overtake while transiting the harbor with the exception of a loaded Liquid Natural Gas (LNG) vessel. When an LNG vessel enters the system, all other vessels are restrained until it has reached its dock. The purpose of this HarborSym analysis is to determine if the inclusion of a meeting area(s) would decrease time delays associated with Post-Panamax vessels transiting the harbor. For this reason, the HarborSym model was run at each potential depth. The transit times/costs generated were then compared to meeting area alternatives, which consist of two separate meeting area alternatives and a combination of the two.

6.2.1.1. Existing Condition

Savannah Harbor is a major deep water port comprised of 11.4 miles of ocean channel and 21.3 miles of inner harbor channel. The ocean channel is 44 feet deep MLLW and 600 feet wide. The inner harbor channel is 42 feet deep MLLW and 500 feet wide. For each project depth alternative, the current channel alignment was considered the existing condition for that scenario.

6.2.1.2. Long Island Alternative

The Long Island meeting area alternative evaluates an 8,000 foot meeting area located from approximately Station 14 to 22 (Corps of Engineers Annual Survey data 1996). This alternative has 1,000 foot transitions and provides for an additional width of 100 feet, making this channel segment 600 feet wide. This alternative is located closest to the entrance of the Savannah River System. This alternative would expand the width of the channel in this area and allow two Post-Panamax vessels to pass once inside the harbor channel, thus decreasing the voyage time/cost for this vessel class.

6.2.1.3. Oglethorpe Alternative

The Oglethorpe Alternative evaluates a 4,000 foot meeting area located from approximately Station 55 to 59 (Corps of Engineers Annual Survey data). This alternative has 1,000-foot transitions and provides for an additional width of 100 feet. The location is approximately one mile upstream from the Elba Island LNG terminal. This channel modification would expand the width of the channel to 600 feet and would allow for two Post-Panamax vessels to pass once inside the harbor channel, thus decreasing the voyage time/cost for this vessel class.

6.2.1.4. Long Island – Oglethorpe Alternative

The Long Island – Oglethorpe Alternative is the inclusion of both the previously mentioned meeting areas within the Savannah River System. Post-Panamax vessels would be allowed to pass in both locations.

6.2.2. Vessel Call List

For all ports there is a specific fleet that transits the harbor. Once a vessel fleet was determined for Savannah Harbor, specifics about the fleet were included in the model. Each vessel call list contains the following information: arrival date, arrival time, vessel name, entry point, exit point, arrival draft, import/export, dock name, dock order, commodity, units, origin/destination, vessel type, Lloyds Registry, net registered tons, gross registered tons, dead weight tons, capacity, length overall, beam, draft, flag, and tons per inch immersion factor. The call list for the base year and each additional year were compiled in four increments from 2017 to 2030, the point at which the Garden City terminal is anticipated to reach its capacity. The arrival dates and times were developed in excel using the random function. From 2030 till the end of the period of analysis, the fleet remains constant.

6.2.2.1. Container Vessel Fleet

The container fleet used in the with and without project conditions were those used for the deepening study. The fleet and the forecast sailing draft distributions are required data inputs when tide and under keel clearance are factors in traffic movement. The fleet forecasts assume that TEU throughput is increased at the harbor (to 6.5 million TEUs) and that Garden City Terminal capacity will be reached in 2030. For the remainder of the period of analysis, 2030 to 2066, the annual TEUs moved through the Savannah Harbor were held constant. The container fleet averages 16 hours at the dock and the transit time round trip is approximately 6 hours. The

following tables provide the estimated annual number of container vessel calls at each project depth. The number of calls estimated for project depths of 45 through 48 feet are similar, but are shown since they differ slightly. A more detailed description of the forecast container fleet can be found in Section 3.4 of this Economics Appendix.

Table 93: Containerized Vessel Fleet – 44-Foot Depth (2017-2030)

Year	Sub-Panamax	Panamax	PPX1	PPX2
2017	497	1,135	312	239
2020	593	700	478	533
2025	758	992	471	761
2030	947	1,067	672	1,035

Table 94: Containerized Vessel Fleet – 45-Foot Depth (2017-2030)

Year	Sub-Panamax	Panamax	PPX1	PPX2
2017	497	1,109	312	239
2020	593	671	474	527
2025	758	952	467	753
2030	947	1,007	666	1,027

Table 95: Containerized Vessel Fleet – 46-Foot Depth (2017-2030)

Year	Sub-Panamax	Panamax	PPX1	PPX2
2017	497	1,096	312	239
2020	593	658	471	524
2025	758	932	465	749
2030	947	982	662	1,021

Table 96: Containerized Vessel Fleet – 47-Foot Depth (2017-2030)

Year	Sub-Panamax	Panamax	PPX1	PPX2
2017	497	1,092	312	239
2020	593	649	471	524
2025	758	924	462	749
2030	947	975	661	1,018

Table 97: Containerized Vessel Fleet – 48-Foot Depth (2017-2030)

Year	Sub-Panamax	Panamax	PPX1	PPX2
2017	497	1,092	312	239
2020	593	649	471	524
2025	758	924	462	749
2030	947	975	661	1,018

6.2.2.2. Liquid Natural Gas (LNG) Vessel Fleet

Southern LNG, Inc. operates the Elba Island terminal, which is one of only four LNG terminals currently operating in the continental US. Southern has plans to expand its Elba Island LNG terminal located in Savannah, Georgia in order to increase storage and send-out capacity. Southern LNG plans to complete the expansion in two phases. The total project is estimated to

cost approximately $350 million. Phase I of the project will add one 200,000 cubic meter storage tank which will hold 1,250,000 barrels. This phase of expansion was placed in service in July 2010 and will add approximately 4.2 billion cubic feet (Bcf) of LNG storage capacity to the terminal. Maximum send out capacity will be 0.405 Bcf/d. Phase I of the project also includes modifying the north and south docks to accommodate new, larger vessels and to facilitate the simultaneous unloading of two ships.

Phase II of the project will add one 200,000 cubic meter (1,250,000 barrels) storage tank. This tank will add approximately 4.2 Bcf of storage capacity to the terminal in 2012 and increase send out by 0.495 Bcf/d. The liquefied natural gas for the expansion will be transported by ship from gas rich regions outside of the United States. Southern LNG's facilities at Elba Island will vaporize the LNG and inject the natural gas into Southern's existing pipeline.[27]

Due to the channel transit restrictions placed on LNG vessels when entering the harbor, an estimate of the number of annual number of LNG vessel calls is essential. Any LNG vessel entering Savannah Harbor has a safety zone restriction both upstream and downstream. The restriction means that when a LNG vessel is transiting the harbor, for safety purposes, no other vessel is allowed within that distance. For Savannah harbor, the distance is from the Atlantic entrance of the harbor to the Elba Island terminal. While an LNG vessel is transiting the system, all other traffic is restricted until the LNG vessel begins to dock. The total number of LNG vessels evaluated in the HarborSym analysis is shown in Table 98 below.

During the base year, the terminal is anticipated to operate at 60 percent capacity increasing to 80 percent capacity by 2030. The fleet was held constant from 2030 till the end of the period of analysis. Note, at 100 percent capacity, the possible number of calls could reach approximately 200. These vessels take approximately 4 hours round trip to transit the harbor channel and spend on average 24 to 30 hours at the dock, depending on the size of the vessel. Table 98 below displays the annual number of calls forecast each year and the size of each vessel class.

Table 98: LNG Vessel Fleet (bcm) (2017-2030)

Year	Total Vessels	BU SAMRA 266,000 17.4%	AL HUWAILA 217,000 12.7%	MERSK ARWA 165,500 23.9%	LUSAIL 145,000 23.5%	BRITISH TRADER 135,000 22.5%
2017	126	22	16	30	30	28
2020	136	24	17	32	32	30
2025	151	26	19	36	35	34
2030	167	29	21	40	39	37

6.2.2.3. General Cargo Vessel Fleet

The General Cargo vessel class will not benefit from channel modification at Savannah Harbor (i.e., deepening nor the addition of meeting areas); however, determining the annual number of general cargo vessels calling Savannah Harbor was critical for properly assessing harbor congestion. Any vessel not identified as a container or LNG vessel was included in this vessel class.

[27] http://www.elpaso.com/elba3/elba3expansion/project_desc.shtm

Using Waterborne Commerce data provided for the years 2001 through 2008, a growth rate was estimated for forecasting the number of General Cargo vessels. The average annual growth for this period was 3.6 percent. Using Georgia Ports Authority data for 2006, an annual vessel fleet was determined for the base year of the project, 2017, and for four increments until 2030. The forecast was then held constant through the end of the period of analysis. The fleet for each future year was then distributed to the general cargo docks in the same percentages as the 2008 vessel fleet. Table 99 provides the total General Cargo fleet for HarborSym modeling purposes.

Table 99: General Cargo Fleet – Annual Vessel Calls (2017-2030)

Year	Vessels
2017	1,867
2020	2,068
2025	2,468
2030	2,946

6.2.3. Sailing Draft Distribution

Vessel sailing draft distributions are critical for determining the benefits of both the meeting area and tide delay analyses due to channel depth and underkeel requirements. The distribution for the container fleet and the LNG fleet were determined because the transit times and costs for these vessel classes are altered by the inclusion of one or more meeting areas and channel deepening. General Cargo vessel transits are not altered by meeting areas and channel deepening has an insignificant impact due to the low number of vessels that transit the system with a draft greater than 38 feet. Therefore, a detailed sailing draft distribution was not developed for this class vessel, and a range was input at 19 to 35 feet based on empirical data from Waterborne Commerce.

6.2.3.1. Container Vessel Fleet

6.2.3.1.1. Background. For the container vessel fleet, an analysis of observed sailing drafts at various deepwater ports was performed. The data represents that obtained from the pilots at Savannah as well as two of the world's largest container fleet operators. The historical data covers various years and will be identified in the following text.

6.2.3.1.2. Purpose and Scope. The purpose of this analysis was to provide the SHEP empirical evidence to support key assumptions about future sailing drafts to be used in the Meeting Area and Tide Delay evaluations. The analysis identifies observed sailing drafts at port terminals around the world. It also examines the sailing drafts by vessel class and terminal depth. Finally it incorporates specific observations at Savannah Harbor and estimates future sailing drafts by vessel class for alternative project depths. It should be noted that all Sub-Panamax vessels were set to a sailing draft of 34 feet. While there would be a range of sailing drafts for this vessel class, it was determined that the maximum draft for a Sub-Panamax vessel would be 34 feet. Therefore, since the draft of these vessels would not alter the benefits, all vessels were set at that sailing draft.

6.2.3.1.3. ***The Data Set.*** As mentioned, the USACE was provided container vessel operations data from two large companies as well as the harbor pilots at Savannah Harbor. This data was provided by the Georgia Ports Authority and/or its contractor and is considered sensitive. The USACE has agreed that the data will only be used to further the efforts of the SHEP. Specific permission must be obtained from the GPA prior to any additional proposed use.

The dataset from each of the identified sources was divided among vessel classes: Panamax, PPX1, and PPX2. Vessel classes were defined as follows: Panamax – 2,900-5,200 TEUs, PPX1 – 5,200-7,600 TEUs, and PPX2 – greater than 7,600 TEUs. Each vessel class was then analyzed separately. Documentation of the evaluation process follows.

6.2.3.1.3.1. ***Panamax Vessel Class.*** It was assumed that under future without project conditions, Panamax vessels would continue to operate at Savannah as they have historically. Therefore, historical data was summarized and is shown in the following table. Note, Panamax vessels calling on Savannah are assumed to be using tide when those vessels are sailing at drafts greater than 38 feet.

According to harbor pilot data, there were a total of 2,365 Panamax vessel transits at Garden City Terminal in 2006. Of this total, 88% percent (2,093 transits) were sailing drafts of less than or equal to 38 feet. Accordingly, 12 percent of all vessel transits were at sailing drafts greater than 38 feet and were therefore utilizing tide to safely navigate the harbor channel. By 2007, approximately 16 percent of Panamax vessel transits were at sailing drafts requiring tide.

Table 100: Historical and Future Without Project Condition Sailing Draft Distribution – Panamax Vessel Class

	Sailing Draft (feet)								
	<=38	39	40	41	42	43	44	45	Total
Pilots 2006	2,093	97	80	58	36	1	0	0	**2,365**
Pilots 2007	2,287	152	110	78	82	4	0	0	**2,713**
Total	**4,380**	**249**	**190**	**136**	**118**	**5**	**0**	**0**	**5,078**
Percent of Total Transits	86%	5%	4%	3%	2%	0%	0%	0%	**100%**
Cumulative Percentage	**86.3%**	**91.2%**	**94.9%**	**97.6%**	**99.9%**	**100.0%**	**100.0%**	**100.0%**	**100%**

Source: Harbor Pilots Data

Savannah Harbor data from the aforementioned carriers was analyzed for use in estimating future with project condition behavior. This dataset covered calendar year 2008 and the first eight months of 2009. The following table illustrates the results of this analysis. An explanation of how this data was applied to estimate future vessel sailing drafts will be presented in the paragraphs that follow.

Table 101: Carrier Reported Sailing Drafts at Savannah Harbor (2008-2009) – Panamax Vessel Class

	Sailing Draft (feet)								
	<=38	39	40	41	42	43	44	45	Total
Combined Carrier Transits	432	40	35	40	43	2	0	0	**592**
Percent of Total Transits	73%	7%	6%	7%	7%	0%	0%	0%	**100%**
Cumulative Percentage	**73.0%**	**79.7%**	**85.6%**	**92.4%**	**99.7%**	**100.0%**	**100.0%**	**100.0%**	**100%**

Source: Container Fleet Operators

Next, to estimate future with project conditions Panamax vessel class sailing draft distributions, it was assumed that the sailing drafts of Panamax vessels at world and United States ports with channel depths of 45 feet would be the best indicator of the 45-foot future with project conditions at Savannah Harbor. Therefore, data for ports with a terminal depth of 45 feet were extracted from the overall dataset obtained from the aforementioned sources.

The extracted records were for 21 world and U.S. ports and totaled 2,522 calls. The dataset covered all of 2008 and eight months of 2009. Table 102 provides a summary of the data obtained.

Table 102: Carrier Reported Sailing Drafts at World Harbors with 45-Foot Terminal Depth – Panamax Vessel Class

	Sailing Draft (feet)												
	<=38	39	40	41	42	43	44	45	46	47	48	49	Total
Carrier 1	1,413	121	133	108	72	31	13	5	0	0	0	0	**1,896**
Carrier 2	273	101	85	60	55	31	14	5	1	0	1	0	**626**
Total Calls	1,686	222	218	168	127	62	27	10	1	0	1	0	**2,522**
Percent of Total Calls	67%	9%	9%	7%	5%	2%	1%	0%	0%	0%	0%	0%	**100%**
Cumulative Percentage	**66.9%**	**75.7%**	**84.3%**	**91.0%**	**96.0%**	**98.5%**	**99.5%**	**99.9%**	**100.0%**	**100%**	**100%**	**100%**	**100%**

Source: Container Fleet Operators

Next, to estimate future with project condition sailing drafts at Savannah Harbor for the 45-foot channel depth alternative, the estimated cumulative percentage at 45-foot harbors (Table 102) was divided by the carrier estimated cumulative percentage at Savannah under existing conditions (Table 101). The dividend was then multiplied by the existing condition cumulative percentage for all calls (Table 100) to estimate the with project 45-foot cumulative percentage for Savannah Harbor. The following equation illustrates this process as performed for determination of the cumulative percentage for the 38-foot sailing draft (45-foot channel alternative):

$$(66.9\% / 73.0\%) * 86.3\% = 79.0\%$$

This calculation process was then repeated for each sailing draft for the 45-foot channel alternative. The results of this effort are shown in Table 103.

Next, interpolation between the pilot's data for existing conditions and the estimated 45-foot sailing draft was performed to estimate the 44-foot with project condition sailing draft (Table 103). The Panamax class sailing draft distribution for the 45-foot alternative was then held constant and used for the 46, 47 and 48-foot alternatives as the design draft of the Panamax vessel is 44.9 feet (Figure 35).

Table 103: Panamax Vessel Class Sailing Draft Distributions

Project Alternative (feet)	Sailing Draft (feet)												
	<=38	39	40	41	42	43	44	45	46	47	48	49	50
42	86.3%	91.2%	94.9%	97.6%	99.9%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
44	82.6%	88.8%	94.2%	96.8%	98.1%	99.2%	99.8%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
45	79.0%	86.5%	93.4%	96.1%	96.2%	98.5%	99.5%	99.9%	100.0%	100.0%	100.0%	100.0%	100.0%
46	79.0%	86.5%	93.4%	96.1%	96.2%	98.5%	99.5%	99.9%	100.0%	100.0%	100.0%	100.0%	100.0%
47	79.0%	86.5%	93.4%	96.1%	96.2%	98.5%	99.5%	99.9%	100.0%	100.0%	100.0%	100.0%	100.0%
48	79.0%	86.5%	93.4%	96.1%	96.2%	98.5%	99.5%	99.9%	100.0%	100.0%	100.0%	100.0%	100.0%

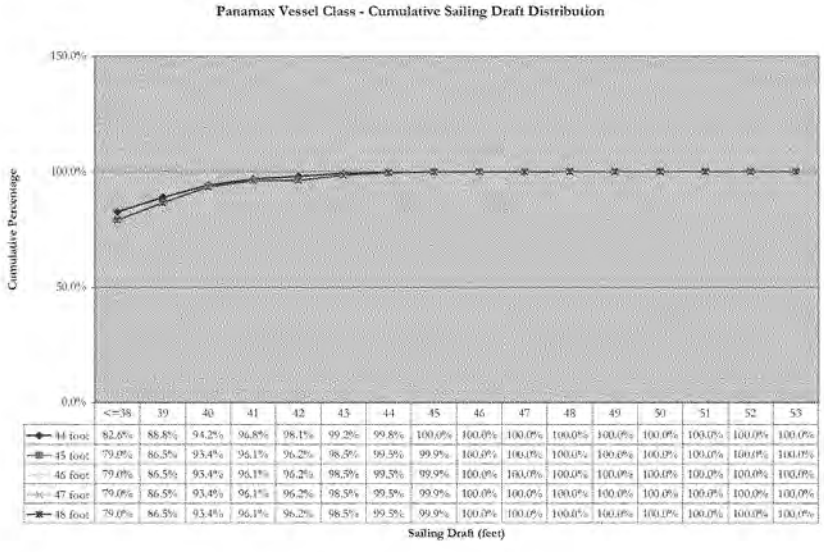


Figure 35: Panamax Vessel Class – Cumulative Sailing Draft Distribution

6.2.3.1.3.2. Post-Panamax Generation 1 Vessel Class. It was assumed that under future without project conditions, PPX1 vessels will continue to operate at Savannah as they have historically. Therefore, historical data was summarized and is shown in the following table. Note, Post-Panamax vessels calling on Savannah are assumed to be using tide when their sailing draft is greater than 37 feet.

According to harbor pilot data, there were a total of 333 Post-Panamax vessel transits at Garden City Terminal during calendar years 2006 and 2007. These calls were on two services, one of which provided 2008 data for use in the analysis that follows. Of the total number of Post-Panamax calls in 2006 and 2007, 64 percent (212 calls) were at sailing drafts less than or equal to 37 feet. Accordingly, 36 percent of all vessel calls were at sailing drafts greater than 37 feet and were therefore utilizing tide to safely navigate the harbor channel.

Table 104: Historical and Future Without Project Condition Sailing Draft Distribution – Generation 1 Post-Panamax Vessel Class

	Sailing Draft (feet)								
	<=37	38	39	40	41	42	43	44	Total
Pilots 2006	88	11	11	9	16	15	0	0	**150**
Pilots 2007	124	15	2	3	10	29	0	0	**183**
Total	212	26	13	12	26	44	**0**	**0**	**333**
Percent of Total Calls	64%	8%	4%	4%	8%	13%	**0%**	**0%**	**100%**
Cumulative Percentage	**64%**	**71%**	**75%**	**79%**	**87%**	**100%**	**100%**	**100%**	**100%**

Source: Harbor Pilot Data

Data from the carrier that provided 2008 and 2009 vessel call data at Savannah was analyzed for use in estimating future with project behavior for those services forecast to utilize PPX1 vessels. The following table illustrates the results of this analysis. An explanation of how this data was applied to estimate future vessel sailing drafts will be presented in the paragraphs that follow.

Table 105: Carrier Reported Sailing Draft Distribution (2008-2009) – Post-Panamax Generation 1 Vessel Class Calls at Savannah

	Sailing Draft (feet)								
	<=37	38	39	40	41	42	43	44	Total
Carrier Calls	35	11	2	2	2	8	0	0	**60**
Percent of Total Calls	58%	18%	3%	3%	3%	13%	0%	0%	**100%**
Cumulative Percentage	**58%**	**77%**	**80%**	**83%**	**87%**	**100%**	**100%**	**100%**	**100%**

Source: Container Fleet Operator

Next, to estimate future with project condition sailing draft distributions for the PPX1 vessel class, it was assumed that the sailing drafts of PPX1 vessels at world and United States ports with channel depths of 45 feet would be the best indicator of the 45-foot future with project conditions at Savannah Harbor. Therefore, data for ports with a terminal depth of 45 feet were extracted from the overall dataset obtained from the aforementioned sources.

The extracted records were for 11 world and U.S. ports and totaled 490 calls. The dataset covered all of 2008 and eight months of 2009. Table 106 provides a summary of the data obtained.

Table 106: Carrier Reported Sailing Drafts at World Harbors with 45-Foot Terminal Depth – PPX1 Vessel Class

	Sailing Draft (feet)													
	<=37	38	39	40	41	42	43	44	45	46	47	48	49	Total
Carrier 1	91	20	24	34	45	51	20	13	15	10	10	1	0	**334**
Carrier 2	17	14	14	13	23	25	21	14	10	5	0	0	0	**156**
Total Calls	108	34	38	47	68	76	41	27	25	15	10	1	0	**490**
Percent of Total Calls	22%	7%	8%	10%	14%	16%	8%	6%	5%	3%	2%	0%	0%	**100%**
Cumulative Percentage	**22%**	**29%**	**37%**	**46%**	**60%**	**76%**	**84%**	**90%**	**95%**	**98%**	**100%**	**100%**	**100%**	**100%**

Source: Container Fleet Operators

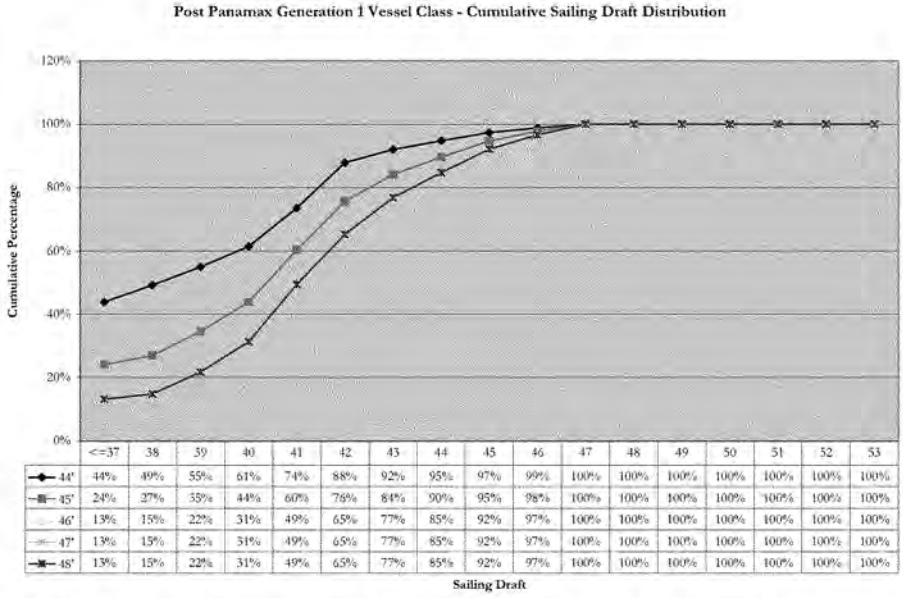
The same methodology utilized to determine the with project condition sailing draft distributions for the Panamax vessel class was then utilized to estimate PPX1 distributions. Table 107 illustrates the results of this effort. Note, to estimate the distribution for the 46-foot alternative, the rate of change between alternate depths (44 and 45 feet) was applied to the 45 foot sailing draft distribution. Following is an example of the calculation process for determining the cumulative percentage for vessels drafting 38 feet under the 46-foot with project condition.

$$(27\% / 49\%) * 27\% = 15\%$$

This calculation was performed for each vessel sailing draft for the 46-foot with project condition. The sailing draft distribution for the 46-foot alternative was then held constant for the 47 and 48-foot alternatives as the design draft of the PPX1 vessel is 46 feet (Figure 36).

Table 107: Post-Panamax Generation 1 Vessel Class – Sailing Draft Distributions

Project Alternative (feet)	Sailing Draft (feet)												
	<=37	38	39	40	41	42	43	44	45	46	47	48	49
42	58%	77%	80%	83%	87%	100%	100%	100%	100%	100%	100%	100%	100%
44	44%	49%	55%	61%	74%	88%	92%	95%	97%	99%	100%	100%	100%
45	24%	27%	35%	44%	60%	76%	84%	90%	95%	98%	100%	100%	100%
46	13%	15%	22%	31%	49%	65%	77%	85%	92%	97%	100%	100%	100%
47	13%	15%	22%	31%	49%	65%	77%	85%	92%	97%	100%	100%	100%
48	13%	15%	22%	31%	49%	65%	77%	85%	92%	97%	100%	100%	100%



	<=37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53
44'	44%	49%	55%	61%	74%	88%	92%	95%	97%	99%	100%	100%	100%	100%	100%	100%	100%
45'	24%	27%	35%	44%	60%	76%	84%	90%	95%	98%	100%	100%	100%	100%	100%	100%	100%
46'	13%	15%	22%	31%	49%	65%	77%	85%	92%	97%	100%	100%	100%	100%	100%	100%	100%
47'	13%	15%	22%	31%	49%	65%	77%	85%	92%	97%	100%	100%	100%	100%	100%	100%	100%
48'	13%	15%	22%	31%	49%	65%	77%	85%	92%	97%	100%	100%	100%	100%	100%	100%	100%

Figure 36: Post-Panamax Generation 1 Vessel Class–Cumulative Sailing Draft Distribution

6.2.3.1.3.3. Post-Panamax Generation 2 Vessel Class. Due to channel depth limitations, PPX2 vessels have not called on the Savannah Harbor. Under future without project conditions, it is assumed that these vessels will not be utilized on services that call on Savannah.

Since PPX2 vessels have not called on Savannah, there is no historical information from the harbor upon which to estimate future sailing drafts. Accordingly, to estimate the sailing draft distribution for the 44-foot channel alternative, the 44-foot alternative distribution for PPX1 vessels was multiplied by a factor of .97, which represents the difference in maximum practical loading of the PPX1 and PPX2 vessels on those routes which deploy PPX2 vessels under 44-foot with project conditions (i.e., FE ECUS PEN, FE ECUS MED PEN, and FE ECUS EU PEN). The following equation illustrates this process for a PPX2 vessel sailing at 37 feet:

$$44\% * .97 = 43\%$$

Next, the same calculation process was used to estimate the sailing draft distribution for the 45-foot channel depth alternative. This time, the factor used was .968, which represents the difference in the loading of PPX1 and PPX2 vessels being deployed under 45-foot with project conditions (i.e., FE SUEZ ECUS PEN). Again, the following equation illustrates this process for a PPX2 vessel sailing at 37 feet:

$$24\% * .968 = 23\%$$

The same process was then used to estimate the sailing draft distribution for the 46-foot channel. For this channel depth alternative a factor of .968 was used, representing deployment on the RTW, ECUS EU GULF PEN and ECUS MED services (PPX2 vessel sailing at 37-feet (46-foot project), 13% * .968 = 13%).

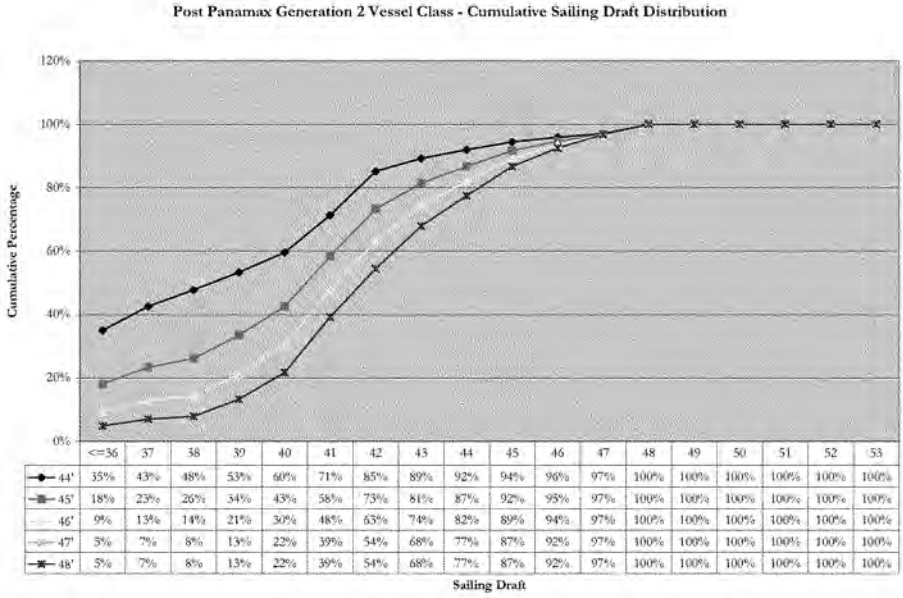
Since, the design draft of the PPX1 vessel is 46 feet, the sailing draft distribution for the 46-foot alternative with project condition was held constant for the 47 and 48-foot alternatives. Therefore, it was not possible to utilize the methodology described for estimating the 47-foot with project condition PPX2 sailing draft distribution as the sailing draft distribution would be the same as that for the PPX2 46-foot alternative. Accordingly, to estimate the PPX2 47-foot with project condition sailing draft distribution, extrapolation was performed. The following equation illustrates this process for a PPX2 vessel sailing at 37 feet (47-foot alternative):

$$(13\% / 23\%) * 13\% = 7\%$$

Since the PPX2 vessel has a design draft of 47.6 feet, the 47-foot sailing draft distribution was then held constant and utilized for the 48-foot with project conditions (Figure 37). The results of these calculations are shown in Table 108.

Table 108: Post-Panamax Generation 2 Vessel Class – Sailing Draft Distributions

Project Alternative (feet)	Sailing Draft (feet)												
	<=37	38	39	40	41	42	43	44	45	46	47	48	49
42	*PPX2 vessels will not call on the Savannah Harbor under without project conditions*												
44	43%	48%	53%	60%	71%	85%	89%	92%	94%	96%	97%	100%	100%
45	23%	26%	34%	43%	58%	73%	81%	87%	92%	95%	97%	100%	100%
46	13%	14%	21%	30%	48%	63%	74%	82%	89%	94%	97%	100%	100%
47	7%	8%	13%	22%	39%	54%	68%	77%	87%	92%	97%	100%	100%
48	7%	8%	13%	22%	39%	54%	68%	77%	87%	92%	97%	100%	100%



	<=36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53
44'	35%	43%	48%	53%	60%	71%	85%	89%	92%	94%	96%	97%	100%	100%	100%	100%	100%	100%
45'	18%	23%	26%	34%	43%	58%	73%	81%	87%	92%	95%	97%	100%	100%	100%	100%	100%	100%
46'	9%	13%	14%	21%	30%	48%	63%	74%	82%	89%	94%	97%	100%	100%	100%	100%	100%	100%
47'	5%	7%	8%	13%	22%	39%	54%	68%	77%	87%	92%	97%	100%	100%	100%	100%	100%	100%
48'	5%	7%	8%	13%	22%	39%	54%	68%	77%	87%	92%	97%	100%	100%	100%	100%	100%	100%

Figure 37: Post-Panamax Generation 2 Vessel Class–Cumulative Sailing Draft Distribution

6.2.3.1.4. Underkeel Clearance Requirement. The Underkeel clearance requirements were provided by IWR with the assistance of the Savannah Harbor Bar Pilots. The clearance required depends on the vessel class. The following table provides the underkeel clearance that was input into HarborSym. The sailing draft, underkeel requirement, and tide data determine when the model will allow a vessel to enter into the system.

Table 109: Underkeel Clearance Requirement

Vessel Class	Clearance Requirement (Feet)
Sub-Panamax	3.75
Panamax	4.00
Post-Panamax Generation 1	4.20
Post-Panamax Generation 2	4.30

6.2.3.2. Liquid Natural Gas (LNG) Vessel Fleet

After discussion with the bar pilots and examining empirical data, it was determined that the sailing draft of most LNG vessel range between 38 and 40 feet. However, for reasons that include both safety and maneuverability, the pilots do not transit a LNG vessel until the tide window is available for the vessel to arrive at the dock at high slack tide. Therefore, for modeling purposes, all LNG class vessels were input with a 40 foot sailing draft allowing for one

underkeel clearance to be input into the model. This was done for simplicity since regardless of sailing draft, LNG vessels entering Savannah Harbor will wait for high slack tide. The sailing draft, underkeel clearance, tide gauge, vessel speed, and distance to the dock ensure that the model accurately simulates the current operations within the Harbor.

6.2.4. Vessel Operating Costs

According to ER1105-2-100 vessel operating costs for navigation studies are provided by HQUSACE on an annual basis. Vessel operating costs were evaluated only for the vessel classes that are anticipated to be impacted by the inclusion of meeting areas into the system or an increase in channel depth. Those classes are the Panamax and Post-Panamax vessels for the container fleet and LNG vessels. While the LNG vessels do not use the meeting areas, due to the safety zone requirement they are impacted by the number of container vessels in the system at a given time.

6.2.4.1. Container Vessel Fleet

For the purposes of the meeting area analysis, hourly operating costs for Foreign Container Class vessels were obtained from IWR. The hourly costs presented in the table below are the latest estimates.

Table 110: Hourly Vessel Operating Costs Foreign Container Vessel Classes

Deadweight Tonnage (DWT: Metric Tonnes)			40,300	42,800	46,400	55,600	65,000	70,500	80,700	103,000
TEU			2,800	3,000	3,500	4,000	4,800	6,000	6,500	8,000
	At Sea									
	Propulsion/Prime Movers & Auxiliary Power Generation									
		Service Speed	$1,684	$1,692	$1,891	$2,170	$2,452	$3,392	$3,684	$3,954
		Economic Speed	$1,445	$1,456	$1,617	$1,842	$2,078	$2,815	$3,062	$3,310
		Half-Power	$1,190	$1,206	$1,323	$1,488	$1,673	$2,177	$2,369	$2,598
		Base Idle	$878	$899	$964	$1,059	$1,183	$1,416	$1,547	$1,749
	In Port									
	Propulsion/Prime Movers & Auxiliary Power Generation									
		Within Harbor/Channel	$1,175	$1,191	$1,305	$1,467	$1,649	$2,139	$2,329	$2,556
		Maneuvering	$1,023	$1,041	$1,130	$1,258	$1,411	$1,772	$1,932	$2,147
		Base Idle	$840	$859	$923	$1,014	$1,135	$1,363	$1,494	$1,690
		Dockside/Static Condition	$643	$664	$696	$743	$827	$886	$979	$1,158

The hourly operating costs were then developed for the container fleet forecast to call on Savannah Harbor. Since not all of the classes forecast appear in the table above, the values were interpolated by dead weight tonnage to obtain hourly costs for the Savannah fleet. While HarborSym has one input for "At Sea" and one for "At Dock," it was determined that "At Sea" costs provided by IWR would inflate benefits since within the harbor system a vessel would not be operating at the same speed/cost as in open water. Therefore, both inputs were derived from "In Port" costs. For "At Sea," the value for "Within Harbor/Channel" was used. For "At Dock," an average of the "Base Idle" and the "Dockside/Static Condition" hourly cost was input. Table 111 displays the hourly operating cost used in the HarborSym model for the meeting area analysis for the container fleet.

Table 111: Container Fleet DWT

Vessel Class	Deadweight Tonnage	Within Harbor/ Channel	Base Idle
Panamax	65,000	$ 1,649	$ 981
PPX1	74,100	$ 2,206	$ 1,164
PPX2	86,100	$ 2,384	$ 1,282

6.2.4.2. Liquid Natural Gas (LNG) Vessel Fleet

Currently, the Corps of Engineers does not have published values to use for vessel operating costs for LNG class vessels. Therefore, data provided by the New England District, which was developed with the assistance of IWR, was used in order to determine vessel operating costs. These costs provided were for four different LNG vessel classes. The following table provides this data.

Table 112: LNG Vessel Operating Costs

		Hourly Total Cost At Sea	Hourly Total Cost At Port
125,000	cubic meters	$2,024	$1,492
1,081,000	barrels		
113,194	short tons		
102,689	metric tonnes		
145,000	cubic meters	$2,147	$1,575
1,254,000	barrels		
131,309	short tons		
119,123	metric tonnes		
177,000	cubic meters	$2,349	$1,715
1,531,000	barrels		
160,314	short tons		
145,436	metric tonnes		
200,000	cubic meters	$2,502	$1,824
1,730,000	barrels		
181,152	short tons		
164,340	metric tonnes		

7.

The data provided by the New England District was then interpolated to provide hourly operating costs for the forecast LNG vessel fleet. The operating costs for vessel classes not within the range of the data provided were obtained using a trendline. The table below shows the values developed.

Table 113: LNG Vessel Operating Cost

Bcm	At Sea	At Dock
135,000	$ 2,085	$ 1,533
145,000	$ 2,146	$ 1,575
165,000	$ 2,272	$ 1,661
217,000	$ 2,617	$ 1,908
266,000	$ 2,967	$ 2,168

The values shown above were input into HarborSym model to determine the impact of the inclusion of meeting areas on LNG class vessels.

6.2.5. Meeting Area Analysis – HarborSym Results

The HarborSym model was used for the economic analysis to compare the without project condition (channel deepened but no meeting area) to the with project alternatives (Long Island, Oglethorpe, Long Island/Oglethorpe combination) over a 50 year period of analysis. The model simulates the without project condition based upon the parameters that are currently maintained in the harbor. The existing rules and their parameters were entered into HarborSym to allow for an accurate representation of the current situation of the harbor. The future parameters of the harbor system were used to represent channel conditions both under the with and without project condition meeting area scenarios. The with project conditions illustrate the channel system if one of the three meeting area alternatives is implemented. Benefits associated with the meeting area for Savannah Harbor were evaluated based upon expanding the channel width of separate reaches, which would allow for alleviation of transit rules affecting the Post-Panamax vessels calling on the harbor. Benefits are based upon a decrease in transit times/costs for each meeting area alternative. The alleviation of transit rules under each proposed depths with project condition was compared to the meeting area without project condition (no channel modification at each proposed depth).

6.2.5.1. Meeting Area - HarborSym Results – Vessel Transit Costs

The HarborSym model was run for each of the three meeting area alternatives and the existing condition for each proposed project depth for the following years: 2017, 2020, 2025, and 2030. Each model run consisted of 50 iterations of a full year, beginning January 1st, 12:00 AM of each year. The average transit cost for the existing condition of each Panamax, Post-Panamax (Generation 1 and 2), and LNG vessel was determined and compared to the average transit cost in the system for each meeting area alternative. Since all other inputs remain the same (Speed in Reach, Docking/Undocking Times, Loading Rates, etc…) benefits are calculated using the reduction in the average transit cost for each of the affected vessel classes and the annual number of calls for each class. The following tables present the average cost for each affected vessel class for the 47 foot project depth. The 47 foot project results are given because due to the deepening benefits, this project depth is the current NED plan. The benefits for the 44, 45, 46, and 48 foot depths were calculated using the same methodology.

Table 114: 47-Foot Channel Depth - 2017

2017	Existing Condition	Long Island	Oglethorpe	Long Island/Oglethorpe
135 LNG	$ 61,638	$ 61,682	$ 61,704	$ 61,777
145 LNG	$ 63,803	$ 63,918	$ 63,863	$ 63,928
165 LNG	$ 77,501	$ 77,552	$ 77,475	$ 77,522
217 LNG	$ 87,707	$ 87,618	$ 87,637	$ 87,631
266 LNG	$ 100,783	$ 100,892	$ 100,861	$ 100,970
Panamax	$ 23,829	$ 23,829	$ 23,829	$ 23,829
PPX1	$ 30,995	$ 30,907	$ 30,906	$ 30,842
PPX 2	$ 34,458	$ 34,372	$ 34,369	$ 34,306
2017	**Total Calls**	**Long Island**	**Oglethorpe**	**Long Island/Oglethorpe**
135 LNG	27	$ (1,187)	$ (1,787)	$ (3,754)
145 LNG	28	$ (3,232)	$ (1,686)	$ (3,507)
165 LNG	29	$ (1,482)	$ 742	$ (614)
217 LNG	15	$ 1,323	$ 1,044	$ 1,131
266 LNG	21	$ (2,278)	$ (1,643)	$ (3,924)
Panamax	1186	$ 166	$ 56	$ 368
PPX1	247	$ 21,737	$ 22,004	$ 37,744
PPX 2	201	$ 17,291	$ 18,018	$ 30,682
		$ 32,338	$ 36,748	$ 58,126

Table 115: 47-Foot Channel Depth – 2020

2020	Existing Condition	Long Island	Oglethorpe	Long Island/Oglethorpe
135 LNG	$ 62,957	$ 63,071	$ 63,211	$ 63,190
145 LNG	$ 66,239	$ 66,326	$ 66,502	$ 66,578
165 LNG	$ 77,440	$ 77,547	$ 77,652	$ 77,702
217 LNG	$ 89,709	$ 89,786	$ 89,970	$ 90,204
266 LNG	$ 102,375	$ 102,546	$ 102,692	$ 102,817
Panamax	$ 23,826	$ 23,824	$ 23,823	$ 23,821
PPX1	$ 31,474	$ 31,294	$ 31,293	$ 31,159
PPX 2	$ 35,131	$ 34,932	$ 34,924	$ 34,776
2020	**Total Calls**	**Long Island**	**Oglethorpe**	**Long Island/Oglethorpe**
135 LNG	30	$ (3,422)	$ (7,627)	$ (7,006)
145 LNG	32	$ (2,788)	$ (8,407)	$ (10,857)
165 LNG	32	$ (3,443)	$ (6,813)	$ (8,409)
217 LNG	17	$ (1,313)	$ (4,440)	$ (8,428)
266 LNG	24	$ (4,116)	$ (7,606)	$ (10,615)
Panamax	649	$ 1,397	$ 2,026	$ 2,922
PPX1	471	$ 84,921	$ 85,083	$ 148,270
PPX 2	524	$ 103,934	$ 108,334	$ 185,963
		$ 175,170	$ 160,550	$ 291,839

Table 116: 47-Foot Channel Depth – 2025

2025	Existing Condition	Long Island	Oglethorpe	Long Island/Oglethorpe
135 LNG	$ 67,653	$ 67,638	$ 67,995	$ 67,865
145 LNG	$ 69,561	$ 69,708	$ 69,727	$ 69,850
165 LNG	$ 82,744	$ 83,168	$ 83,155	$ 83,524
217 LNG	$ 97,484	$ 97,929	$ 98,264	$ 98,451
266 LNG	$ 108,815	$ 108,984	$ 109,184	$ 109,359
Panamax	$ 24,026	$ 24,017	$ 24,017	$ 24,008
PPX1	$ 32,158	$ 31,915	$ 31,935	$ 31,713
PPX 2	$ 35,757	$ 35,521	$ 35,502	$ 35,307
2025	**Total Calls**	**Long Island**	**Oglethorpe**	**Long Island/Oglethorpe**
135 LNG	34	$ 508	$ (11,627)	$ (7,216)
145 LNG	35	$ (5,126)	$ (5,800)	$ (10,098)
165 LNG	36	$ (15,265)	$ (14,801)	$ (28,082)
217 LNG	19	$ (8,457)	$ (14,822)	$ (18,371)
266 LNG	26	$ (4,411)	$ (9,601)	$ (14,165)
Panamax	924	$ 8,139	$ 9,052	$ 16,651
PPX1	462	$ 112,135	$ 102,995	$ 205,543
PPX 2	749	$ 177,010	$ 191,336	$ 337,201
		$ 264,532	$ 246,730	$ 481,464

Table 117: 47-Foot Channel Depth - 2030

2030	Existing Condition	Long Island	Oglethorpe	Long Island/Oglethorpe
135 LNG	$ 70,511	$ 70,291	$ 71,465	$ 70,770
145 LNG	$ 71,805	$ 72,042	$ 72,045	$ 71,908
165 LNG	$ 75,877	$ 76,165	$ 76,258	$ 76,437
217 LNG	$ 97,995	$ 98,571	$ 98,382	$ 98,903
266 LNG	$ 110,426	$ 110,137	$ 110,911	$ 110,593
Panamax	$ 24,831	$ 24,793	$ 24,796	$ 24,768
PPX1	$ 34,258	$ 33,896	$ 33,883	$ 33,690
PPX 2	$ 37,991	$ 37,626	$ 37,663	$ 37,373
2030	**Total Calls**	**Long Island**	**Oglethorpe**	**Long Island/Oglethorpe**
135 LNG	37	$ 8,132	$ (35,301)	$ (9,556)
145 LNG	39	$ (9,245)	$ (9,342)	$ (4,002)
165 LNG	40	$ (11,521)	$ (15,212)	$ (22,393)
217 LNG	21	$ (12,097)	$ (8,110)	$ (19,069)
266 LNG	29	$ 8,389	$ (14,073)	$ (4,856)
Panamax	975	$ 37,055	$ 34,396	$ 61,664
PPX1	661	$ 239,010	$ 247,565	$ 375,249
PPX 2	1018	$ 371,593	$ 333,581	$ 628,742
		$ 631,316	$ 533,504	$ 1,005,779

6.2.5.2. Meeting Area - Annual Benefits

Using the output data for transit costs provided by HarborSym (Displayed in Table 114 through Table 117), annual benefits was determined for each meeting area alternative at each project depth. The values provided for the model run years were then interpolated to attain benefits for the years between, remaining constant after 2030 when TEU capacity is forecasted to be reached. The benefits stated are in FY11 dollars and are provided in Table 118. As stated previously, the calculation for the 44, 45, 46, and 48 foot depths use the same methodology. All spreadsheet calculations were provided to the Deep Draft Center of Expertise for review. The approved for use white paper is provided as an attachment to this Economics Appendix (Attachment 3).[28]

Table 118: Annual Benefits - 47-Foot Channel Depth

Annual Benefits			
Year	Long Island	Oglethorpe	Long Island/Oglethorpe
2017	$89,471	$86,269	$151,611
2018	$118,037	$111,029	$198,354
2019	$146,603	$135,790	$245,097
2020	$175,170	$160,550	$291,839
2021	$193,042	$177,786	$329,764
2022	$210,915	$195,022	$367,689
2023	$228,787	$212,258	$405,614
2024	$246,660	$229,494	$443,539
2025	$264,532	$246,730	$481,464
2026	$337,889	$304,085	$586,327
2027	$411,246	$361,440	$691,190
2028	$484,602	$418,795	$796,053
2029	$557,959	$476,149	$900,916
2030	$631,316	$533,504	$1,005,779

6.2.5.3. Average Annual Benefits – Meeting Area

Average annual benefits were developed using the annual benefits from the proposed meeting area alternatives, the Federal Discount Rate for FY11 of 4.125%, and a 50 year period of analysis. Table 119 displays the average annual benefits, rounded to the nearest thousand, for each meeting area alternative at each project depth.

[28] The approved for use white paper will be developed during the review process. A copy of the document will be included in the final report.

Table 119: Average Annual Benefits

Average Annual Benefits			
Project Depth	**Long Island**	**Oglethorpe**	**Long Island/Oglethorpe**
44-Foot Depth	$400,000	$385,000	$717,000
45-Foot Depth	$401,000	$387,000	$722,000
46-Foot Depth	$407,000	$393,000	$731,000
47-Foot Depth	$450,000	$387,000	$730,000
48-Foot Depth	$424,000	$373,000	$723,000

6.2.5.4. Meeting Area - Average Annual Costs

The cost to construct each meeting area was determined for each potential project depth. The following table displays the estimated cost to construct each meeting area, along with the total cost to construct both. These costs are provided at the October 10 price level.

Table 120: Construction Cost - Meeting Areas

Project Depth	Long Island	Oglethorpe	Long Island/Oglethorpe
44-Foot Depth	$2,957,000	$4,146,000	$7,103,000$
45-Foot Depth	$3,127,000	$4,262,000	$7,389,000$
46-Foot Depth	$3,238,000	$4,318,000	$7,556,000$
47-Foot Depth	$3,465,000	$4,505,000	$7,970,000$
48-Foot Depth	$3,690,000	$4,687,000	$8,377,000$

Average annual costs were developed using the construction cost provided in the previous table for the proposed meeting area alternatives, the Federal Discount Rate for FY11 of 4.125%, and a 50 year period of analysis. Operations and Maintenance was considered negligible. This is due to the harbor being in equilibrium, meaning that there will be no increase in the amount of dredged material within the harbor due to the deepening. The following table displays the average annual costs, rounded to the nearest ten thousand, for each meeting area alternative at each project depth.

Table 121: Average Annual Cost - Meeting Areas

Project Depth	Long Island	Oglethorpe	Long Island/Oglethorpe
44-Foot Depth	$135,000	$189,000	$324,000
45-Foot Depth	$143,000	$195,000	$337,000
46-Foot Depth	$148,000	$197,000	$345,000
47-Foot Depth	$158,000	$206,000	$364,000
48-Foot Depth	$169,000	$214,000	$383,000

7.1.1.1. Benefit Cost Ratio – Meeting Areas

The average annual benefits and costs for the meeting areas were evaluated in order to determine that the meeting areas were incrementally justified and that the NED deepening plan includes the meeting area alternative that maximizes net benefits. As displayed in Table 122 the meeting area alternative that maximizes net benefits at each proposed project depth is the combination of both meeting areas.

Table 122: Benefit Cost Ratio - Meeting Areas

Long Island				
	AAB	AAC	Net Benefits	BC Ratio
44-foot Project Depth	$400,000	$135,000	$ 265,000	2.96
45-foot Project Depth	$401,000	$143,000	$ 258,000	2.80
46-foot Project Depth	$407,000	$148,000	$ 259,000	2.75
47-foot Project Depth	$450,000	$158,000	$ 292,000	2.85
48-foot Project Depth	$424,000	$169,000	$ 255,000	2.51
Oglethorpe				
	AAB	AAC	Net Benefits	BC Ratio
44-foot Project Depth	$385,000	$189,000	$ 196,000	2.04
45-foot Project Depth	$387,000	$195,000	$ 192,000	1.98
46-foot Project Depth	$393,000	$197,000	$ 196,000	1.99
47-foot Project Depth	$387,000	$206,000	$ 181,000	1.88
48-foot Project Depth	$373,000	$214,000	$ 159,000	1.74
Long Island/Oglethorpe				
	AAB	AAC	Net Benefits	BC Ratio
44-foot Project Depth	$717,000	$324,000	$ 393,000	2.21
45-foot Project Depth	$722,000	$337,000	$ 385,000	2.14
46-foot Project Depth	$731,000	$345,000	$ 386,000	2.12
47-foot Project Depth	$730,000	$364,000	$ 366,000	2.01
48-foot Project Depth	$723,000	$383,000	$ 340,000	1.89

6.3. Savannah Harbor Expansion Project – Tide Delay Analysis

Tide benefits were estimated as the reduction in the average tide delay cost of a vessel class and calculated by comparing the existing condition of 42 feet with the alternative project depths (44, 45, 46, 47, and 48 feet). Currently, due to underkeel requirements and vessel sailing drafts, there is a portion of the annual fleet that cannot transit the Savannah Harbor River System without the assistance of a tide that essentially increases the channel depth. With additional channel depth, the transit restrictions are decreased allowing the vessel to call on the harbor with fewer delays. The tide delay benefit analysis was performed by evaluating the anticipated vessel fleet at each proposed project depth and the projected sailing draft distribution at that depth. Benefits were derived by calculating the difference in the average vessel transit costs for each impacted vessel class for the anticipated 44 foot channel depth vessel fleet calling on the harbor with the channel depths set to 42 feet for the initial runs, and then a second set of runs with the channel depth set to 44 feet to find the reduction in the average transit costs. For each additional foot of depth, the

model runs were set up in the same manner. A 43 foot project was not evaluated since 43 foot was not an alternative evaluated for deepening benefits.
Table 123 displays this methodology.

Table 123: Tide Delay Methodology

Anticipated Vessel Fleet	Channel Depth – Model Run	
	Initial Run	Second Run
44-Foot Fleet	42-Foot	44-Foot
45-Foot Fleet	44-Foot	45-Foot
46-Foot Fleet	45-Foot	46-Foot
47-Foot Fleet	46-Foot	47-Foot
48-Foot Fleet	47-Foot	48-Foot

6.3.1. HarborSym Analysis – Tide Delay

The HarborSym model was used to calculate the tide delay benefits, or the reduction in tide delay times, for each channel deepening alternative. Meeting Areas were not included in the model runs to ensure that the benefits generated were due to additional depth only. The existing vessel operating rules and associated parameters were entered into HarborSym to allow for an accurate representation of existing harbor conditions. The anticipated future vessel operating rules and associated parameters of the harbor system were entered to represent channel conditions both under the with and without project condition channel deepening scenarios. The with project conditions illustrate the harbor system if the channel depth entered into the model was the same channel depth as the forecasted fleet mix at that depth (i.e. 44 foot vessel fleet call list, 44 foot channel depth). The without project condition assumes that the anticipated fleet mix has one foot less channel depth (two feet to compare 42 and 44) than is associated with the forecasted vessel fleet as described in the previous section (i.e. 44 foot vessel call list, 42 foot channel depth). Benefits calculated as the reduction in tide related delays were based upon the assumption that with each channel deepening alternative, opportunities for vessels to safely transit the channel would increase as vessels would not be as dependent on tide for movement.

6.3.2. Vessel Transit Costs – Tide Delay

The HarborSym model was run for each of the five channel depth alternatives and the 42 foot project depth for the following years: 2017, 2020, 2025, and 2030. Each model run consisted of 50 iterations of a full year, beginning January 1st, 12:00 AM of that year. The average transit cost for the initial scenario run of each Panamax, Post-Panamax (Generation 1 and 2), and LNG vessel was determined and compared to the average transit cost in the system when an additional one foot of depth was added. Since all other inputs remain the same (Speed in Reach, Docking/Undocking Times, Loading Rates, etc…) benefits are calculated using the reduction in the average transit cost for each of the affected vessel. The vessel operating costs methodology is the same as that used in the meeting area analysis. The following tables present the average cost for each affected vessel class for each channel depth alternative. The 46 and 47-foot project alternative results are displayed. The 44, 45, and 48 foot alternatives use the same methodology and have been reviewed by the Deep Draft Center of Expertise for accuracy.

Table 124: 46-Foot Fleet, 45 to 46-Foot Depth - 2017

46-Foot Vessel Fleet		
2017	**45-Foot Depth**	**46-Foot Depth**
135 LNG	$ 62,226	$ 62,173
145 LNG	$ 63,839	$ 63,745
165 LNG	$ 77,803	$ 78,110
217 LNG	$ 88,136	$ 87,972
266 LNG	$ 101,075	$ 101,047
Panamax	$ 23,953	$ 23,899
PPX1	$ 32,356	$ 31,672
PPX2	$ 35,291	$ 34,792
2017	**Total Calls**	**Benefits**
135 LNG	27	$ 1,447
145 LNG	28	$ 2,647
165 LNG	29	$ (8,914)
217 LNG	15	$ 2,468
266 LNG	21	$ 577
Panamax	1190	$ 64,379
PPX1	247	$ 168,965
PPX2	201	$ 100,346
		$ 331,915

Table 125: 46-Foot Fleet, 45 to 46-Foot Depth - 2020

46-Foot Vessel Fleet		
2020	**45-Foot Depth**	**46-Foot Depth**
135 LNG	$ 62,978	$ 63,252
145 LNG	$ 66,016	$ 66,488
165 LNG	$ 77,464	$ 77,395
217 LNG	$ 89,984	$ 90,478
266 LNG	$ 102,752	$ 102,554
Panamax	$ 23,939	$ 23,890
PPX1	$ 32,838	$ 32,143
PPX2	$ 36,003	$ 35,441
2020	**Total Calls**	**Benefits**
135 LNG	30	$ (8,224)
145 LNG	32	$ (15,100)
165 LNG	32	$ 2,205
217 LNG	17	$ (8,390)
266 LNG	24	$ 4,754
Panamax	658	$ 31,921
PPX1	471	$ 327,621
PPX2	524	$ 294,421
		$ 629,208

Table 126: 46-Foot Fleet, 45 to 46-Foot Depth - 2025

46-Foot Vessel Fleet		
2025	**45-Foot Depth**	**46-Foot Depth**
135 LNG	$ 67,510	$ 67,840
145 LNG	$ 69,094	$ 69,268
165 LNG	$ 82,789	$ 83,264
217 LNG	$ 96,382	$ 96,115
266 LNG	$ 107,843	$ 108,038
Panamax	$ 24,134	$ 24,097
PPX1	$ 33,451	$ 32,750
PPX2	$ 36,661	$ 35,993
2025	**Total Calls**	**Benefits**
135 LNG	34	$ (11,228)
145 LNG	35	$ (6,112)
165 LNG	36	$ (17,091)
217 LNG	19	$ 5,072
266 LNG	26	$ (5,070)
Panamax	932	$ 34,750
PPX1	465	$ 326,055
PPX2	749	$ 500,678
		$ 827,053

Table 127: 46-Foot Fleet, 45 to 46-Foot Depth – 2030

46-Foot Vessel Fleet		
2030	**45-Foot Depth**	**46-Foot Depth**
135 LNG	$ 71,107	$ 71,606
145 LNG	$ 71,346	$ 72,016
165 LNG	$ 75,298	$ 75,589
217 LNG	$ 98,106	$ 98,378
266 LNG	$ 110,661	$ 110,836
Panamax	$ 24,827	$ 24,801
PPX1	$ 35,411	$ 34,866
PPX2	$ 38,678	$ 38,152
2030	**Total Calls**	**Benefits**
135 LNG	37	$ (18,466)
145 LNG	39	$ (26,137)
165 LNG	40	$ (11,654)
217 LNG	21	$ (5,697)
266 LNG	29	$ (5,068)
Panamax	982	$ 25,956
PPX1	662	$ 360,952
PPX2	1021	$ 537,282
		$ 857,168

Table 128: 47-Foot Fleet, 46 to 47-Foot Depth – 2017

47-Foot Vessel Fleet		
2017	**46-Foot Depth**	**47-Foot Depth**
135 LNG	$ 61,836	$ 62,127
145 LNG	$ 63,904	$ 64,326
165 LNG	$ 77,662	$ 77,877
217 LNG	$ 88,215	$ 88,384
266 LNG	$ 101,018	$ 101,614
Panamax	$ 23,920	$ 23,895
PPX1	$ 31,648	$ 31,127
PPX2	$ 35,170	$ 34,611
2017	**Total Calls**	**Benefits**
135 LNG	27	$ (7,864)
145 LNG	28	$ (11,821)
165 LNG	29	$ (6,236)
217 LNG	15	$ (2,543)
266 LNG	21	$ (12,511)
Panamax	1186	$ 29,936
PPX1	247	$ 128,678
PPX2	201	$ 112,277
		$ 229,917

Table 129: 47-Foot Fleet, 46 to 47-Foot Depth – 2020

47-Foot Vessel Fleet		
2020	**46-Foot Depth**	**47-Foot Depth**
135 LNG	$ 63,169	$ 63,590
145 LNG	$ 66,200	$ 66,751
165 LNG	$ 77,482	$ 77,872
217 LNG	$ 89,358	$ 90,291
266 LNG	$ 102,515	$ 103,084
Panamax	$ 23,916	$ 23,881
PPX1	$ 32,089	$ 31,609
PPX2	$ 35,742	$ 35,283
2020	**Total Calls**	**Benefits**
135 LNG	30	$ (12,655)
145 LNG	32	$ (17,656)
165 LNG	32	$ (12,492)
217 LNG	17	$ (15,853)
266 LNG	24	$ (13,653)
Panamax	649	$ 22,777
PPX1	471	$ 226,189
PPX2	524	$ 240,655
		$ 417,311

Table 130: 47-Foot Fleet, 46 to 47-Foot Depth – 2025

47-Foot Vessel Fleet		
2025	**46-Foot Depth**	**47-Foot Depth**
135 LNG	$ 67,683	$ 68,324
145 LNG	$ 69,593	$ 70,442
165 LNG	$ 82,966	$ 83,738
217 LNG	$ 97,147	$ 98,507
266 LNG	$ 108,611	$ 109,961
Panamax	$ 24,121	$ 24,084
PPX1	$ 32,753	$ 32,302
PPX2	$ 36,417	$ 35,904
2025	**Total Calls**	**Benefits**
135 LNG	34	$ (21,795)
145 LNG	35	$ (29,709)
165 LNG	36	$ (27,783)
217 LNG	19	$ (25,842)
266 LNG	26	$ (35,088)
Panamax	924	$ 34,036
PPX1	462	$ 208,718
PPX2	749	$ 384,087
		$ 486,623

Table 131: 47-Foot Fleet, 46 to 47-Foot Depth – 2030

47-Foot Vessel Fleet		
2030	**46-Foot Depth**	**47-Foot Depth**
135 LNG	$ 70,840	$ 71,582
145 LNG	$ 72,068	$ 72,738
165 LNG	$ 75,887	$ 76,687
217 LNG	$ 97,579	$ 98,399
266 LNG	$ 110,812	$ 111,305
Panamax	$ 24,930	$ 24,822
PPX1	$ 34,761	$ 34,438
PPX2	$ 38,624	$ 38,182
2030	**Total Calls**	**Benefits**
135 LNG	37	$ (27,482)
145 LNG	39	$ (26,153)
165 LNG	40	$ (32,018)
217 LNG	21	$ (17,210)
266 LNG	29	$ (14,287)
Panamax	975	$ 105,841
PPX1	661	$ 213,069
PPX2	1018	$ 450,439
		$ 652,199

6.3.2. Tide Delay - Annual Benefits

Using the output data for transit costs provided by HarborSym, displayed in through Table 131 annual tide delay benefits were determined for each channel depth alternative. The values provided for the model run years were then interpolated to attain benefits for the years between. Tide delay benefits were held constant in 2030 when Garden City capacity is forecast to be reached. The benefits stated are in FY11 dollars and are displayed in Table 132. Calculations were provided to the Deep Draft Center of Expertise for review. The approved for use white paper is provided as an attachment to this Economics Appendix.[29]

Table 132: Tide Delay Benefits

Year	42 to 44 Feet	44 to 45 Feet	45 to 46 Feet	46 to 47 Feet	47 to 48 Feet
2017	$ 1,036,564	$ 554,120	$ 450,832	$ 304,875	$ 186,724
2018	$ 1,080,214	$ 586,951	$ 510,291	$ 342,354	$ 233,941
2019	$ 1,123,863	$ 619,781	$ 569,750	$ 379,832	$ 281,158
2020	$ 1,167,512	$ 652,611	$ 629,208	$ 417,311	$ 328,375
2021	$ 1,221,220	$ 711,386	$ 668,777	$ 431,174	$ 358,815
2022	$ 1,274,929	$ 770,161	$ 708,346	$ 445,036	$ 389,256
2023	$ 1,328,637	$ 828,936	$ 747,915	$ 458,898	$ 419,696
2024	$ 1,382,346	$ 887,711	$ 787,484	$ 472,761	$ 450,137
2025	$ 1,436,054	$ 946,486	$ 827,053	$ 486,623	$ 480,577
2026	$ 1,452,883	$ 978,093	$ 833,076	$ 519,738	$ 499,960
2027	$ 1,469,713	$ 1,009,699	$ 839,099	$ 552,853	$ 519,343
2028	$ 1,486,542	$ 1,041,306	$ 845,122	$ 585,969	$ 538,725
2029	$ 1,503,371	$ 1,072,912	$ 851,145	$ 619,084	$ 558,108
2030	$ 1,520,200	$ 1,104,519	$ 857,168	$ 652,199	$ 577,490

6.3.3. Tide Delay - Average Annual Benefits

Average annual benefits were developed using the annual benefits from the proposed project depth alternatives using the Federal Discount Rate for FY11 of 4.125% and a 50 period of analysis. Table 133 displays the rounded average annual benefits for each project alternative.

Table 133: Average Annual Benefits - Tide Delay

Project Depth	Cumulative Benefits
42 to 44 Feet	$1,408,000
44 to 45 Feet	$2,366,000
45 to 46 Feet	$3,146,000
46 to 47 Feet	$3,702,000
47 to 48 Feet	$4,190,000

[29] The approved for use white paper will be developed during the review process. A copy of the document will be included in the final report.

6.4. Cumulative Benefits – Meeting Area and Tide Delay Benefits

The following table displays the benefits of both the meeting area and tide delay benefits. The numbers have been rounded.

Table 134: Cumulative Benefits

Project Depth (feet)	Tide Benefits	Long Island	Total Benefits
42 to 44	$1,408,000	$ 400,000	$ 1,808,000
44 to 45	$2,366,000	$ 401,000	$ 2,767,000
45 to 46	$3,146,000	$ 407,000	$ 3,553,000
46 to 47	$3,702,000	$ 450,000	$ 4,152,000
47 to 48	$4,190,000	$ 424,000	$ 4,614,000
Project Depth	**Tide Benefits**	**Oglethorpe**	**Total Benefits**
42 to 44	$1,408,000	$ 385,000	$ 1,793,000
44 to 45	$2,366,000	$ 387,000	$ 2,753,000
45 to 46	$3,146,000	$ 393,000	$ 3,539,000
46 to 47	$3,702,000	$ 387,000	$ 4,089,000
47 to 48	$4,190,000	$ 373,000	$ 4,563,000
Project Depth	**Tide Benefits**	**Long Island/Oglethorpe**	**Total Benefits**
42 to 44	$1,408,000	$ 717,000	$ 2,125,000
44 to 45	$2,366,000	$ 722,000	$ 3,088,000
45 to 46	$3,146,000	$ 731,000	$ 3,877,000
46 to 47	$3,702,000	$ 730,000	$ 4,432,000
47 to 48	$4,190,000	$ 723,000	$ 4,913,000

6.5. Project NED Benefits Summary

The benefits attributable to channel expansion at Savannah Harbor include reduced total transportation costs for each incremental project depth, reduced tide delay costs, and reduced delay costs resulting from the construction of meeting areas. The following table summarizes average annual project benefits estimated for the SHEP. Benefits were calculated for the 50-year period of analysis (2017-2066) at the Fiscal Year 2011 Federal interest rate of 4.125 percent.

Table 13535: NED Benefits Summary FY-2011 (4.125%)

Benefit Category	Alternative (Project Depth - feet)				
	44	45	46	47	48
Transportation Cost Savings	$98,210,000	$133,150,000	$150,370,000	$155,040,000	$155,040,000
Meeting Area (Long Island/Oglethorpe)	$720,000	$720,000	$730,000	$730,000	$720,000
Tide Delay Reduction	$1,410,000	$2,370,000	$3,150,000	$3,700,000	$4,190,000
Total AAE Benefits	**$100,340,000**	**$136,240,000**	**$154,250,000**	**$159,470,000**	**$159,950,000**
Incremental Benefits *FY11 Values*		**$35,900,000**	**$18,010,000**	**$5,220,000**	**$480,000**

6.5.1 Updated FY2012 Benefits for Recommended Plan

The recommended plan is the NED plan, the 47-foot alternative (See Section 11 of the GRR Main Report). The evaluation of alternative plans and plan selection addressed up to this point, have used FY 11 costs and benefits. Benefits were evaluated using vessel operating costs (VOCs) prepared by IWR and issued by HQ in Economics Guidance Memorandum (EGM) 11-04. In July 2011, new VOCs were prepared by IWR and issued by HQ in EGM 11-05. Benefits and costs for the recommended plan have been updated in December 2011 to reflect FY 2012 price levels using the federal 4% interest rate for Corps of Engineer Projects (EGM, 12-01). Vessel operating costs (VOC) for PMX and PPX vessels were also updated to incorporate the latest published rates (EGM 11-05). Vessel operating costs at-sea are used in the Load Factor Analysis which is an input to the Transportation Cost Savings Model (TCSM). They are expressed in the model in the form of cost per 1000 miles. VOCs within-harbor, expressed as hourly costs, are input for the HarborSym Model. The TCSM calculates the round trip water transportation benefits and HarborSym calculates the tide delay and meeting areas benefits. Approximately one percent of the increase in vessel operating cost is attributable to the decrease in the Federal discount rate 4.125% in FY2011 and 4.0 % in FY2012. The remaining increase in vessel operation cost represents a substantial increase in the operating cost at-sea, of which a large proportion is the increase in fuel (bunkerage) from $535 to $756. The following table 135a displays the costs per 1000 miles using FY2011 and FY2012 VOCs and the percent increase in vessel operating cost for typical vessels which were generally proportional across all relevant vessel classes (PMX and PPX 1 and 2). The new costs per 1000 miles for PMX and PPX 1 and 2 vessels were incorporated in to the TCSM and the model was rerun.

Table 135a: Change in at-sea Vessel Operating cost FY2012 (4.00%)

Change in Vessel Operating Cost Per 1000 Miles Updated to FY2012 Price Levels						
Typical Vessel	AVG DWT	AVG TEU	FY2011 Vessel Operating Cost	FY2012 Updated Vessel Operating Cost	Change in Vessel Operating Cost	Percentage Increase in Vessel Operating Costs
PMX	64,956	4,729	$101,999	$132,118	$30,119	30%
PPX1	74,070	6,186	$104,391	$145,949	$41,558	40%
PPX2	103,817	8,670	$138,722	$195,031	$56,309	41%

Tide delay and meeting area benefits derive from within-harbor vessel operating costs. Table 135b displays the hourly in harbor vessel operating costs for FY2011 and FY2012. The percentage change in cost was applied to the HarborSym delay output to update benefits. Note that for the PPX 2 vessel, the DWT changes from the FY2011 values to FY2012 values, and the relative increase in hourly costs increases more than for the other representative vessels. This is because prior HarborSym runs used a slightly smaller PPX 2 vessel that was used in the TCSM. This update to FY 2012 values, brings these vessels in to line for consistency and accuracies of the results.

Table 135b: Change in Within-Harbor Vessel Operating cost FY2012 (4.00%)

FY 2012 In Harbor Vessel Operating Cost				
Vessel	DWT	AVG TEU	FY11 VOC Per Hour	FY12 Updated VOC Per Hour
Panamax	65,000	4,720	$1,649	$2,296
PPX1	74,100	6,185	$2,206	$2,774
PPX2	86,100/103,817	7,200/8,670	$2,384	$3,516

The transportation cost savings benefits increased from $155, 040,000 to $206,900,000, the tide delay reduction benefits increased from $3,700,000 to $5,300,000 and the meeting area benefits increased from $730,000 to $1,020,000. Total average annual recommended plan benefits increased from $159,470,000 to $213,220,000, as displayed in Table 135c.

Table 135c: NED Benefits Summary FY-2012 (4.0%)

FY 2012 (4.0%) Average Annual Benefits	Recommended Plan 47
Transportation Cost Savings	$206,900,000
Meeting Area (Long Island/Oglethorpe)	$1,020,000
Tide Delay Reduction	$5,300,000
Total AAE Benefits	**$213,220,000**

7.0 MULTIPORT ANALYSIS

Multiport analysis is a systematic assessment of the effects of the with-project condition on other ports. It also includes the effects of authorized projects at other ports on the with-project and without project conditions. The detailed multiport analysis conducted for the Savannah Harbor Expansion Project is contained in Attachment 4 to this Economics Appendix.

7.1. Multiport Analysis – GEC Evaluation (Final Report dated July 2006)

First, Savannah Harbor's economic study area was determined. For container traffic, principally imports, this study area was defined as a hinterland east of the Mississippi River with the following cities serving as a perimeter: Atlanta, New Orleans, Memphis, St. Louis, Chicago, and Detroit. Eleven other cities were ultimately used for the mapping of the competitive hinterland for the least total delivered transportation cost analysis: Mobile, Jackson, Birmingham, Charlotte, Nashville, Knoxville, Louisville, Cincinnati, Columbus, Indianapolis, and Cleveland.

Next, the historical volumes of container imports through Savannah Harbor and the alternative ports of Norfolk, Wilmington, Charleston, and Jacksonville were compiled. The container volumes were used as previously projected for the ports for the period 2004-2050, including major world trading areas for imports and exports. These projections were not constrained by any port capacity limitations. Then, the container vessel fleet composition for the ports was described relative to the services and major world areas.

The current cost of commodity (container) movements was compiled for Savannah Harbor, consisting of the vessel voyage cost (at sea), vessel and cargo related port costs, and hinterland transportation costs. A vector of sea costs was developed for the voyage legs that precede and follow Savannah Harbor in conjunction with calls at other U.S. East Coast ports, notably Norfolk and New York. Port cost, including vessel time in port was compiled based on vessel and cargo

services, including pilotage, tug cost, dockage, wharfage, stevedoring, and container handling. Land transportation costs for truck and rail movements between the ports and hinterland cities were also compiled. Total delivered transportation cost (voyage, port, and hinterland) for imported containers through the 17 major hinterland cities (New Orleans, Mobile, Memphis, St. Louis, Jackson, Birmingham, Atlanta, Charlotte, Nashville, Knoxville, Louisville, Cincinnati, Columbus, Indianapolis, Chicago, Detroit, and Cleveland) were compiled.

Next, the current total delivered transportation cost of container movements was determined for competing harbors (Norfolk, Wilmington, Charleston, and Jacksonville) for benefiting services. Utilizing the aforementioned information, a spreadsheet was utilized to compute the least total cost port and the incremental costs for other ports. A range of hinterlands based on incremental least total delivered transportation costs of $50 per TEU was developed for sensitivity purposes.

In summary, the future cost of container movements under with-project conditions was determined for Savannah Harbor for benefiting services and alternative ports. The analysis determined that with project conditions would not result in a diversion of containers from other ports on the basis of least total transportation cost (voyage, port and hinterland).

The use of Savannah Harbor under without and with-project conditions with respect to imported containers was determined. For the benefiting services, Savannah Harbor has the least total delivered transportation cost under without-project conditions for the major nodes of Memphis, St. Louis, Jackson, Birmingham, Atlanta, and Knoxville. The least total cost nodes do not change under the with project conditions at Savannah Harbor. Alternatively, Charleston Harbor has the least total delivered transportation cost for the major nodes of Knoxville, Louisville, Cincinnati, and Indianapolis. Norfolk has the least total delivered transportation cost for the major nodes of Columbus, Chicago, Detroit, and Cleveland.

As mentioned, the multiport analysis determined that traffic would not be diverted and therefore no NED impacts were identified under the with-project conditions and a least total delivered transportation cost analysis. Further, there were no authorized projects at other competing ports (Norfolk, Wilmington, Charleston, and Jacksonville) that might affect possible diversion of cargo away from Savannah Harbor.

7.2. Update

The SHEP DEIS and GRR were prepared as directed by the authorization for the project which was provided in the Water Resources Development Act of 1999 (Public Law 106-53, Section 102 (b)(9). The SHEP was approved to include 1) an analysis of the impacts of project depth alternatives ranging from 42 through 48 feet and 2) a selected plan for navigation and an associated mitigation plan as required under Section 906 (a) of the Water Resources Development Act of 1986 (33 U.S.C. 2283 (a)). This authorization was in response to previous studies which determined that deepening of the navigation channel in Savannah Harbor was the only solution to the current inefficiencies of operation in the Federal Navigation channel caused by the existing depth (-42 feet mlw). Inefficiencies of operation are characterized by larger vessels having to light-load and/or wait on high tide. This situation is expected to worsen as

larger ships replace the older, smaller vessels. The Purpose and Need section of the FEIS contains a more detailed discussion of these issues.

The findings of the GEC multiport study suggest that there would be no substantial changes in the origins and destinations of imports and exports to key U.S. markets served by Savannah. Given this study's findings, a basic assumption for the SHEP Economic Appendix would be no substantial changes in hinterland service area and therefore no change in overall cargo without and with channel improvements at Savannah harbor. This basic assumption is further supported by the fact that PPX 1 vessels are calling Savannah in increasing numbers and are anticipated to call in greater numbers once the Panama Canal is enlarged.

In the draft report, it was assumed that PPX 2 vessels would call only if the channel were deepened to at least 44 ft; however, recent developments and carrier announcements indicate that even in the without project condition, PPX 2 vessels have and will continue to call at Savannah. The savings per TEU for the ocean voyage costs range from about $10 to $60 depending on the trade route distance, percentage of Savannah cargo and other factors. This is derived by dividing the "benefiting tonnes" on each trade route, by the ocean voyage transportation costs for the respective routes. At these levels of savings, and with landside trucking costs within the local area of Savannah estimated to range from $100 to $150 each round trip, and movements outside of the local area are estimated to average $1.50 to $2.00 per round trip mile, there is not a sufficient differential to attract large amounts of cargo diverted from or to other ports. It is further believed that there are numerous other factors involved in port developments that would have a greater affect on cargo diversions such as new container yard developments, location of distribution centers, and landside transportation improvements.

The best estimates available without detailed research peg thirty percent of imports are delivered within 30 miles of Garden City and about thirty percent are destined along the I-16 Corridor to and including Atlanta. Export origins for pulp paper and poultry within 200 miles account for 45 percent, Clay within 200 miles about 20 percent and grain stuffing which is within 30 miles of the port accounts for about 5 percent.

Also, at these levels of savings, there is not a sufficient differential to support the additional handling cost involved in any "Super Port" concept.

Table 136: Savings per TEU - Imports (2025)

World Region Service	Savings/TEU - Imports - 2025				
	44	45	46	47	48
Fe (Panama) ECUS	$ 20	$ 25	$ 25	$ 25	$ 25
FE ECUS EU PEN	$ 33	$ 43	$ 48	$ 48	$ 48
FE (Suez) ECUS PEN	$ 36	$ 48	$ 57	$ 59	$ 59
RTW	$ 23	$ 34	$ 41	$ 47	$ 47
FE ECUS MED PEN	$ 31	$ 45	$ 54	$ 60	$ 60
ECUS MED	$ 23	$ 34	$ 42	$ 47	$ 47
ECUS EU GULF PEN	$ 16	$ 24	$ 29	$ 33	$ 33

8. SOCIOECONOMIC AND REGIONAL ANALYSES

Four accounts are established in the Principals and Guidelines to facilitate the evaluation and display of effects of alternative plans. The national economic development (NED) account displays changes in the economic value of the national output of goods and services. The environmental quality (EQ) account displays non-monetary effects on ecological, cultural and aesthetic resources including the positive and adverse effects of ecosystem restoration plans. The regional economic development (RED) account displays changes in the distribution of regional economic activity (e.g. income and employment). The other social effects (OSE) account displays plan effects from perspectives that are relevant to the planning process, but are not reflected in the other three accounts (e.g. community impacts, health and safety, displacement and energy conservation). Display of the national economic development and environmental quality accounts is required. Display of the regional economic development and other social effects accounts is discretionary.

8.1. Socioeconomic Overview

8.1.1. Demographics

The Garden City Terminal is located in Chatham County, Georgia. The county is comprised of 438.11 square miles and 529.8 persons per square mile. Neighboring counties are Effingham, Bulloch Bryan, Evans, Liberty, Long, Tattnall, and McIntosh. These counties can be found surrounding Chatham County the eastern most county on the Georgia Map below.

Figure 38: Georgia County Map

Jasper County, across the Savannah River from the Savannah Harbor, is located in the state of South Carolina. It and its surrounding counties of Hampton, Allendale, Colleton, Charleston and Beaufort can be found at the bottom of the South Carolina Map below.

Figure 39: South Carolina County Map

The 2009 Chatham County, Georgia population estimate was 256,992 persons. The population in year 2000 was 232,247, showing a 10.7% increase from 2000 to 2009. The percent of females in the population in 2009 was 52.2%. The racial make-up consisted of 55.5% white, 40.4% black, 0.4% American Indian and Alaska Native persons, 2.2% Asian, 0.1% Native Hawaiian and Other Pacific Islander. The next table presents common statistics for these Georgia counties. These same statistics for Jasper County, South Carolina and surrounding counties are presented as well.

Table 137: Population and Demographics–Selected Georgia and South Carolina Counties

County	2009 Population	2000 Population	% Change	% Females	% White	% Black
Georgia Counties						
Chatham	256,992	232,247	10.7%	52.2%	55.5%	40.4%
Effingham	53,541	37,538	42.6%	50.1%	82.8%	14.9%
Bulloch	69,213	55,983	23.6%	51.1%	68.0%	29.6%
Bryan	32,559	23,417	39.0%	50.5%	80.7%	15.5%
Liberty	62,186	61,610	0.9%	50.5%	52.4%	41.0%
Evans	11,695	10,495	11.4%	51.8%	67.9%	30.4%
Long	12,234	10,304	18.7%	51.6%	71.7%	24.4%
Tattnall	24,493	22,305	9.8%	41.6%	68.4%	30.2%
McIntosh	11,378	10,847	4.9%	52.0%	65.5%	32.5%
South Carolina Counties						
Jasper	23,221	20,671	12.3%	46.2%	51.6%	46.6%
Beaufort	155,215	120,948	28.3%	50.5%	77.1%	20.1%
Hampton	21,014	21,382	-1.7%	49.3%	44.0%	54.9%
Allendale	10,195	11,211	-9.1%	46.7%	27.5%	71.4%
Colleton	39,246	38,264	2.6%	52.5%	57.8%	40.2%
Charleston	355,276	310,099	14.6%	51.7%	66.3%	30.5%

8.1.2. Employment

The pre-recession level of private nonfarm employment growth was very robust in most of the counties surrounding Chatham. All but a few counties had double digit growth except Evans which had a 7.9% increase. Decreases were evident in both Tattnall and McIntosh counties which experienced 12.2% and 18.8% declines in private nonfarm employment. Of note was in Tattnall County where 41.9% of the firms were women-owned, followed by Liberty, Chatham and Evans with 36.3%, 29.5% and 25.2%, respectively.

South Carolina counties, Jasper Beaufort and Charleston posted double digit growth of 12.3%, 28.2% and 14.6% respectively. Colleton County grew 2.6% while declines of -1.7% and -9.1% occurred in Hampton and Allendale Counties. The next table presents these statistics for selected Georgia and South Carolina counties.

Table 138: Employment Statistics - Selected Georgia and South Carolina Counties

County	2000 Private Nonfarm	2008 Private Nonfarm employment	2000 - 2008 Private Nonfarm employment % Change	Total Number of Firms 2002	% Women-owned Firms	% Black-owned Firms	% Asian-owned Firms	% Hispanic-owned Firms
Georgia Counties								
Chatham	7,256	122,759	14.6%	17,789	29.5%	12.4%	2.7%	0.9%
Effingham	725	7,398	38.2%	2635	22.4%	F	F	F
Bulloch	1,472	18,190	10.4%	3,982	17.9%	F	F	F
Bryan	614	5,775	83.2%	1,938	23.0%	F	F	F
Liberty	841	11,213	18.2%	2,473	36.3%	29.8%	4.3%	4.7%
Evans	241	3,897	7.9%	789	25.2%	22.1%	F	F
Long	73	399	81.4%	271	F	F	F	F
Tattnall	314	2,659	-12.2%	1,252	41.9%	F	F	F
McIntosh	230	1,646	-18.8%	929	F	F	F	F
South Carolina Counties								
Jasper	583	7,300	110.9%	1,436	27.1%	19.1%	F	F
Beaufort	5,025	55,682	18.0%	13,839	26.5%	7.6%	F	F
Hampton	407	4,311	-9.1%	1,275	19.7%	22.3%	F	F
Allendale	135	1,524	-34.5%	446	F	31.6%	F	F
Colleton	853	9,175	5.3%	3,074	19.4%	10.1%	F	F
Charleston	12,156	181,831	7.1%	30,232	28.1%	7.7%	1.8%	1.0%

F – Not Disclosed

8.1.3. Households

There were 117,991 housing units in Chatham County, Georgia, in 2009; in 2000 there were 89,865 households with 2.49 persons per household. The year 2000 homeownership rate for the county was 60.4% and the median value of owner-occupied housing was $95,000.

In Jasper County of South Carolina there were 9860 housing units in 2009; in 2000 there were 7042 households with 2.75 persons per household. The homeownership rate in Jasper County was 77.7% in 2000 and the median value of owner-occupied housing was $77,600.

Table 139: Housing and Households–Selected Georgia and South Carolina Counties

County	Housing Units 2000	Housing Units 2009	Persons per household 2000	Home ownership rate 2000	Median Value Owner occupied housing 2000
Georgia Counties					
Chatham	89,865	117,991	2.49	60.4%	$95,000
Effingham	13,151	19,559	2.84	82.6%	$106,600
Bulloch	20,743	28,734	2.53	58.1%	$94,300
Bryan	8,089	12,496	2.88	77.9%	$115,600
Liberty	19,383	25,119	2.93	50.7%	$79,800
Evans	3,778	4,708	2.62	71.5%	$69,000
Long	3,574	4,693	2.88	66.2%	$71,100
Tattnall	7,057	8,976	2.60	70.7%	$67,300
McIntosh	4,202	6,965	2.54	83.6%	$81,700
South Carolina Counties					
Jasper	7,042	9,860	2.75	77.7%	$77,600
Beaufort	45,532	84,530	2.51	73.2%	$213,900
Hampton	7,444	8,828	2.64	78.1%	$94,900
Allendale	3,915	4,643	2.56	72.7%	$46,900
Colleton	14,470	19,377	2.62	80.3%	$73,200
Charleston	123,326	175,059	2.42	61.0%	$94,900

8.1.4. Income

The Chatham County, Georgia, median house hold income in 2008 was $45,132 and the percent of persons below the poverty level was 17%, as compared to the State of Georgia's at 14.7%. Only two of the ten neighboring counties have a lower incidence of persons living below the poverty level, (i.e., compared to the State of Georgia).

In Jasper County, South Carolina the median household income in 2008 was $38,778 and the percent of persons below the poverty level was 19.8% compared to the State of Georgia's 14.7%. Four of the six, South Carolina counties surrounding Jasper County had greater percentages of persons below the poverty level compared to the State's 15.7% lead by Allendale County with 41.8 percent of persons below the poverty level. See the following table for these comparisons.

Table 140: Income and Poverty–Selected Georgia and South Carolina Counties

County	Median Household Income 2008	Percent of Persons Below Poverty Level	Georgia Persons Below Poverty Level	South Carolina Persons Below Poverty Level	USA Persons Below Poverty Level
Georgia Counties					
Chatham	$45,132	17.0%	14.7%	15.7%	13.2%
Effingham	$59,956	10.1%	14.7%	15.7%	13.2%
Bulloch	$38,631	23.1%	14.7%	15.7%	13.2%
Bryan	$62,038	10.2%	14.7%	15.7%	13.2%
Liberty	$39,997	15.4%	14.7%	15.7%	13.2%
Evans	$33,269	24.8%	14.7%	15.7%	13.2%
Long	$38,168	23.2%	14.7%	15.7%	13.2%
Tattnall	$36,647	24.5%	14.7%	15.7%	13.2%
McIntosh	$36,397	18.8%	14.7%	15.7%	13.2%
South Carolina					
Jasper	$38,778	19.8%	14.7%	15.7%	13.2%
Beaufort	$55,897	10.1%	14.7%	15.7%	13.2%
Hampton	$36,003	23.4%	14.7%	15.7%	13.2%
Allendale	$25,329	41.8%	14.7%	15.7%	13.2%
Colleton	$34,136	21.1%	14.7%	15.7%	13.2%
Charleston	$50,213	15.4%	14.7%	15.7%	13.2%

8.2. Regional Economic Development Analysis

The regional economic development (RED) account measures changes in the distribution of regional economic activity that would result from each alternative plan. Evaluations of regional effects are measured using nationally consistent projection of income, employment, output and population.

8.2.1. Regional Analysis

The USACE Online Regional Economic System (RECONS) is a system designed to provide estimates of regional, state, and national contributions of federal spending associated with Civil Works and American Recovery and Reinvestment Act ARRA Projects. It also provides a means for estimating the forward linked benefits (stemming from effects) associated with non-federal expenditures sustained, enabled, or generated by USACE Recreation, Navigation, and Formally Utilized Sites Remedial Action Program (FUSRAP). Contributions are measured in terms of economic output, jobs, earnings, and/or value added. The system was used to perform the following regional analysis for the SHEP.

8.2.2. Summary

This document section summarizes the analysis and provides estimates of the economic impacts of 2009 for The Savannah Harbor expansion Project. The U.S Army Corps of Engineers (USACE) Institute for Water Resources, the Louis Berger Group and Michigan USACE University developed the regional economic impact modeling tool called RECONS to provide estimates of regional and national job creation and retention and other economic measures such as income, value added, and sales. This modeling tool automates calculations and generates estimates of jobs and other economic measures such as income and sales associated with USACE's ARRA spending and annual Civil Work program spending. This is done by extracting multipliers and other economic measures from more than 1,500 regional economic models that were built specifically for USACE's project locations. These multipliers were then imported to a database and the tool matches various spending profiles to the matching industry sectors by location to produce economic impact estimates. The Tool will be used as a means to document the performance of direct investment spending of the USACE as directed by the American Recovery and Reinvestment Act (ARRA). The Tool also allows the USACE to evaluate project and program expenditures associated with the annual expenditure by the USACE. The Tool has been developed in both a desktop and on-line version.

8.2.3. Results of the Economic Impact Analysis

This RED impact analysis was evaluated at three geographical levels: Local, Bi-State and National. The local represents the Savannah impact area which encompasses the area included in about a 40-mile radius around the project area. The Bi-State level will include the States of Georgia and South Carolina. The National level will include the 48 contiguous United States.

The following table displays the overall spending profile that makes up the dispersion of the total project construction cost among the major industry sectors. The spending profile also identifies the geographical capture rate, also called Local Purchase Coefficient (LPC) in RECONS, of the cost components. The geographic capture rate is the portion of USACE spending on industries (sales) captured by industries located within the impact area. In many cases, IMPLAN's trade flows Regional Purchase Coefficients (RPCs) are utilized as a proxy to estimate where the money flows for each of the receiving industry sectors of the cost components within each of the impact areas.

Table 141: Spending and LPCs

Category	Spending (%)	Spending ($)	Local LPC (%)	State LPC (%)	National LPC (%)
Fuel	15%	$89,415,150	16%	18%	81%
Consumable Operating Expenses – Textiles, Lubricants, and Metal Valves and Parts	10%	$59,610,100	24%	34%	74%
Consumable Operating Expenses – Restaurants	1.4%	$8,345,414	100%	100%	100%
Repairs and Equipment	40%	$238,440,400	71%	83%	100%
Labor	25%	$149,025,250	5%	5%	100%
Consumable Operating Expenses – Other Food and Beverages	8.6%	$51,264,686	28%	51%	92%
Total	100%	$596,101,100			

Table 142 displays the geographical capture amounts for each of the three geographical impact analyses. Which is that portion of USACE spending that is captured in each impact area. It initially measures $226,692,771 at the local impact level and increases to $276,732,471 at the Bi-State level, Georgia and South Carolina, and expands to a $559,101,991 capture at the national level. The labor income represents all forms of employment earnings. In IMPLAN's regional economic model, it is the sum of employee compensation and proprietor income. The Gross Regional Product (GRP) which is also known as value added, is equal to gross industry output (i.e., sales or gross revenues) less its intermediate inputs (i.e., the consumption of goods and services purchased from other U.S. industries or imported). The number of jobs equates to the labor income. An interesting note is that in the local geography one job averages an annual wage of $41,320, the Bi-State equivalent is $42,309 and the National equivalent is $39,924 (labor income/job). The total impact, direct and secondary, yields a local average wage of $39,607, Bi-State $42,547 and $44,230 nationally.

Table 142: Overall Summary Economic Impacts

		Local	Bi-State	Nation
Capture Amount		$226,692,771	$276,732,471	$559,101,991
Direct Impact				
	Job	1,826.14	2,153.67	6,541.07
	Labor Income	$75,457,631	$91,120,637	$257,553,334
	GRP	$140,419,298	$168,743,184	$355,314,310
Total Impact				
	Job	2,428.10	3,725.99	11,554.98
	Labor Income	$96,169,986	$158,531,133	$511,073,882
	GRP	$185,208,212	$287,270,325	$794,610,195

The next three tables present the economic impacts by Industry Sector both for each geographical region. Note that the largest impact area is 417, Commercial and industrial machinery and equipment repair and maintenance, as one would expect in a heavily dredging operation. Impacts at the National level show a tremendous expansion most certainly due to the many multiple turnover of money that ripples throughout the national economy.

Table 143: Economic Impact at Local Region

Implan No.	Industry Sector	Sales	Jobs	Labor Income	GRP
	Direct Effects				
115	Petroleum refineries	$10,775,725	1.18	$452,487	$735,136
198	Valve and fittings other than plumbing manufacturing	$893,363	2.66	$169,702	$347,606
319	Wholesale trade businesses	$13,614,457	81.87	$5,039,680	$8,713,585
323	Retail Stores - Building material and garden supply	$7,232,415	83.91	$2,881,825	$4,694,880
324	Retail Stores - Food and beverage	$6,336,969	102.01	$2,631,314	$4,043,885
332	Transport by air	$13,964	0.05	$3,438	$4,373
333	Transport by rail	$149,273	0.39	$36,522	$86,757
334	Transport by water	$7,518	0.01	$974	$2,276
335	Transport by truck	$1,290,071	10.15	$469,031	$627,214
337	Transport by pipeline	$128,656	0.18	$34,717	$50,392
413	Food services and drinking places	$8,345,414	158.93	$2,699,302	$4,020,898
417	Commercial and industrial machinery and equipment repair and maintenance	$168,156,070	1,196.49	$53,230,241	$109,178,103
5001	Labor	$7,451,263	180.6	$7,451,263	$7,451,263
69	All other food manufacturing	$2,297,613	7.71	$357,135	$462,930
	Total Direct Effects	$83,859,128	601.96	$20,712,355	$44,788,914
	Total Effects	**$310,551,899**	**2,428.10**	**$96,169,986**	**$185,208,212**

Table 144: Economic Impact at Bi-State Level

Implan No.	Industry Sector	Sales	Jobs	Labor Income	GRP
	Direct Effects				
115	Petroleum refineries	$10,775,725	1.18	$452,487	$735,136
198	Valve and fittings other than plumbing manufacturing	$3,288,976	10.04	$624,771	$786,671
319	Wholesale trade businesses	$19,751,072	118.77	$7,358,811	$10,878,600
323	Retail Stores - Building material and garden supply	$8,275,889	96.02	$3,305,552	$5,093,838
324	Retail Stores - Food and beverage	$7,074,479	113.88	$2,941,935	$4,318,386
332	Transport by air	$52,049	0.2	$13,457	$14,244
333	Transport by rail	$293,240	0.77	$72,693	$122,979
334	Transport by water	$13,069	0.02	$1,782	$3,068
335	Transport by truck	$2,263,394	17.81	$827,773	$930,932
337	Transport by pipeline	$128,656	0.18	$34,717	$50,392
413	Food services and drinking places	$8,345,414	158.93	$2,699,302	$4,020,898
417	Commercial and industrial machinery and equipment repair and maintenance	$198,553,679	1,420.17	$63,513,002	$117,442,167
5001	Labor	$7,451,263	180.6	$7,451,263	$7,451,263
69	All other food manufacturing	$10,465,565	35.1	$1,823,094	$1,884,933
	Total Direct Effects	$207,787,622	1,572.32	$67,410,496	$118,527,141
	Total Effects	**$484,520,093**	**3,725.99**	**$158,531,133**	**$287,270,325**

Table 145: Economic Impact at National Level

Implan No.	Industry Sector	Sales	Jobs	Labor Income	GRP
	Direct Effects				
115	Petroleum refineries	$66,404,337	7.67	$2,788,404	$4,530,204
198	Valve and fittings other than plumbing manufacturing	$26,563,758	81.72	$5,345,938	$10,809,959
319	Wholesale trade businesses	$20,371,599	122.5	$7,605,520	$13,123,520
323	Retail Stores - Building material and garden supply	$8,351,742	96.9	$3,336,354	$5,431,543
324	Retail Stores - Food and beverage	$7,620,359	122.67	$3,176,042	$4,877,186
332	Transport by air	$58,040	0.23	$16,539	$21,451
333	Transport by rail	$335,375	0.88	$83,326	$195,901
334	Transport by water	$34,248	0.07	$5,287	$10,779
335	Transport by truck	$2,391,256	18.81	$880,100	$1,175,652
337	Transport by pipeline	$418,741	0.71	$123,426	$178,608
413	Food services and drinking places	$8,345,414	158.93	$2,699,302	$4,020,898
417	Commercial and industrial machinery and equipment repair and maintenance	$238,440,400	1,713.68	$77,005,694	$154,871,331
5001	Labor	$149,025,250	4,023.21	$149,025,250	$149,025,250
69	All other food manufacturing	$30,741,472	103.1	$5,462,150	$7,042,029
	Total Direct Effects	$859,122,773	5,103.91	$67,410,496	$439,295,885
	Total Effects	**$1,418,224,764**	**11,554.98**	**$158,531,133**	**$287,270,325**

Total Savannah Harbor Expansion Project Economic Impact for the Bi-State geographical area of Georgia and South Carolina as displayed in Table 144 is composed of $484,520,093 in sales, 3,726 jobs, $158,531,133 in labor income and a contribution of $287,270,325 to GRP.

GENERAL RE-EVALUATION REPORT
APPENDIX A: ECONOMICS
SAVANNAH HARBOR EXPANSION PROJECT
Chatham County, Georgia and Jasper County, South Carolina

January 2012

ATTACHMENT 1
Carrier Letters

US Army Corps
of Engineers
Savannah District
South Atlantic Division

July 6, 2009

Curtis J. Foltz
Georgia Ports Authority,
2 Main Street,
Garden City,
Georgia 31408

Ref: Savannah Harbor Deepening

Dear Curtis,

CMA CGM would like to give our full support behind this project. We are today the world's third largest container carrier, with six services calling at Savannah on a weekly basis.
Today several of our vessels are tide bound due to their draft and larger vessels are planned. We have just started anew joint service with Maersk Line with vessels arriving from Asia via the Suez Canal. The size of these vessels is in the 6500 -7000 TEU range, we are also contemplating vessels up to 8200 TEUS capacity on this service. All of these vessels will be tide bound when fully loaded as is expected.
CMA CGM has close to 80 vessels on order and most of these are large vessels with capacities of up to 13,500 TEUS. These vessels will probably trade on the Asia – Europe services, however this will free up vessels in the 8000 -12000 TEU range.
Once the new Panama Canal is opened we expect to see all of our Asian strings of vessels move to deploy vessels in the 8000 TEU + range to gain the economies of scale.
We need to have the Savannah River deepened to safely accommodate vessels of this size. The same vessels that are expected to work on the East Coast are currently working on our transpacific services and their arrival drafts are in the 46 – 47ft range. We support the move by the GPA to go to 48ft without tidal restrictions. We are concerned today that our deep drafted vessels may encounter problems in the river forcing them to anchor, with vessels this size it would be a problem and they would ground at low water. Savannah has restrictions surrounding the LNG Terminal as well as frequent fog on the river that can impede navigation.
Savannah today enjoys an enviable reputation as one of the few preferred major ports on the East Coast for Asian imports. Many of our customers have a preference for Savannah as the preferred South Atlantic Port and have developed large Distribution Facilities in the area.

CMA CGM (America) LLC
300 Lighting Way – 2nd Floor - Secaucus, NJ 07094 – Tel: (201) 770-5200

We wish to continue supporting the Port of Savannah and the customers who want their cargo to go over the port, however to do this in the coming years with the large vessels that we are planning to deploy, we must have the river dredged to at least 48ft to enable our vessels to safely transit the river and berth at the Port of Savannah.

Yours Truly,

Ian S Cairns
Vice President Terminal Strategy & Development

CMA CGM (America) LLC
300 Lighting Way – 2nd Floor – Secaucus, NJ 07094 – Tel: (201) 770-5200

July 6, 2009

To Whom It May Concern

.....

Dear John,

At present, the Savannah River's draft of 42 feet is restrictive, and insufficient for our vessels 'currently' deployed to your port, it forces deeper draft vessels to arrive and depart on high water; thus, the vessel operator MUST schedule there arrivals to coincide with high water and there departures limited by the same restrictions This restriction significantly impacts Maersk's ability to berth at the appropriate times (contractual ILA start times) and as a consequence incur additional ports expenses. Most importantly, if the berth is NOT available - which occurred only this weekend (4th July) there is a significant 'knock on' affect which impacts multiple vessels. Working around high water arrival and departures is far from optimal and is most certainly does not allow Maersk to fully utilize our assets, this situation will no doubt curtail Savannah's ability to grow as a port, both for our benefit and that of the community.

Maersk currently operates a fleet with over 500 container ships of which approximately 100 are considered post panamax (6,000+ teu), and we continue to build vessels of 1305 feet long, 185 feet wide, 52 feet draft, and 11,000+ teu which are the largest in our fleet. According to AXS Alphaliner and other shipping reports, by January 2013, there will be a total of 204 vessels of 10,000 teu class sailing the oceans.

In 2015, the Panama Canal expansion will have been completed and vessels of 10,000 teu and higher will have the ability to transit the canal and thus companies such as Maersk will be able to utilize their larger tonnage to the East Coast of the United States and take advantage of that which the benefits of economy of scale can bring.

Should Maersk decide to deploy these vessels to the East Coast of the United States (USEC), they will call ports which offer the minimum of restrictions. Those ports which cannot accommodate these vessels for any reason whether these are 'river' ports or not will not be considered as part of the port rotation. Under the current conditions at the Port of Savannah I do not foresee these class of vessels calling your port.

As previously stated our vessels currently deployed to Savannah incur draft restrictions both on arrival and departure. In the recent past (prior to global economic downturn) we have had to chose between 'bunkering' our vessel or reducing cargo intake to draft restrictions.

Dredging the river to 48 feet we believe is a minimum requirement in order to sustain the schedule requirements of our business. The tide window is too short to move large vessels in and out of port where the transit time itself is close the the tidal changes - transit time pilot to berth 3 - 4 hours, low water to high water 6 hours.

We must also consider the width of these large vessels, in the case of our largest vessels - 185 feet. Post Panamax vessels will require more width than is presently available on the Savannah River for these large vessels to safely pass each other. This situation severely impacts the amount of traffic which can actually move in/out on any tide. We have also experienced this first hand as it exist today where river traffic comes to a stand still when a vessel is maneuvering with the confines of the LNG tanker facility.

The dredging (deepening and widening) of the Savannah River is long over due, and we Maersk support fully supports this project.

Your Truly,

Alan A. McCalmont.
Director.
North American Vessel Operations.
Maersk Inc.
9300, Arrowpoint Boulevard.
Charlotte, NC. 28273-8136.
Reg. No. 13-5159146
704-571-5324 (office)
704-243-4917 (home)
201-914-9007 (mobile)
Nammarmng@maersk.com
www.maersk.com

Mediterranean Shipping Company S.A.
700 Watermark Blvd.,
Mt. Pleasant, S.C. 29464
843-971-4100

July 6, 2009

Curtis J. Foltz, COO
Georgia Port Authority
P.O. Box 2406
Savannah, Ga. 31402
912-963-5563

Dear Curtis,

MSC has deployed post panamax vessels on services which have called at Savannah the past two years.

These vessels were the 5900 teu and 6700 class of vessels [LOA = 983 x Bdth 131 x max draft 47.5ft]; throughout 2007 we had so many problems operating these vessels at Savannah, that we decided to withdraw the services in 2008 and transship the cargo onto alternate services.

The main problems encountered were delays operating in / out of the Savannah River, with drafts in the range of 41 - 42ft. At these drafts the vessels have to arrive and sail on the high water and must 'ride' the tide to / from the berth to/from the Sea bouy.

We suffered untold delays when we were unable to dock our vessels because there was no berth available which coincided with the tide, meaning we had to wait for the following tide, and a further 12 hour delay.
In addition, due to the narrow width of the Savannah River, there were and are issues with vessels passing each other. This limits traffic to one way only, which severely restricts the amount of vessels which can actually move in / out on any one tide.

This situation is further compounded with the additional width of the post panamax vessels. There is just not sufficient room for these vessels to safely pass each other along many sections of the river.

The tidal restrictions have caused significant increases in operating costs, caused MSC to by-pass ports, leave cargo behind, missed Panama Canal appointments and overall severely disrupted vessel network integrity around the World which in turn have and more importantly will not service the trade in the future.

The current 41 ft max draft restriction at Savannah, translates into 18,000 tons less cargo on board one of our 6700teu class vessels.

MSC currently operates a fleet of over 400 vessels, including 93 post panamax vessels.

MSC has a new building program which includes a number of vessels of +10,000 teu class [LOA = 1200ft x Bdth 167ft x max draft 50.8ft].

According to AXS Alphaliner and other shipping consultants, by Jan 2013, there will be a total of 204 vessels of the 10,000 teu Class in existence.

In 2015, the third set of locks at the Panama Canal will be completed and will be in operation.
The 10,000 teu Class of vessel will be able to transit these locks and pass through the canal. It is therefore safe to assume, that all the shipping lines which have constructed these vessels will deploy them on their Asia - E Coast USA services, to take advantage of the economies of scale that they bring and which they were built for.

Economies of scale only work if vessels are loaded to capacity.

When MSC deploys these vessels, they will call at the ports which have in place the infrastructure which can handle them with minimal restrictions.
We will avoid any port, which imposes restrictions which increase the risk of delays and which limits our ability to fully maximize the cargo carrying capacity of the vessel.

Savannah will not be able to handle this class of vessel unless the harbor is deepened to a minimum of 48 ft.

We have already experienced what happens in this harbor with deep drafted vessels of a much smaller post panamax class; trying to enter and depart using tide windows, just DOES NOT WORK. There is not enough time with a tide window to move all the vessels in /out and if one fails to move it then creates a whole back log of traffic / delays and additional costs to the shipping line.

It causes delays detentions and increased operating costs and reduced cargo capacity.

Imagine what it would be like with a 10,000 teu class, 1200 ft x 167 ft size vessel!

Sincerely

C J Parvin
VP Marine Operations

NYK Line (North America) Inc.

Corporate Headquarters
300 Lighting Way, 5th Floor
Secaucus, New Jersey 07094
Telephone: 201-330-3000
Fax: 201-330-9751

July 6, 2009

Mr. Curtis J. Foltz
Chief Operating Officer
Georgia Ports Authority
P.O. Box 2406
Savannah, GA 31402

Re: Savannah Harbor Deepening

Dear Mr. Foltz,

The Savannah River's current draft of 42 feet, at times, has become extremely restrictive and forced NYK to sail (arrival and/or departure) our deeper draft vessels at solely high tide. The restriction caused by your current draft significantly impacts NYK Line's ability to maintain our vessel /berth schedule, labor orders, and most importantly the vessels booking for the transit through the Panama Canal.

In today's environment, we must maximize use of all vessels and the ports which they call. Our service proforma's are based on fixed days and times and can not be set based upon a ports river tidal swing.

As we approach the Panama Canal's (2014) ability to handle 8,000 plus teu vessels, NYK is looking for those strategic partners who can handle these larger type vessels without any sort of navigational restrictions. Those ports whose rivers may have any navigational restrictions will be avoided or eliminated from our service rotations for those larger vessels.

The Savannah River must be deepened to no less than 48 Feet (MLW). Without this deepening, NYK would be unable to bring in larger class vessels (8000 teus) into the port of Savannah.

Sincerely,

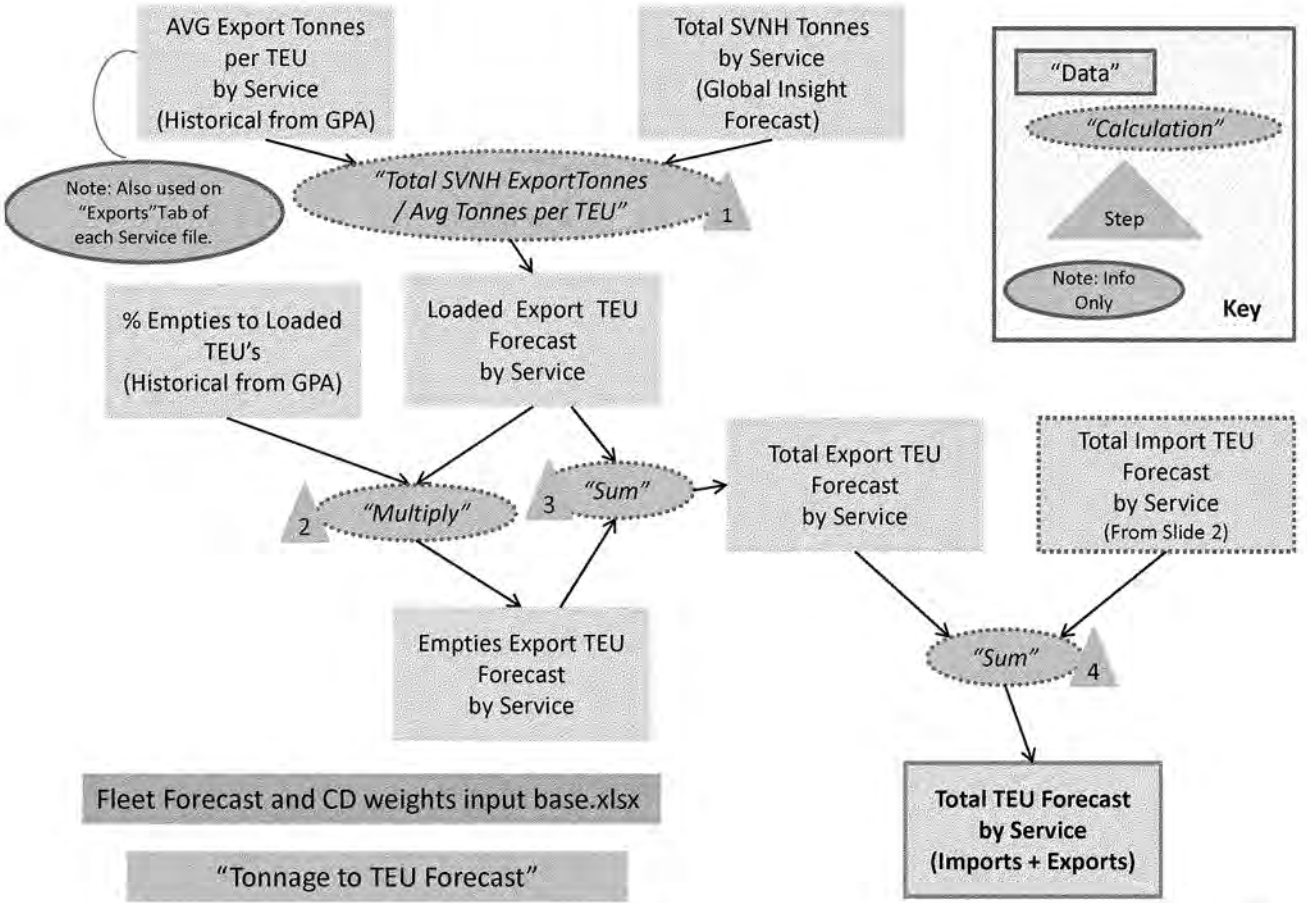
Dan Sheehy
Director of Marine and Terminal Operations
NYK Line (North America) Inc.
300 Lighting Way
Secaucus, NJ 07094

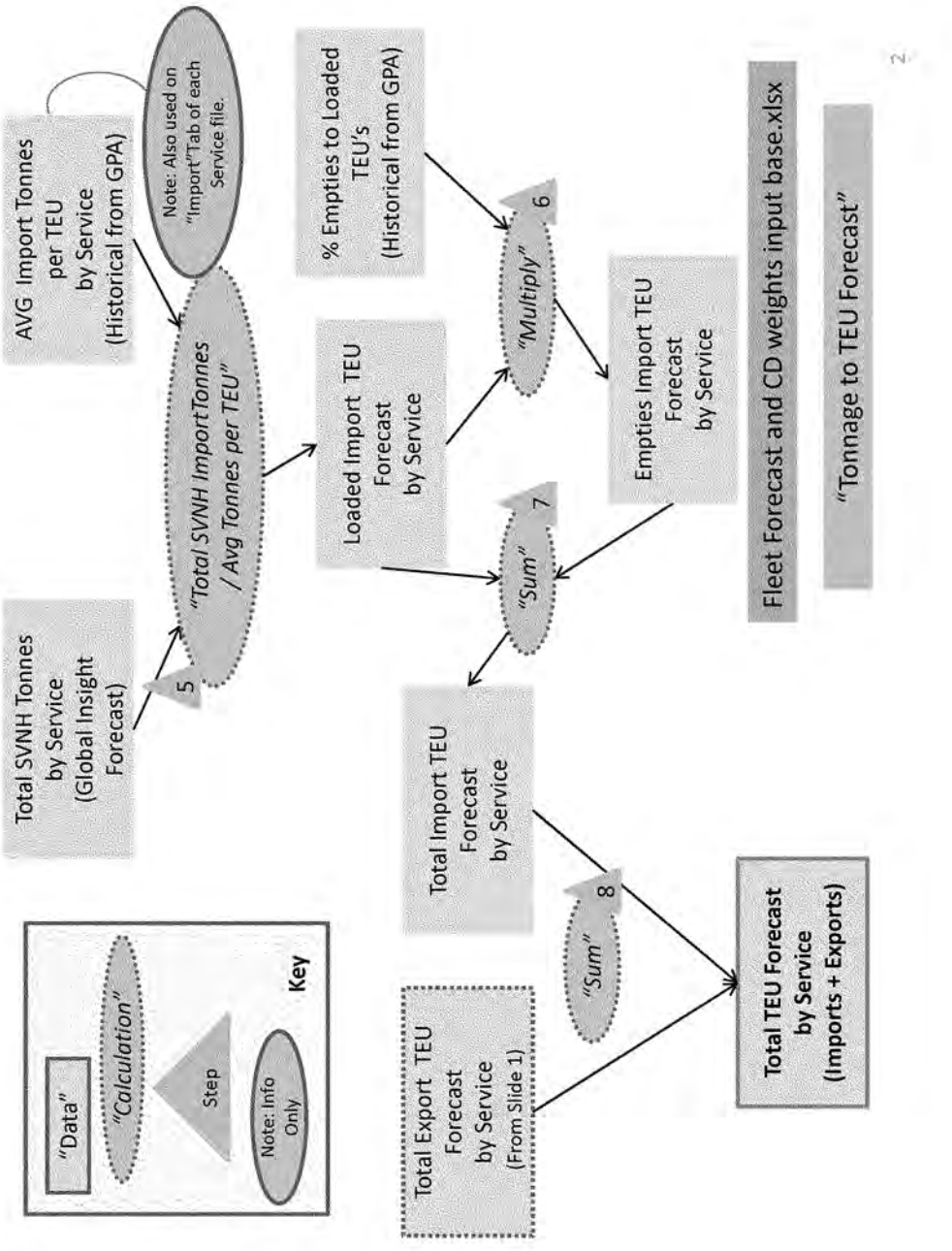
GENERAL RE-EVALUATION REPORT
APPENDIX A: ECONOMICS
SAVANNAH HARBOR EXPANSION PROJECT
Chatham County, Georgia and Jasper County, South Carolina

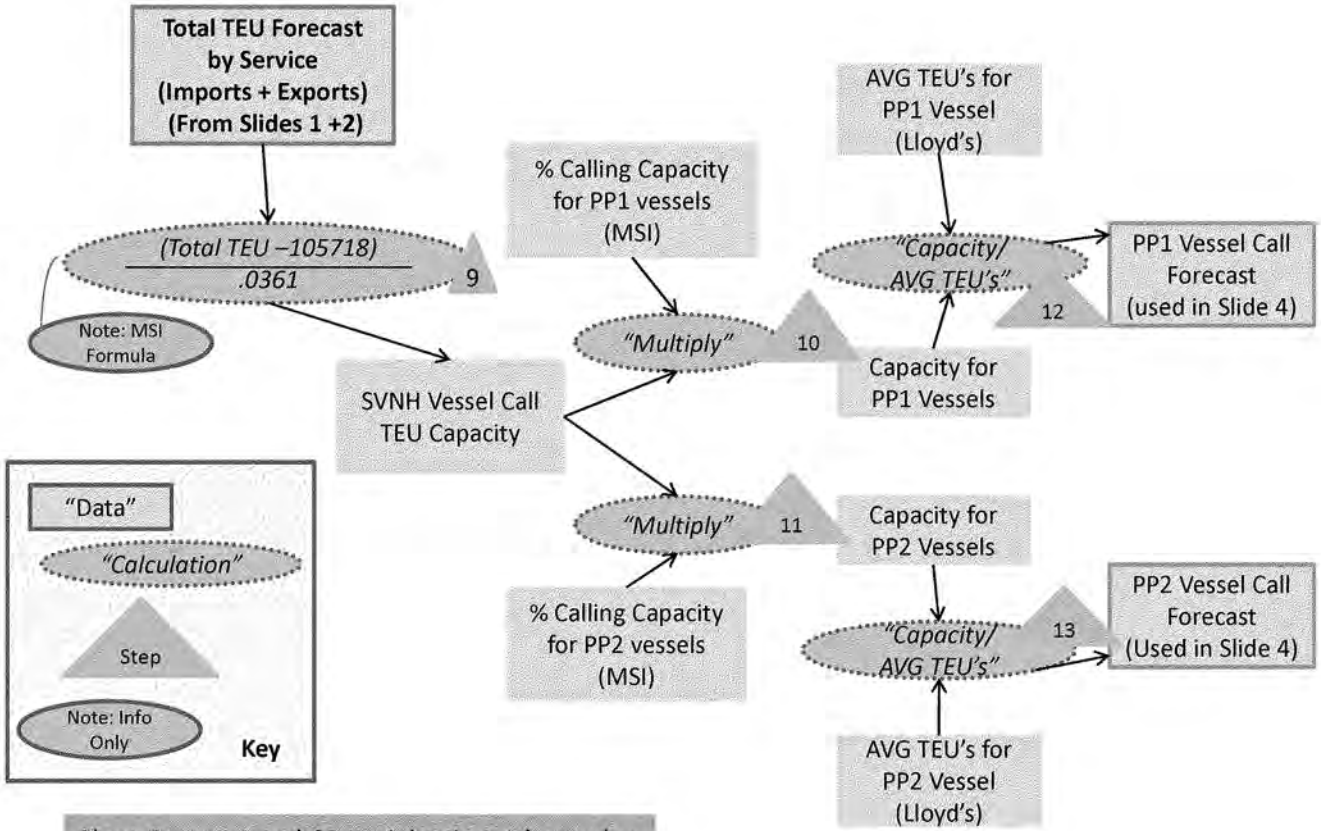
January 2012

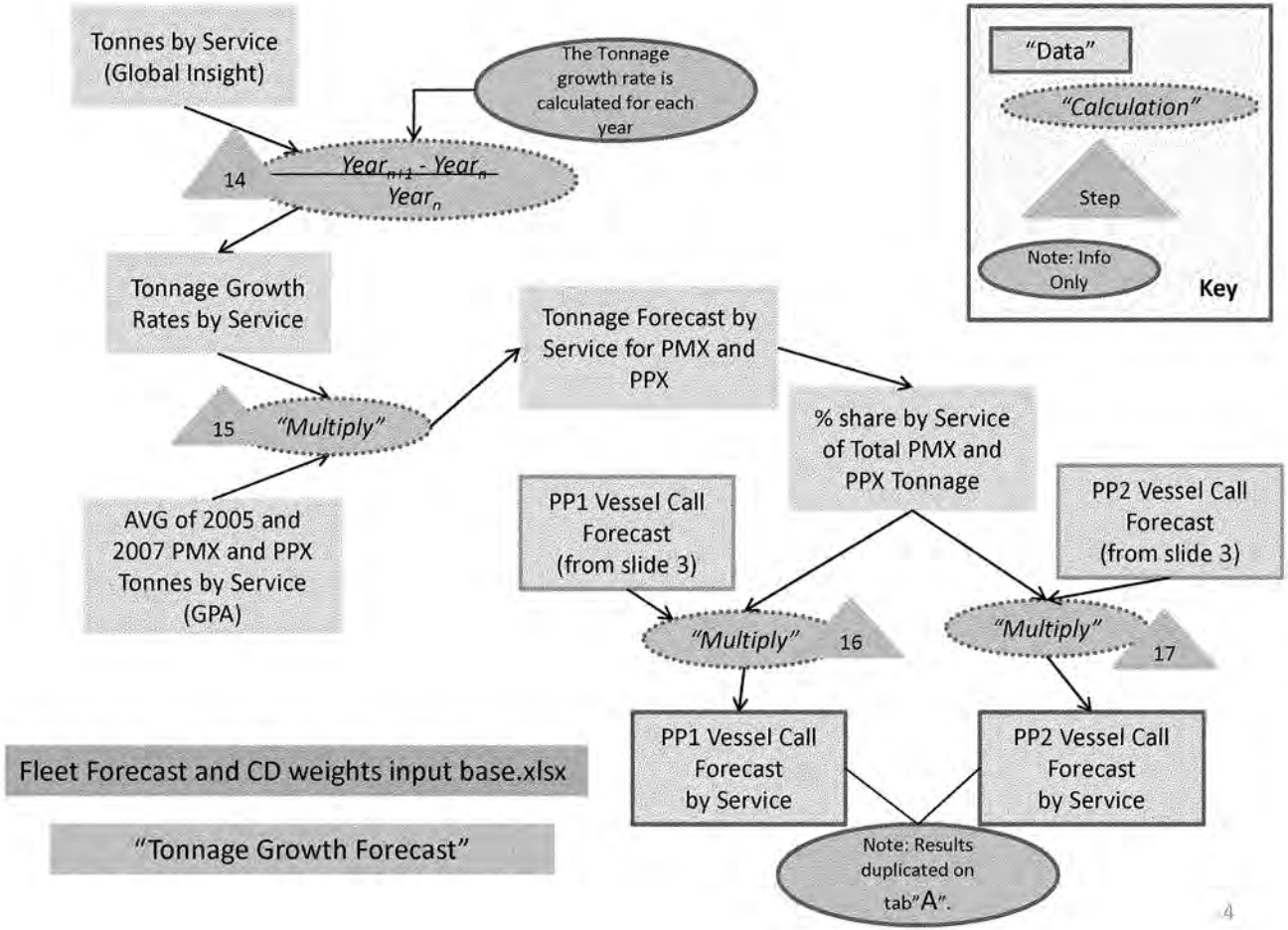
ATTACHMENT 2
Transportation Cost Savings
Model Flow Chart

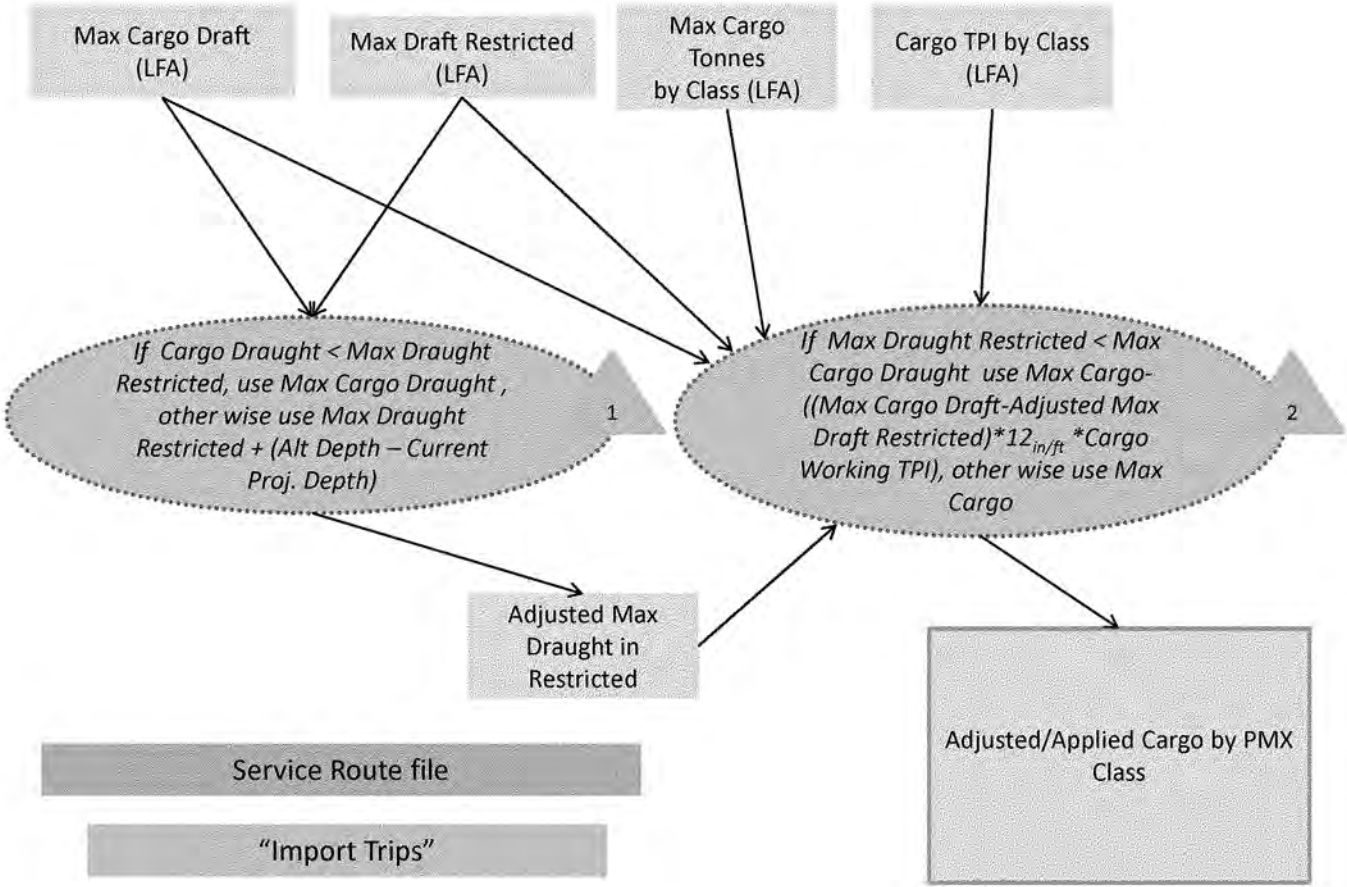
US Army Corps
of Engineers
Savannah District
South Atlantic Division

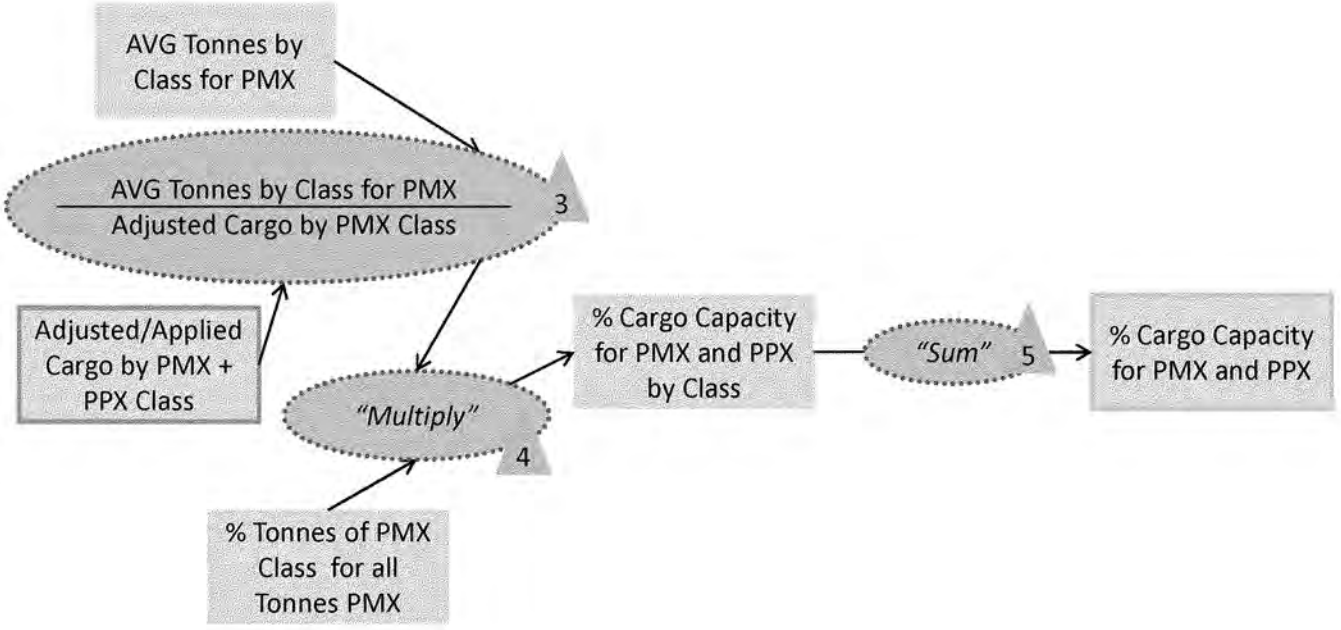

AVG Export Tonnes per TEU by Service (Historical from GPA)
Total SVNH Tonnes by Service (Global Insight Forecast)
Note: Also used on "Exports"Tab of each Service file.
"Total SVNH ExportTonnes / Avg Tonnes per TEU"
1
"Data"
"Calculation"
Step
Note: Info Only
Key
% Empties to Loaded TEU's (Historical from GPA)
Loaded Export TEU Forecast by Service
2
"Multiply"
3
"Sum"
Total Export TEU Forecast by Service
Total Import TEU Forecast by Service (From Slide 2)
Empties Export TEU Forecast by Service
"Sum"
4
Fleet Forecast and CD weights input base.xlsx
"Tonnage to TEU Forecast"
Total TEU Forecast by Service (Imports + Exports)


Total SVNH Tonnes by Service (Global Insight Forecast)
5
"Total SVNH ImportTonnes / Avg Tonnes per TEU"
AVG Import Tonnes per TEU by Service (Historical from GPA)
Note: Also used on "Import"Tab of each Service file.
Loaded Import TEU Forecast by Service
% Empties to Loaded TEU's (Historical from GPA)
"Multiply"
6
Empties Import TEU Forecast by Service
"Sum"
7
Total Import TEU Forecast by Service
Total Export TEU Forecast by Service (From Slide 1)
"Sum"
8
Total TEU Forecast by Service (Imports + Exports)
Fleet Forecast and CD weights input base.xlsx
"Tonnage to TEU Forecast"
Key
"Data"
"Calculation"
Step
Note: Info Only


Total TEU Forecast by Service (Imports + Exports) (From Slides 1 +2)
(Total TEU –105718) / .0361
9
Note: MSI Formula
% Calling Capacity for PP1 vessels (MSI)
AVG TEU's for PP1 Vessel (Lloyd's)
"Capacity/ AVG TEU's"
12
PP1 Vessel Call Forecast (used in Slide 4)
"Multiply"
10
Capacity for PP1 Vessels
SVNH Vessel Call TEU Capacity
"Multiply"
11
Capacity for PP2 Vessels
% Calling Capacity for PP2 vessels (MSI)
"Capacity/ AVG TEU's"
13
PP2 Vessel Call Forecast (Used in Slide 4)
AVG TEU's for PP2 Vessel (Lloyd's)
"Data"
"Calculation"
Step
Note: Info Only
Key
Fleet Forecast and CD weights input base.xlsx
"Essential MSI Adjusted"

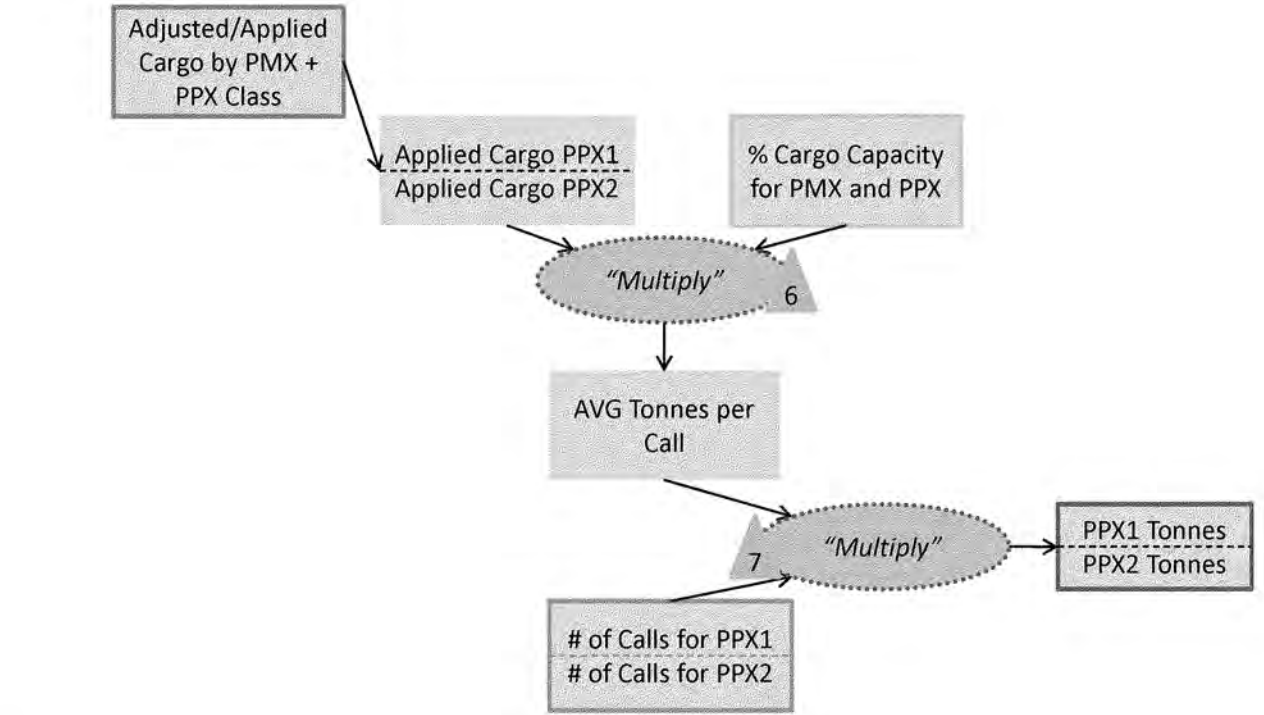

Tonnes by Service (Global Insight)
The Tonnage growth rate is calculated for each year
14
$\frac{Year_{n+1} - Year_n}{Year_n}$
Tonnage Growth Rates by Service
15
"Multiply"
AVG of 2005 and 2007 PMX and PPX Tonnes by Service (GPA)
Tonnage Forecast by Service for PMX and PPX
% share by Service of Total PMX and PPX Tonnage
PP1 Vessel Call Forecast (from slide 3)
PP2 Vessel Call Forecast (from slide 3)
"Multiply"
16
"Multiply"
17
PP1 Vessel Call Forecast by Service
PP2 Vessel Call Forecast by Service
Note: Results duplicated on tab"A".
"Data"
"Calculation"
Step
Note: Info Only
Key
Fleet Forecast and CD weights input base.xlsx
"Tonnage Growth Forecast"

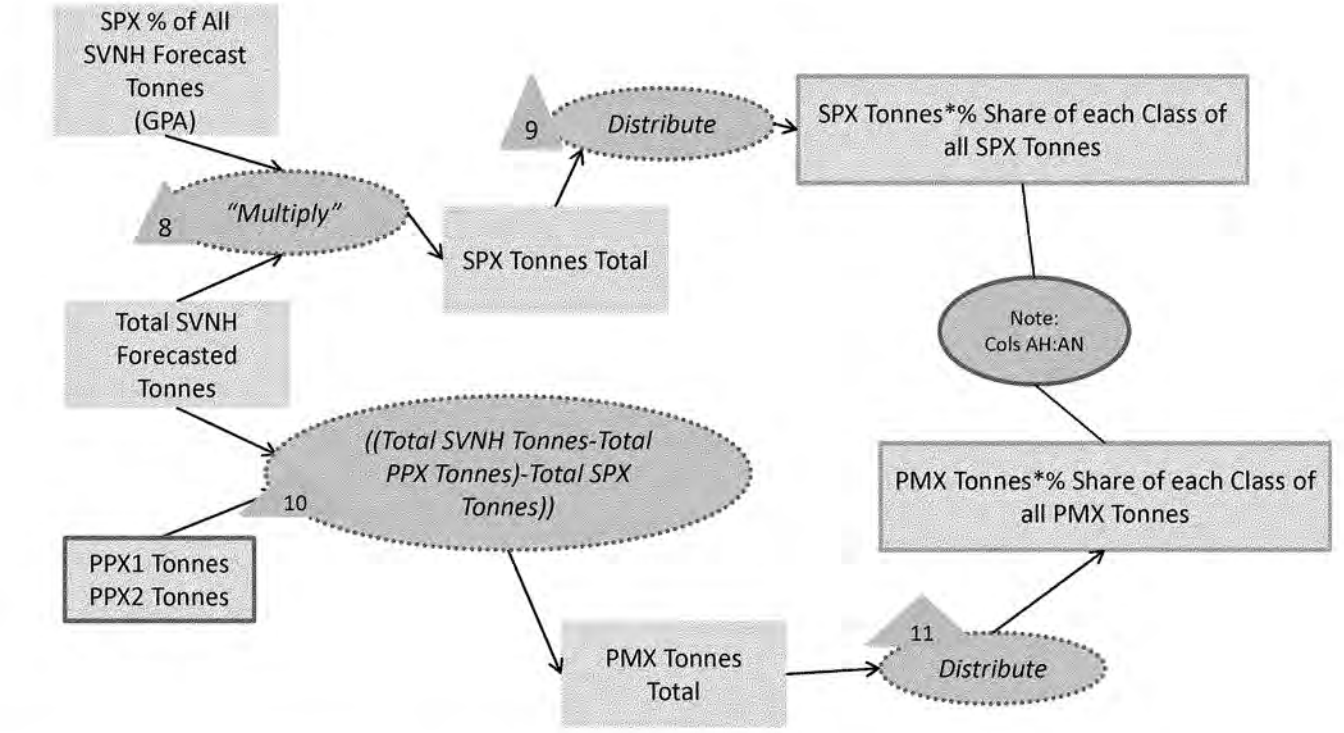

Max Cargo Draft (LFA)
Max Draft Restricted (LFA)
Max Cargo Tonnes by Class (LFA)
Cargo TPI by Class (LFA)
If Cargo Draught < Max Draught Restricted, use Max Cargo Draught , other wise use Max Draught Restricted + (Alt Depth – Current Proj. Depth)
1
If Max Draught Restricted < Max Cargo Draught use Max Cargo-((Max Cargo Draft-Adjusted Max Draft Restricted)*12in/ft *Cargo Working TPI), other wise use Max Cargo
2
Adjusted Max Draught in Restricted
Adjusted/Applied Cargo by PMX Class
Service Route file
"Import Trips"

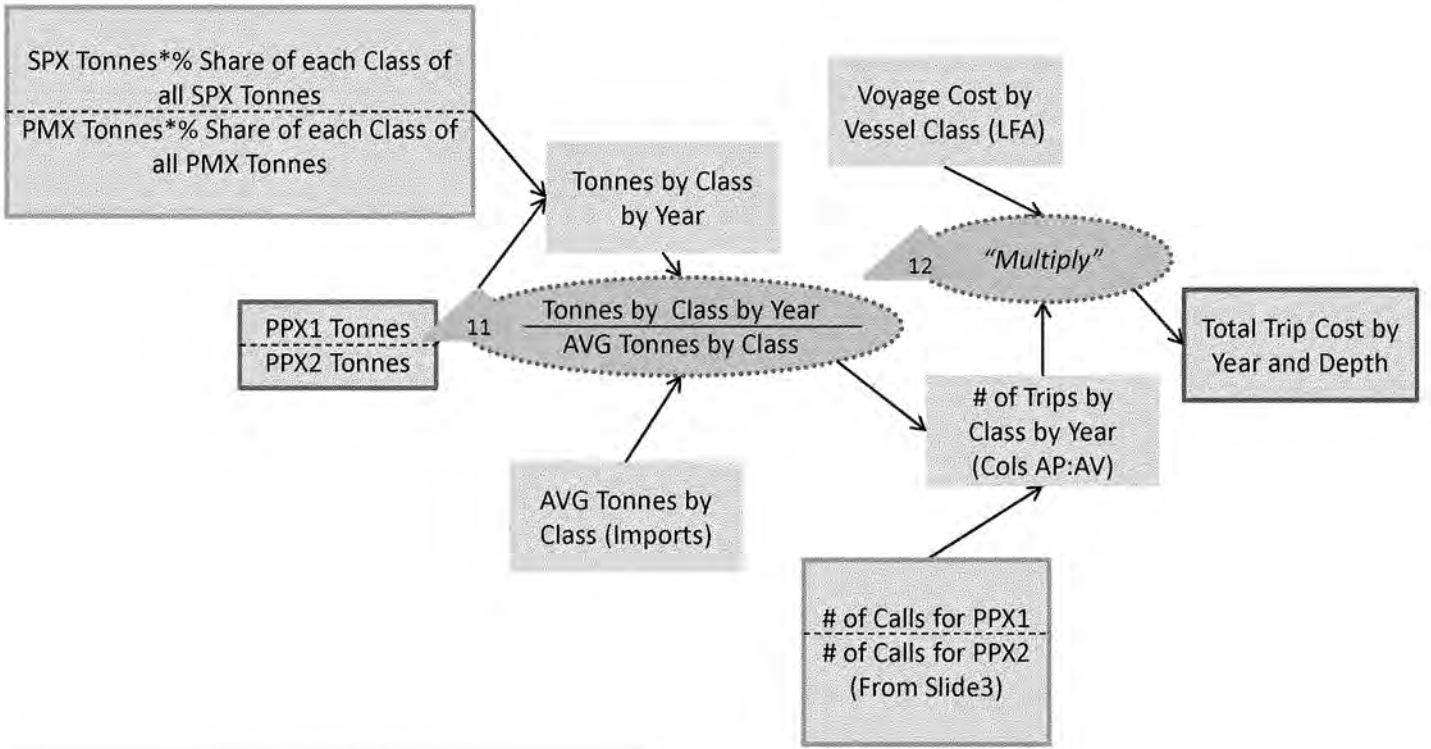


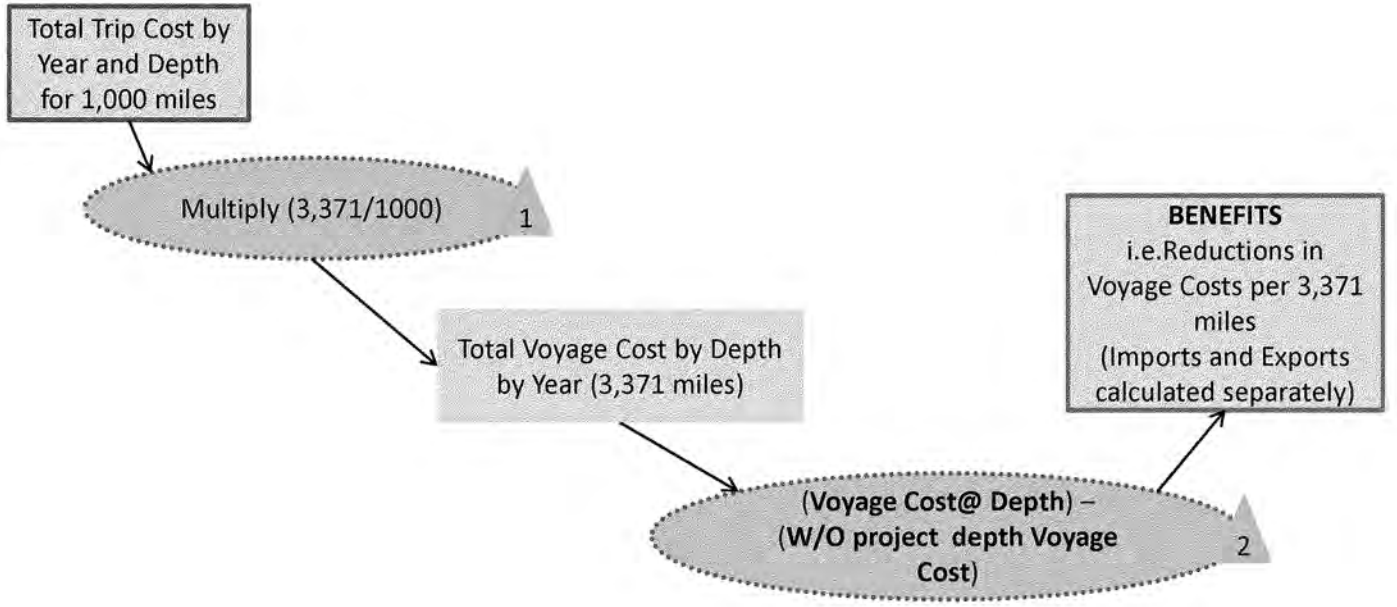
Service Route file

"Import Trips"


Adjusted/Applied Cargo by PMX + PPX Class
Applied Cargo PPX1
Applied Cargo PPX2
% Cargo Capacity for PMX and PPX
"Multiply"
6
AVG Tonnes per Call
"Multiply"
7
PPX1 Tonnes
PPX2 Tonnes
# of Calls for PPX1
# of Calls for PPX2
Service Route file
"Import Trips"

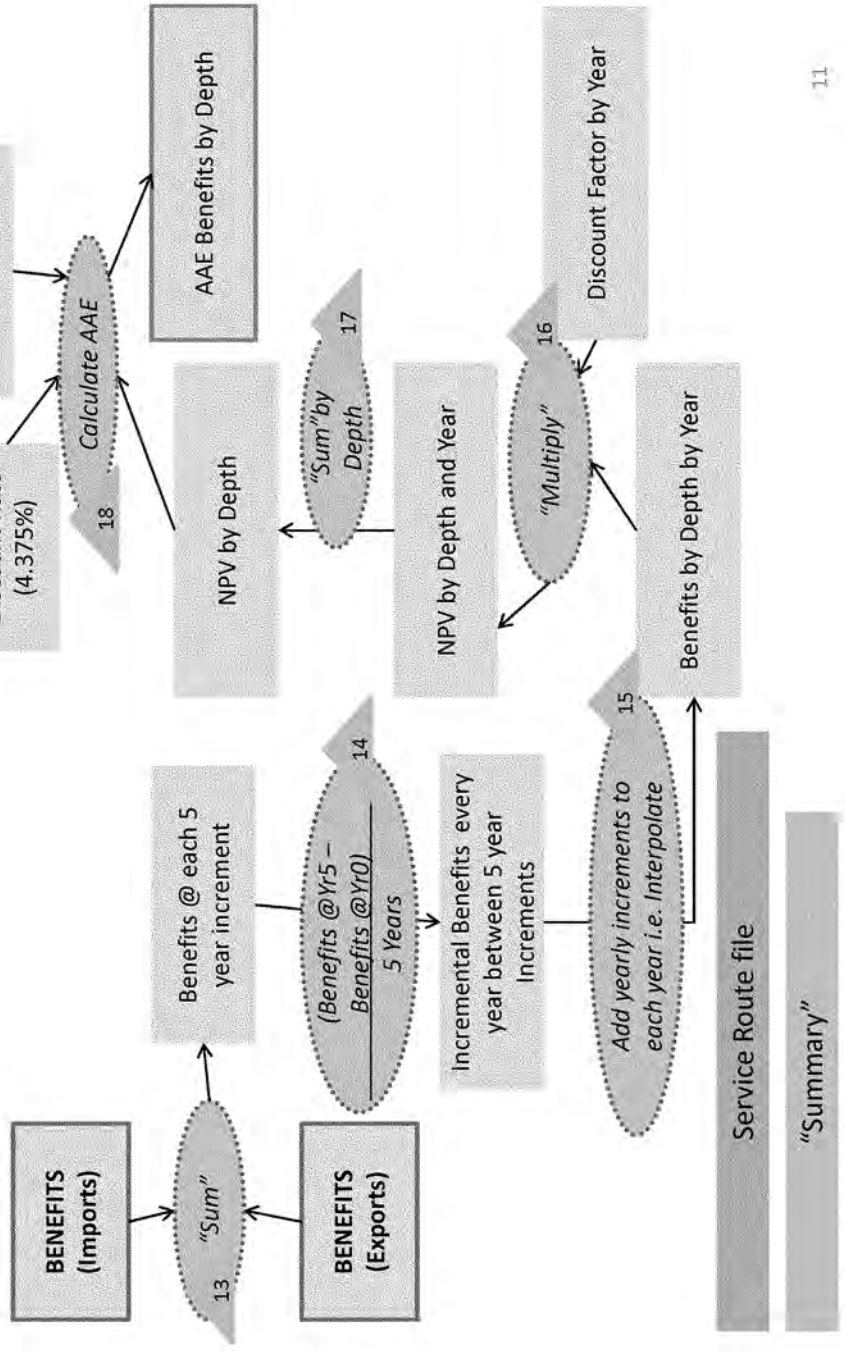

SPX % of All SVNH Forecast Tonnes (GPA)
8
"Multiply"
Total SVNH Forecasted Tonnes
SPX Tonnes Total
9
Distribute
SPX Tonnes*% Share of each Class of all SPX Tonnes
Note: Cols AH:AN
((Total SVNH Tonnes-Total PPX Tonnes)-Total SPX Tonnes))
10
PPX1 Tonnes
PPX2 Tonnes
PMX Tonnes Total
11
Distribute
PMX Tonnes*% Share of each Class of all PMX Tonnes
Service Route file
"Import Trips"


SPX Tonnes*% Share of each Class of all SPX Tonnes
PMX Tonnes*% Share of each Class of all PMX Tonnes
Tonnes by Class by Year
Voyage Cost by Vessel Class (LFA)
12
"Multiply"
PPX1 Tonnes
PPX2 Tonnes
11
Tonnes by Class by Year
AVG Tonnes by Class
Total Trip Cost by Year and Depth
# of Trips by Class by Year (Cols AP:AV)
AVG Tonnes by Class (Imports)
# of Calls for PPX1
# of Calls for PPX2
(From Slide3)
Service Route file
"Import Trips"



Service Route file

"Summary"


BENEFITS (Imports)
BENEFITS (Exports)
13 "Sum"
Benefits @ each 5 year increment
14 (Benefits @Yr5 – Benefits @Yr0) / 5 Years
Incremental Benefits every year between 5 year Increments
15 Add yearly increments to each year i.e. Interpolate
Benefits by Depth by Year
16 "Multiply"
Discount Factor by Year
NPV by Depth and Year
17 "Sum" by Depth
NPV by Depth
Discount Rate (4.375%)
Period of Analysis (50 Years)
18 Calculate AAE
AAE Benefits by Depth
Service Route file
"Summary"
11

GENERAL RE-EVALUATION REPORT
APPENDIX A: ECONOMICS
SAVANNAH HARBOR EXPANSION PROJECT
Chatham County, Georgia and Jasper County, South Carolina

January 2012

ATTACHMENT 3
Certification Documentation for Use of HarborSym

US Army Corps of Engineers
Savannah District
South Atlantic Division

DEPARTMENT OF THE ARMY
MOBILE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 2288
MOBILE, AL 36628-0001

CESAM-PD-FE 14 April 2011

MEMORANDUM FOR, MS.STACY BROWN, (CECW-SAD), 441 G STREET, NW, WASHINGTON, DC 20314

SUBJECT: Certification and Completion of Agency Technical Review and Model Certification – Approval for Use – HarborSym Model for, General Re-Evaluation Report - Savannah Harbor Expansion Project, Chatham County, Georgia and Jasper County, South Carolina

1. References:

a. EC 1165-2-209, "Civil Works Review Policy," 31 January 2010.
b. EC 1105-2-412, "Assuring Quality of Planning Models," 20 July 2009.
c. EC 1105.2.407, "Planning Models Improvement Program: Model Certification," 31 May 2005.
d. Memorandum, CECW-CP, 30 March 2007, Subject: Peer Review Process.
e. Supplemental information for the "Peer Review Process," Memo, dated March 2007.

2. The PCX concurs that such peer review of the HarborSym Model has been completed. All comments resulting from the ATR and Approval for Use have been documented, evaluated and responded to by the Mobile District PDT, in DrChecks. All comments have been back-checked, all outstanding issues have been addressed and closed by the ATR reviewer.

3. The point of contact is Mr. Bernard E. Moseby, CESAM-PD-FE, (251) 694-3884.

Encls

BERNARD E. MOSEBY
Technical Director
Deep Draft Navigation Planning Center Expertise

CF:
CECW-SAD/SCHWICHTENBERG
CESAD-PD-S/PAYNES
CESAD-PD-S/SMALL
CESAD-PD-S/STRATTON

GENERAL RE-EVALUATION REPORT
APPENDIX A: ECONOMICS
SAVANNAH HARBOR EXPANSION PROJECT
Chatham County, Georgia and Jasper County, South Carolina

January 2012

ATTACHMENT 4
GEC Multiport Analysis for the
Savannah Harbor Expansion Project

US Army Corps
of Engineers
Savannah District
South Atlantic Division

Final Report

SAVANNAH HARBOR EXPANSION PROJECT

MULTIPORT ANALYSIS FOR THE SAVANNAH HARBOR EXPANSION PROJECT

US Army Corps of Engineers
Savannah District
Savannah, Georgia

Final Report

SAVANNAH HARBOR EXPANSION PROJECT

MULTIPORT ANALYSIS FOR THE SAVANNAH HARBOR EXPANSION PROJECT

Contract No. DACA-03-02-D-0003
Delivery Order No. 0015
GEC Project No. 22312115

Prepared by

GEC
Gulf Engineers & Consultants
9357 Interline Avenue
Baton Rouge, Louisiana 70809
Phone – 225/612-3000

U.S. ARMY CORPS OF ENGINEERS
SAVANNAH DISTRICT
SAVANNAH, GEORGIA

July 31, 2006

TABLE OF CONTENTS

TABLE OF CONTENTS

Section		Page
I	EXECUTIVE SUMMARY	1
II	INTRODUCTION	3
III	METHODOLOGY	4
IV	DETERMINE ECONOMIC STUDY AREA (Task 1)	7
V	HISTORIC VOLUMES AND COMMODITY FLOWS OF SOUTH ATLANTIC PORTS: 1995-2003 (Task 2)	10
	Savannah	10
	Charleston	12
	Jacksonville	15
	Wilmington	17
	Norfolk	20
	World Region Totals	22
	Commodity Flows	26
VI	SOUTH ATLANTIC WATERBORNE COMMERCE TO 2050 (Task 3)	29
	Savannah	29
	Charleston	39
	Jacksonville	48
	Wilmington	48
	Norfolk	48
VII	VESSEL FLEET COMPOSITION OF SOUTH ATLANTIC PORTS (Task 4)	57
	Norfolk	57
	Charleston	61
	Wilmington	63
	Jacksonville	64
VIII	CURRENT COST OF COMMODITY MOVEMENTS – SAVANNAH HARBOR WITHOUT-PROJECT CONDITIONS (Task 5)	66
	Sea Cost	66
	Calculating Sea Cost	68
	Port Cost	69

TABLE OF CONTENTS (cont'd)

Section		Page
	Land Transportation Cost	70
	Calculating Truck Cost	73
	Direct Rail Services	76
	Calculating Rail Cost	77
	Total Delivered Transportation Cost	82
IX	DETERMINE CURRENT COST OF ALTERNATIVE IMPROVEMENT (Task 6)	83
	Mid-Atlantic and South Atlantic Ports Sea Cost	84
	Mid-Atlantic and South Atlantic Port Costs	84
	Mid-Atlantic and South Atlantic Port Comparison for Truck Cost	84
	Mid-Atlantic and South Atlantic Port Comparison for Total Cost	86
	Least Total Transportation Cost	86
	Hinterland Cities Less than $50 Difference in Total Cost (Without Project)	86
X	DETERMINE FUTURE COST OF COMMODITY MOVEMENTS – SAVANNAH HARBOR WITH-PROJECT CONDITIONS (Task 7)	93
	Calculating With-Project Port and Land Cost	94
	Calculating With-Project Total Cost	95
	Calculating With-Project Least Cost	95
	Hinterland Cities, Less than $50 Difference in Total Cost (45 Foot Project)	96
XI	DETERMINE USE OF HARBOR AND CHANNEL WITH-PROJECT AND WITHOUT-PROJECT	98
XII	COMPUTE NED BENEFITS (Task 9)	102
XIII	SUMMARY	103
Appendix A:	MATERIALS FOR SECTION VIII	A-1
Appendix B:	MATERIALS FOR SECTION IX	B-1
Appendix C:	MATERIALS FOR SECTION X	C-1
Appendix D:	GROWTH TRENDS IN SELECTED FOREIGN PORTS	D-1
Appendix E:	COMMENTS AND RESPONSES	E-1

LIST OF TABLES

Number		Page
1	Highway Mileages for Major South East U.S. Ports and Hinterlands	8
2	Incremental Highway Mileages for Major South East U.S. Ports and Hinterlands	8
3	CTs of Imports to South Atlantic Ports, by Selected World Regions, 1995-2003	24
4	TEUs of Imports to South Atlantic Ports, by Selected World Regions, 1995-2003	24
5	CTs of Exports from South Atlantic Ports, by Selected World Regions, 1995-2003	25
6	TEUs of Exports from South Atlantic Ports, by Selected World Regions, 1995-2003	25
7	CTs of Imports to South Atlantic Ports from Selected World Regions, by Commodity, 1995-2003	27
8	TEUs of Imports to South Atlantic Ports from Selected World Regions, by Commodity, 1995-2003	27
9	CTs of Exports to South Atlantic Ports from Selected World Regions, by Commodity, 1995-2003	27
10	TEUs of Exports to South Atlantic Ports from Selected World Regions, by Commodity, 1995-2003	27
11	Savannah Harbor Major Container Liner (2003)	58
12	Ports of Virginia Major Container Lines (June and July 2005	59
13	Norfolk International Terminal's Leading Lines and Their Vessels	60
14	Port of Charleston Major Container Lines (January and February 2005)	61
15	Port of Wilmington Major Container Lines (July 2005)	64
16	Port of Jacksonville Major Container Lines (June 2005)	64
17	Port Leg Nautical Distances Eastbound	67
18	Port Leg Nautical distances Westbound	68
19	Current Sea Cost for Benefiting Trade Routes, Calling Savannah Harbor ($/TEC)	69

LIST OF TABLES (cont'd)

Number		Page
20	Port Cost for Five South Atlantic Ports	69
21	Highway Distances in Miles from Port Cities to Hinterland Cities	73
22	Incremental Highway Mileages for Major Southeast U.S. Ports and Hinterlands	74
23	Average Distances in Miles Traveled from Each Southeastern Port	75
24	Truck Costs for Savannah Associated with Hinterland Cities	75
25	Estimated Rail Terminal-to-Terminal Hinterland Rates ($/FEU)	80
26	Estimated Rail/Truck Intermodal Port to Hinterland Terminal Rates ($/FEU	80
27	Estimated Rail/Truck Intermodal Port to Hinterland Terminal Rates (R/TEU)	81
28	Savannah Harbor Total Cost, Existing Conditions, Inbound FE ECUS MED PEN	82
29	Wilmington Sea Cost for Benefiting Services	83
30	Port Costs for Five Mid-Atlantic and South Atlantic Ports, FE ECUS MED PEN	84
31	Truck Costs for Norfolk Associated with Hinterland Cities	85
32	Land Cost per TEU Based on Truck Cost for Five Mid-Atlantic and South Atlantic Ports	85
33	Incremental Differences in Least Cost for Competing Ports at 42 Feet, Inbound FE ECUS MED PEN	87
34	Savannah Sea Costs Based on 45-Foot Depth	94
35	Average Total Sea Cost for Savannah Harbor for Three World Trade Routes, With-Project Conditions ($/TEU)	94
36	Savannah Total Cost for Hinterland, 45 Feet, Inbound, FE ECUS MED PEN	95
37	Incremental Differences in Least Cost for Competing Ports, 45 Feet, Inbound, FE ECUS MED PEN	96
38	Savannah Harbor Least Total Incremental Cost, Import Containers, 42-Foot Project ($/TEU)	98

LIST OF TABLES (cont'd)

Number		Page
39	Vessel Cost Savings by Project Depth for Benefiting Services ($/TEU)	100
40	Vessel Costs by Project Depth for Benefiting Services ($/TEU)	101

LIST OF FIGURES

Number		Page
1	Flowchart of Deep-Draft Navigation Benefit Evaluation Procedures (Multiport Analysis)	6
2	Domestic Hinterland for South Atlantic Coast Port Imports	9
3	CTs of Imports to Savannah, 1995-2003	10
4	TEUs of Imports to Savannah, 1995-2003	11
5	CTs of Exports from Savannah, 1995-2003	11
6	TEUs of Exports from Savannah, 1995-2003	12
7	CTs of Imports to Charleston, 1995-2003	13
8	TEUs of Imports to Charleston, 1995-2003	13
9	CTs of Exports from Charleston, 1995-2003	14
10	TEUs of Exports from Charleston, 1995-2003	14
11	CTs of Imports to Jacksonville, 1995-2003	15
12	TEUs of Imports to Jacksonville, 1995-2003	16
13	CTs of Exports from Jacksonville, 1995-2003	16
14	TEUs of Exports from Jacksonville, 1995-2003	17
15	CTs of Imports to Wilmington, 1995-2003	18
16	TEUs of imports to Wilmington, 1995-2003	18
17	CTs of Exports from Wilmington, 1995-2003	19
18	TEUs of Exports from Wilmington, 1995-2003	19
19	CTs of Imports to Norfolk, 1995-2003	20
20	TEUs of Imports to Norfolk, 1995-2003	20
21	CTs of Exports from Norfolk, 1995-2003	21

LIST OF FIGURES (cont'd)

Number		Page
22	TEUs of Exports from Norfolk, 1995-2003	
23	Historic Trends of Imports and Exports during 1995-2003 in CTs for the South Atlantic Ports: Major World Hinterlands	22
24	Historic Trends of Imports and Exports during 1995-2003 in TEUs for the South Atlantic Ports: Major World Hinterlands	23
25	CTs of Imports to South Atlantic Ports from North East Asia, 1995-2050	30
26	CTs of Imports to South Atlantic Ports from Oceania, 1995-2050	31
27	CTs of Imports for selected/Combined Trade Routes, by South Atlantic Ports, 1995-2003	32
28	TEUs of Imports to South Atlantic Ports from North East Asia, 1995-2003	33
29	TEUs of Imports to South Atlantic Ports from Oceania, 1995-2003	34
30	TEUs of Imports for Selected/Combined Trade Routes, by South Atlantic Ports, 1995-2050	35
31	TEUs of Imports for Selected/Combined Trade Routes, by Commodity, 1995-2050	36
32	CTs of Imports for Selected/Combined Trade Routes, by Commodity, 1995-2050	37
33	CTs of Exports for Selected/Combined Trade Routes, by Commodity, 1995-2050	38
34	TEUs of Exports for Selected/Combined Trade Routes, by Commodity, 1995-2050	38
35	CTs of Imports to South Atlantic Ports from Middle East/Mediterranean, 1995-2050	40
36	TEUs of Imports to Selected South Atlantic Ports, by South Atlantic Ports, 1995-2050	41
37	TEUs of Imports to South Atlantic Ports from Europe, 1995-2050	42

LIST OF FIGURES (cont'd)

Number		Page
38	TEUs of Imports to South Atlantic Ports from Middle East/Mediterranean, 1995-2050	43
39	CTs of Exports from South Atlantic Ports to Europe, 1995-2050	44
40	CTs of Exports from South Atlantic Ports to India/South East Asia, 1995-2050	45
41	CTs of Exports from South Atlantic Ports to Middle East/Mediterranean, 1995-2050	46
42	CTs of Exports for Selected/Combined Trade Routes, by South Atlantic Ports, 1995-2050	47
43	CTs of Imports to South Atlantic Ports from Europe, 1995-2050	49
44	CTs of Imports for Selected Commodities, Chemicals, by South Atlantic Ports, 1995-2050	50
45	CTs of Imports for Selected Commodities, Extractives, by South Atlantic Ports, 1995-2050	51
46	CTs of Exports for Selected Commodities, High Technology, by South Atlantic Ports, 1995-2050	52
47	TEUs of Exports for Selected Commodities, High Technology, by South Atlantic Ports, 1995-2050	53
48	CTs of Imports to South Atlantic Ports from India/South East Asia, 1995-2050	54
49	TEUs of Imports to South Atlantic Ports from India/South East Asia, 1995-2050	55
50	CTs of Imports for Selected Commodities, Agriculture, by South Atlantic Ports, 1995-2050	56
51	Domestic Hinterland for Five Mid and South Atlantic Coast Ports	71
52	Interstate Highway System, Five Mid and South Atlantic Ports and the Domestic Hinterland	72
53	Railroad Designation, Intermodal Cities Served from the Five Mid and South Atlantic Ports for Norfolk Southern	78

LIST OF FIGURES (cont'd)

Number		Page
54	Railroad Designation, Intermodal Cities Served from the Five Mid and South Atlantic Ports for CSX	79
55	Incremental Difference in Least Total Transportation Cost for Savannah Compared to the other Mid and South Atlantic Ports ($/TEU) (Without Project)	88
56	Incremental Difference in Least Total Transportation Cost for Charleston Compared to the other Mid and South Atlantic Ports ($/TEU) (Without Project)	89
57	Incremental Difference in Least Total Transportation Cost for Jacksonville Compared to the other Mid and South Atlantic Ports ($/TEC) (Without Project)	90
58	Incremental Difference in Least Total Transportation Cost for Wilmington Compared to the other Mid and South Atlantic Ports ($/TEC) (Without Project)	91
59	Incremental Difference in Least Total Transportation Cost for Norfolk Compared to the other Mid and South Atlantic Ports ($/TEU) (Without Project)	92
60	Incremental Difference in Least Total Transportation Cost for Savannah Compared to the other Mid and South Atlantic Port ($/TEU) (45 Foot Project)	97

MULTIPORT ANALYSIS

I. EXECUTIVE SUMMARY

Multiport analysis is a systematic assessment of the effects of the efforts of the with-project condition on other ports. It includes the effects of authorized projects at other ports on the with-project and without-project conditions. The objective of multiport analysis is to allow the planner to adjust the traffic for shifts of cargoes among alternative ports in response to the with-project condition at the port of study, as well as other authorized ports with local cooperation agreements at alternative ports.

Multiport analysis is performed as a series of nine steps to arrive at adjustments to NED benefits directly from the project (Figure 1). For Savannah Harbor, the multiport analysis determined the economic study area (Step one in Section IV) to be related to container traffic, principally imports, serving a hinterland east of the Mississippi River consisting of the following major South and Midwest cities serving as a perimeter: Atlanta, New Orleans, Memphis, St. Louis, Chicago, and Detroit (Table 1 and Figure 2). Eleven other cities were ultimately used for the mapping of the competitive hinterland for the least total delivered transportation cost analysis, including Mobile, Jackson, Birmingham, Charlotte, Nashville, Knoxville, Louisville, Cincinnati, Columbus, Indianapolis, and Cleveland. A broad geographic hinterland was preferred to allow maximum latitude for possible with-project shifts of containers from other ports.

The historical volumes of container imports through Savannah Harbor and the alternative ports of Norfolk, Wilmington, Charleston, and Jacksonville were compiled (Step 2 in Section V). The major South Atlantic container port competing with Savannah is Charleston. Norfolk is traditionally regarded as a North Atlantic port competing primarily with New York. However, Maersk-SeaLand is building a major privately owned marine container terminal at Hampton Roads that might compete to some extent with its own services currently calling Savannah. Jacksonville is a niche container port, serving primarily the offshore domestic trade (Puerto Rico), as well as the Caribbean and Latin America. Wilmington has not been a major player in the South Atlantic container markets.

The container volumes were used as previously projected for the ports for the period 2004 through 2050, including major world trading areas for imports and exports (Step 3 in Section VI). These projections were not constrained by any port capacity limitations.

The container vessel fleet composition for the ports was described relative to the services and major world areas (Step 4 in Section VII).

The current cost of commodity (container) movements was compiled for Savannah Harbor (Step 5 in Section VIII), consisting of the vessel voyage, vessel, and cargo-related port costs and hinterland transportation costs. A vector of sea costs was developed for the voyage legs that precede and follow Savannah Harbor in conjunction with calls at other U.S. East Coast (ECUS) ports, notably Norfolk and New York. Port cost, including vessel time in port, was compiled based on vessel and cargo services, including pilotage, tuggage, dockage, wharfage, stevedoring, and container handling. Land transportation costs for truck and rail movements between the ports and hinterland cities were also compiled. Total delivered transportation cost (voyage, port, and hinterland) for imported containers through the ports and 17 major hinterland cities (New

Orleans, Mobile, Memphis, St. Louis, Jackson, Birmingham, Atlanta, Charlotte, Nashville, Knoxville, Louisville, Cincinnati, Columbus, Indianapolis, Chicago, Detroit, and Cleveland) were compiled (Table 28).

The current total delivered transportation cost of container movements was determined for competing harbors (Norfolk, Wilmington, Charleston, and Jacksonville) for benefiting services (Step 6 in Section IX). The spreadsheet computes the least total cost port and the incremental costs for other ports. A range of hinterlands based on incremental least total delivered transportation costs of $50 per TEU was developed for sensitivity purposes (figures 55, 56, 57, 58, and 59 for Savannah, Charleston, Jacksonville, Wilmington, and Norfolk, respectively).

The future cost of container movements under with-project conditions (43 to 48 feet) was determined for Savannah Harbor for benefiting services and alternative ports (Step 7 in Section X). In no instance would the vessel voyage cost savings at Savannah Harbor under with-project conditions result in the diversion of containers from other ports on the basis of least total transportation cost (voyage, port, and hinterland). A range of hinterlands based on incremental least total delivered transportation costs of $50 TEU was developed for sensitivity purposes (Figure 60).

The use of Savannah Harbor under without- and with-project conditions with respect to imported containers was determined (Step 8 in Section XI). For the three benefiting services, Savannah Harbor has the least total delivered transportation cost (voyage, port, and hinterland) under without-project conditions for the major nodes of Memphis, St. Louis, Jackson, Birmingham, Atlanta, and Knoxville (Table 38). These least total cost nodes do not change under the with-project conditions at Savannah Harbor. Alternatively, Charleston Harbor has the least total delivered transportation cost for the major nodes of Knoxville, Louisville, Cincinnati, and Indianapolis. Norfolk has the least total delivered transportation cost for the major nodes of Columbus, Chicago, Detroit, and Cleveland.

The multiport analysis indicates that there are no NED benefits for Savannah Harbor for the three benefiting services because no traffic (containers) is diverted from other ports under the with-project conditions and a least total delivered transportation cost analysis (Step 9 in Section XII). Currently, there are no authorized projects at other competing ports (Norfolk, Wilmington, Charleston, and Jacksonville) that might affect possible diversion of cargo away from Savannah Harbor.

II. INTRODUCTION

Multiport analysis is a systematic assessment of the effects of the with-project condition on other ports. It includes the effects of authorized projects at other ports on the with-project and without-project conditions. Conceptually, multiport analysis is an adjustment to NED benefits that includes systems analysis of port competition. In actual practice, multiport analysis is a systematic comparison of alternative transportation costs for cargoes that could use the project port or be handled through alternative ports.

The objective of multiport analysis is to allow the planner to adjust the traffic forecast for shifts of cargoes among alternative ports in response to the with-project condition at the port of study, as well as other authorized projects with local cooperation agreements at alternative ports. Since the purpose of multiport analysis is to account for changes in the with-project condition traffic forecast, only commodities affecting NED benefits and handled by alternative ports for competitive hinterlands must be analyzed. The entire universe of cargoes handled by the project port is seldom subject to a multiport analysis. Only commodities that could be affected by projects at the port or at alternative ports that would affect the traffic forecasts and benefits should be considered. Therefore, the purpose and scope of a multiport analysis is usually much more limited and well defined than is suggested by the words "multiport analysis."

For purposes of the Savannah Harbor Expansion Project (SHEP), multiport analysis was defined to include major competing South Atlantic container ports, excluding South Florida and including Norfolk. The competing ports are Norfolk, Wilmington, Charleston, and Jacksonville.

The South Florida container ports, primarily Miami and Port Everglades, were excluded primarily because they handle local cargo or transship between other world areas and the Caribbean and Latin America regions. Norfolk is traditionally regarded as a North Atlantic port. It was included because of the development of a major large privately owned marine container terminal by Maersk-SeaLand that could have competitive impacts on both North and South Atlantic ports for certain Midwest markets, particularly rail intermodal based.

None of the alternative ports have deeper channels authorized but not completed other than New York. Norfolk is 50-foot depth for the largest marine container terminal, Norfolk International Terminal (NIT). The under development Maersk-SeaLand terminal will be on a 50-foot channel as well. Wilmington has a recently completed 42-foot channel. Charleston has a 45-foot channel. Jacksonville has a 40-foot and 38-foot authorized channel, although the port indicates a 41-foot channel. There are no increased authorizations for deeper depths at any of these ports at this time. It is possible that Charleston will pursue a deeper channel at some time in the future, particularly if New York Harbor, regarded as the standard for depth of East Coast ports for container imports, is eventually fully developed to its 50-foot authorized depth. Currently, New York is still not fully developed to the authorized 45-foot depth (along with some air draft issues).

III. METHODOLOGY

Multiport analysis consists of a series of sequential steps. Figure 1, Flowchart of Deep-Draft Navigation Benefit Evaluation Procedure (Multiport Analysis), is an application of the P&G's nine steps for multiport analysis. Conceptually, multiport analysis entails an extension of the study scope to include other ports. Multiport analysis consists of commodity flows in competitive (overlapping) port hinterlands.[1]

The P&G study steps are followed as the tasks to be performed for a multiport analysis of Savannah Harbor. These tasks constitute the steps to be executed for a multiport analysis that each represents a set of deliverables. In this final report the first nine tasks will be presented as deliverables: (1) Determine the Economic Study Area; (2) Identify Types and Volumes of Commodity Flow; (3) Project Waterborne Commerce; and (4) Determine Vessel Fleet Composition and Cost; (5) Determine Current Commodity Movement Cost; (6) Determine Alternative Movement Cost; (7) Determine Future Commodity Movement Cost; (8) Determine Harbor Use With and Without Project; and (9) Compute NED Benefits.

The fully executed multiport analysis in this final report pertains to the comparison of changes in total delivered transportation costs of container cargoes through Savannah Harbor for trades that would benefit from deeper channels compared to similar movements for other ports at Norfolk, Wilmington, Charleston, and Jacksonville. The total cost components are compiled for that portion of the benefiting ocean voyage that precedes and follows Savannah Harbor as derived from the NED benefits methodology.[2] The total costs in addition to changes in sea voyage costs (NED benefits that are affected by harbor deepening) include port costs related to vessel and cargo handling and land transportation costs for the competitive hinterland.

The total delivered transportation costs framework embodied in the multiport analysis represents a compilation of different cost elements for sea, port, and land transportation. Some of these cost elements contain parameter estimates to allow for the inclusion of a full data set of all related transportation cost components for the multiport analysis. Estimated values have been included in the total delivered cost analysis to serve as a proxy to reflect the nominal (estimated) inclusion of all transportation costs related to ocean, port, and land cost elements that constitute the total transportation delivered cost framework of multiport analysis. Beginning in Section VIII, these sections describe the components of a spreadsheet model that (1) calculates "total transportation delivered cost" for containerized cargoes using Savannah Harbor in without-project conditions (Section VIII, Part 5 of multiport analysis); (2) calculates "total transportation delivered cost" for containerized cargoes using alternative ports (Section IX, Part 6 of multiport analysis) and; (3) calculates "total transportation delivered cost" for containerized cargoes using Savannah Harbor in with-project conditions (Section X, Part 7 of multiport analysis). Based on spreadsheet least total transportation costs (sea, port, and land), future use of Savannah Harbor is estimated from a multiport analyses perspective for marine containerized cargoes. Resulting NED benefits are computed.

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[1] *National Economic Development Procedures Manual, Deep Draft Navigation*, pp. 155 - 156.
[2] Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: NED Benefits Model Final Report (May 2006).

Overall, the multiport perspective presented is for a "total delivered cost" analysis of the three transportation components of sea, port, and land. The spreadsheet determines the total cost for each element and then each sea route/port/hinterland city as a summation of all of the transportation cost elements (sea, port, and land). The spreadsheet compiles the least total cost for the sea, port, and land cost components for each port for particular trades and hinterlands and summarizes all these cost elements into a "total cost." The incremental costs between the least cost ports are also computed for each transportation cost element (sea, port, and land), as well as total delivered cost.

The spreadsheet does not perform any optimization. It relies entirely on user inputs related to the individual transportation cost components (sea, port, and land).[3] Each is calculated and then compared across the ports for the trades and hinterland cities and then summed to a "total cost." The total costs of sea, port, and land and their summations are then ranked by the spreadsheet by "least total cost" for the five ports of Savannah, Norfolk, Wilmington, Charleston, and Jacksonville.[4]

[3] All of the user inputs can be changed for the three benefiting services. Ultimately, other benefiting services and attendant sea costs could also be utilized.

[4] Norfolk is shown for the major existing marine terminals that have different access channel depths ranging from 42 to 50 feet.

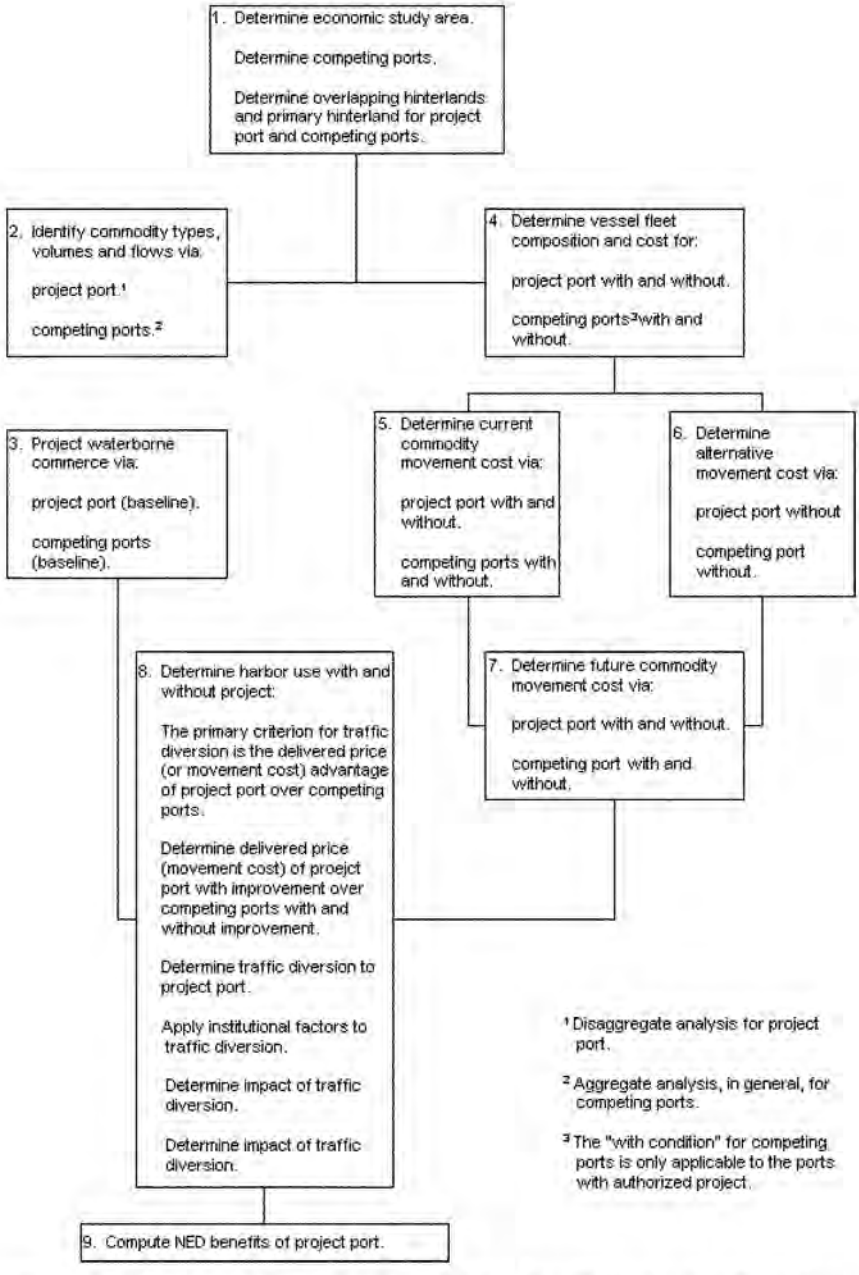

Figure 1. Flowchart of Deep-Draft Navigation Benefit Evaluation Procedure (Multiport Analysis)

IV. DETERMINE ECONOMIC STUDY AREA (Task 1)

The economic study area for a multiport analysis of Savannah Harbor should reflect competing ports and the overlapping hinterlands and the primary hinterland for the project port and competing ports. Savannah Harbor shares a large common hinterland with adjacent container ports at Jacksonville, Charleston, Wilmington, and Norfolk.

The vessel fleet forecast has indicated that container vessels are the primary, if not the exclusive, beneficiary of deepening Savannah Harbor. The major container services with respect to present and projected numbers and sizes of benefiting container vessels calling Savannah Harbor were identified as major east-west services not otherwise constrained by the Panama Canal.[5] Specifically, two major types of services were identified as beneficiaries from a deeper Savannah Harbor: FE SUEZ ECUS PEN and FE ECUS EU/MED PEN.

The FE SUEZ ECUS PEN links the East Coast of the U.S. (ECUS), including Savannah Harbor, with the Far East (FE) Indian Subcontinent portion of Southeast Asia via the Suez Canal. The FE ECUS EU/MED PEN services reflect components of FE ECUS via the Panama Canal to Europe (EU) or the Mediterranean (MED). The Trans-Pacific and Trans-Atlantic pendulum services are connected by the Panama Canal for these deployments. Only the latter portion of the deployment (Trans-Atlantic) would benefit from deepening Savannah Harbor with respect to vessel calls having deeper drafts to and from Savannah Harbor for Europe or Mediterranean services to and from the ECUS.

Savannah Harbor is served by a network of Panamax container vessels that rely on Panama Canal transits, primarily for FE ECUS pendulum services. These "all-water" services have grown rapidly in response to West Coast port congestion and related problems. These vessels and services will not benefit from a deeper Savannah Harbor with respect to their Far East deployments.[6] Savannah Harbor is also served by smaller container vessels in the Sub-Panamax and Handysize size categories that will not benefit from deepening. Container vessels smaller than Panamax are primarily used for ECUS north-south routes involving South America and Africa. Although growth is projected for these services, the vessel sizes will not sufficiently increase and therefore cannot be considered a potential beneficiary of Savannah Harbor deepening.

The major world trade routes served by the benefiting services were determined to be the relevant overseas hinterlands for the purpose of imports and growth projections for containerized cargoes. These world areas include: North East Asia (NEA); (2) South East Asia (SEA); (3) Middle East (ME); (4) Oceania (OC); and (5) Europe (EU). Savannah Harbor services calling these world regions for containerized imports are regarded as competing with the other major South Atlantic coast ports of Jacksonville, Charleston, and Wilmington, as well as Norfolk for interior U.S. markets.

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[5] Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Vessel Fleet Forecasts, Part 7, Savannah Fleet With Project.

[6] Maximum draft for the Panama Canal is 39.5 feet Tropical Fresh Water (TFW).

The South Atlantic ports of interest exclude the South Florida container ports, Miami and Port Everglades, because of the specificity of their hinterland relative to South Florida and associated transshipment services for the Caribbean and Latin America niche markets. Jacksonville and, to a lesser extent, Wilmington also serve niche markets relative to Charleston and Savannah. Although normally regarded as a North Atlantic coast port, Norfolk is viewed as a competitor to Savannah for Midwest hinterland traffic by virtue of rail connections and emerging private sector marine terminal development by Maersk-Sealand.

Determining a distinct domestic hinterland for containerized imports through the different South Atlantic ports is difficult because of the close proximity of several of the ports in relation to the geography of the South and Midwest. The assumed domestic hinterland for South Atlantic Coast port import is shown in Figure 2.

Table 1 shows the highway distances between the major South Atlantic ports, including Norfolk, and a perimeter of major U.S. South and Midwest cities, including Atlanta. The perimeter extends from Detroit to Chicago, St. Louis, Memphis, and New Orleans. The incremental highway distances based on the shortest lane are shown in Table 2. Charleston is 59 miles farther from Atlanta than Savannah, and Jacksonville is 89 miles farther from Atlanta than Savannah. For the perimeter cities except Detroit, the incremental highway distances are generally a minimum for Savannah (Memphis and St. Louis) or comparatively small, such as 57 miles more to Chicago from Savannah than Norfolk. Other than Jacksonville, Savannah is 138 miles farther from New Orleans.

Table 1. Highway Mileages for Major South East U.S. Ports and Hinterlands

Port Cities	Atlanta	New Orleans	Memphis	St. Louis	Chicago	Detroit
Savannah	255	690	642	815	957	931
Charleston	314	788	702	854	903	877
Norfolk	563	1,042	919	925	900	726
Jacksonville	344	552	731	904	1,063	1,062

Source: G.E.C., Inc., based on Rand McNally Tripmaker

Table 2. Incremental Highway Mileages for Major South East U.S. Ports and Hinterlands

Port Cities	Atlanta	New Orleans	Memphis	St. Louis	Chicago	Detroit
Savannah	0	138	0	0	57	205
Charleston	59	236	60	39	3	151
Norfolk	308	490	277	110	0	0
Jacksonville	89	0	89	89	163	336

Source: G.E.C., Inc., based on Rand McNally Tripmaker.

The examples of highway distances and incremental distances suggest that the competitive landside trucking costs for marine containers will cover a wide range of geography, because some of the ports have very similar highway distances. Moreover, although Atlanta would commonly be regarded as a competitive hinterland for Savannah because of proximity, the

incremental distance for Charleston (59 miles) is not substantially greater from a highway distance perspective.

Note: This figure represents major cities in eastern United States; however, Figure 51 shows the 17 hinterland cities chosen for multiport analysis purposes.

Source: G.E.C. Inc.

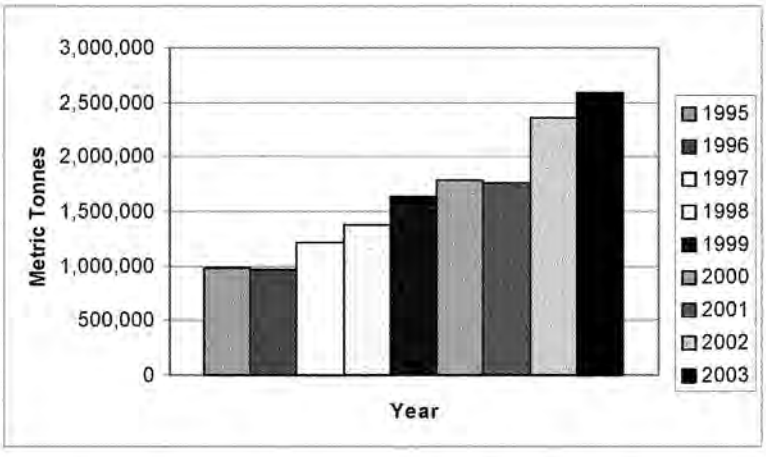
Figure 2. Domestic Hinterland for South Atlantic Coast Port Imports

V. HISTORIC VOLUMES AND COMMODITY FLOWS OF SOUTH ATLANTIC PORTS: 1995-2003 (Task 2)

The following information is a condensed summary of the historic trends in containerized tonnes (CT) and TEUs at each of the five South Atlantic ports for the five world regions of competitive interest.[7] This section of the report identifies the containerized activity at the ports with respect to tonnes and estimated equivalent loaded TEUs for the major competitive foreign hinterlands[8]. Consequently, the statistics presented do not reflect the total volumes of containerized cargoes at the ports. On the other hand, the regions of competitive overlap do account for a large proportion of the increased import volumes of their respective commodities. However, except for Savannah, the ports have experienced decreases in exports for their respective commodities.

SAVANNAH

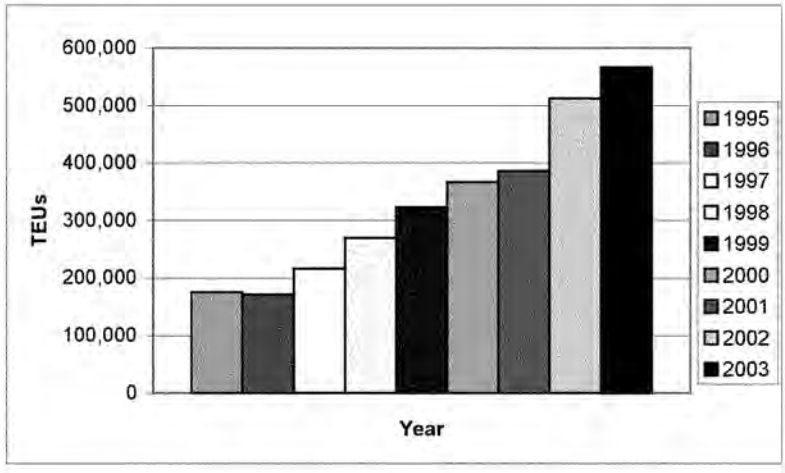
Over the nine-year period, Savannah increased CT imports each year from one million to slightly above 2.5 million (Figure 3). The same results appear for TEU imports, which increased from under 200,000 to nearly 600,000 (Figure 4).



Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 3. CTs of Imports to Savannah, 1995-2003

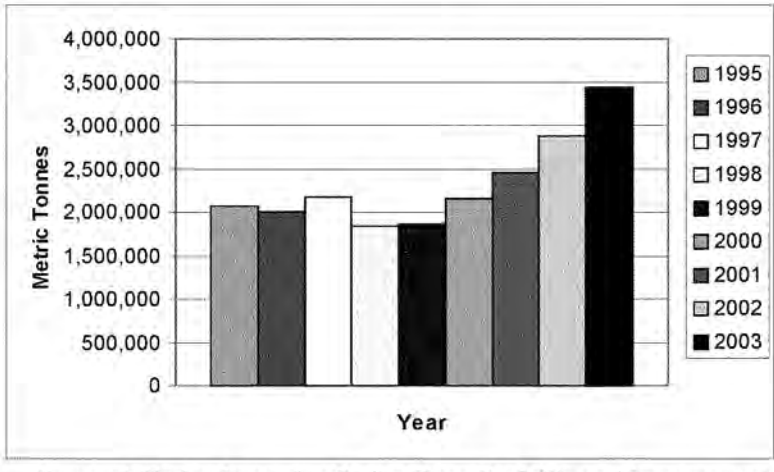
[7] The competitive foreign hinterlands for containerized cargoes have been identified as North East Asia, South East Asia, Oceania, Middle East, and Europe.
[8] Empty TEUs are excluded.



Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

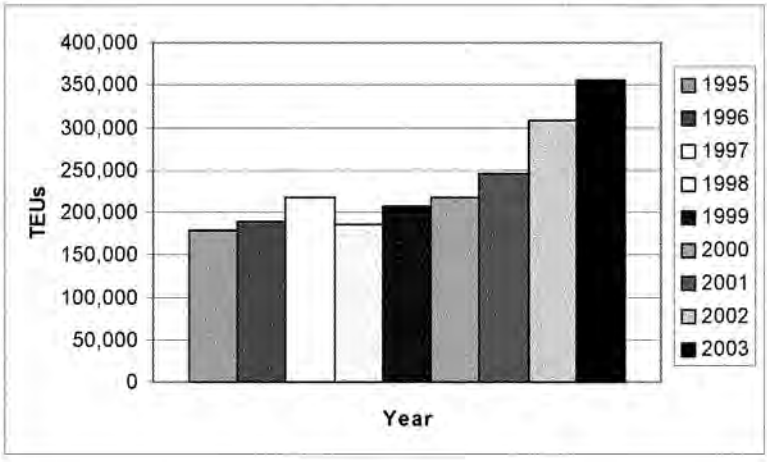
Figure 4. TEUs of Imports to Savannah, 1995-2003

Over the nine-year period, Savannah's containerized export tonnes fluctuated slightly, but increased by over one million CTs from 2000 to 2003 (Figure 5). TEU exports followed a relatively similar pattern during the nine-year period (Figure 6).



Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 5. CTs of Exports from Savannah, 1995-2003



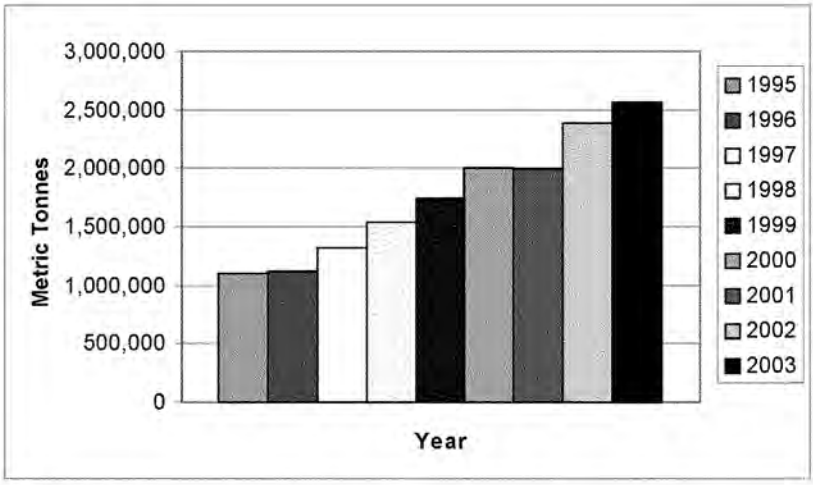
Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 6. TEUs of Exports from Savannah, 1995-2003

CHARLESTON

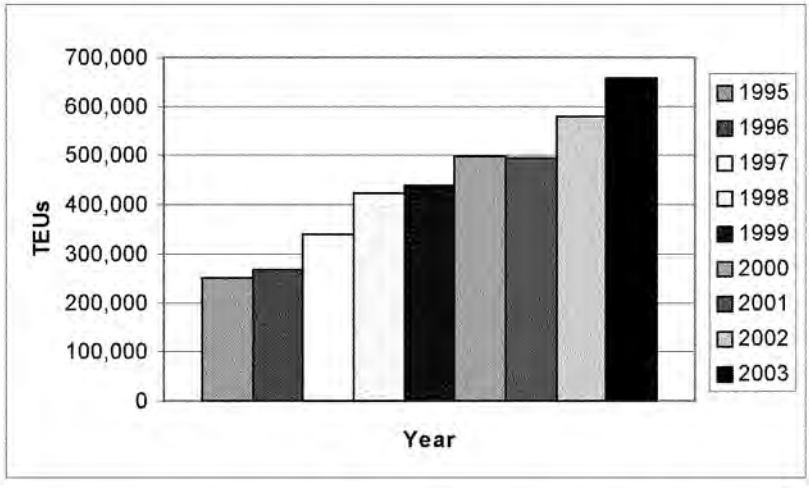
Charleston experienced a similar nine-year trend as Savannah with respect to CT imports. Although 2001 did not show an increase, the following years showed an increase to over 2.5 million CTs (Figure 7). TEU imports followed a very similar pattern, except that 1996 was slightly higher than 1995 (Figure 8).

Slight increases and decreases characterize Charleston's CT exports during the nine-year period. Savannah's CT exports increased greatly from 2000 through 2003, whereas Charleston's volume only slightly increased (Figure 9). In 1999, TEU exports for Charleston reached a peak at nearly 400,000. Savannah increased through 2003, whereas Charleston's average varied slightly over the nine-year period. By 2003, Charleston was similar to Savannah in reaching nearly 350,000 TEUs (Figure 10).



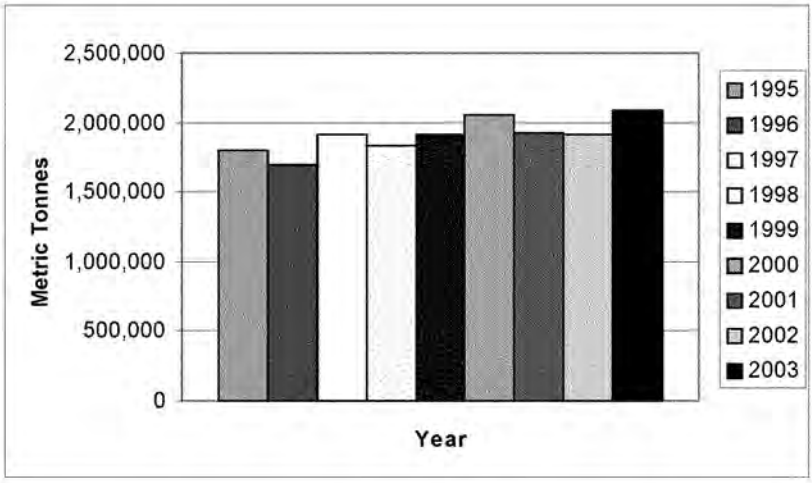
Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 7. CTs of Imports to Charleston, 1995-2003



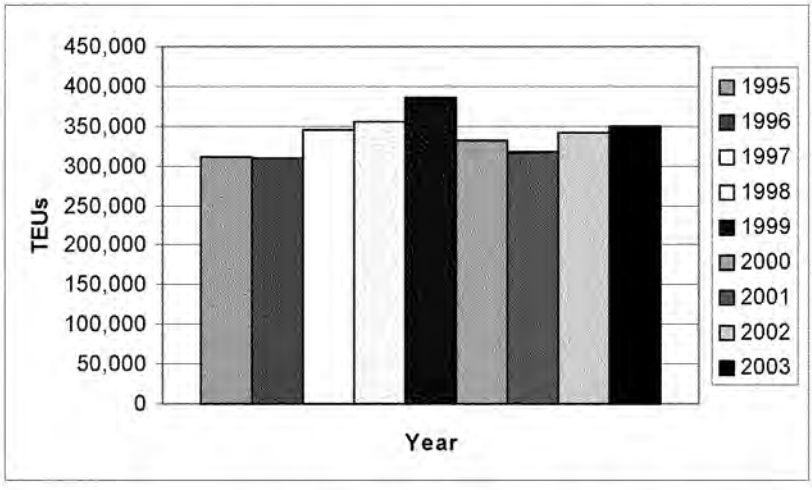
Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 8. TEUs of Imports to Charleston, 1995-2003



Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 9. CTs of Exports from Charleston, 1995-2003



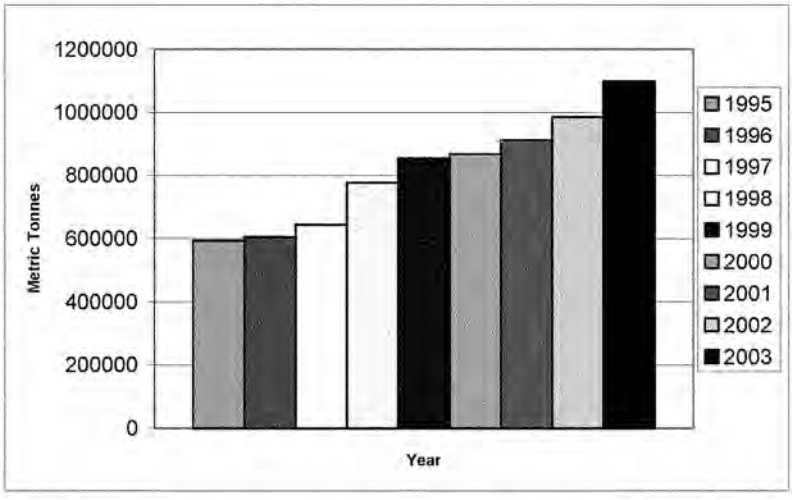
Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 10. TEUs of Exports from Charleston, 1995-2003

JACKSONVILLE

Jacksonville's CT imports increased each year from 1995 to 2003. Jacksonville moved from 600,000 CTs in 1995 to nearly 1.1 million in 2003, nearly doubling import commodities during the nine years (Figure 11). TEU imports showed a very similar trend, increasing from about 54,000 in 1995 to nearly 100,000 in 2003 (Figure 12).[9]

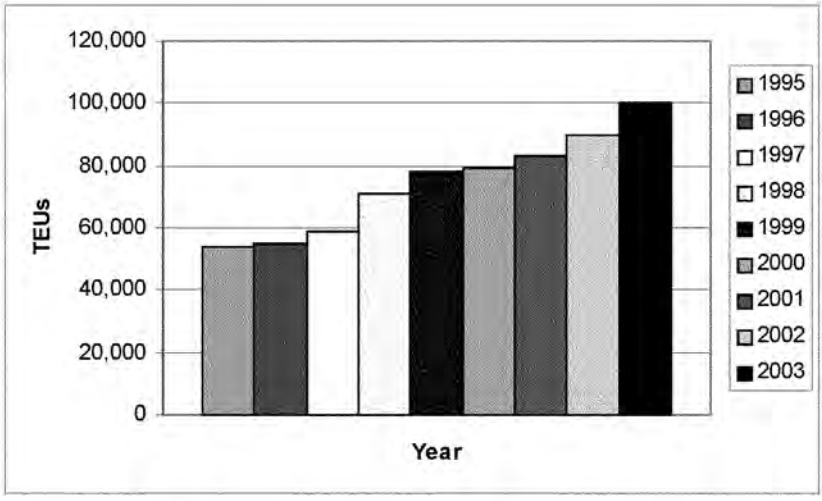
CT export volumes increased until 1997, reaching a peak of nearly 750,000, but fluctuated thereafter and registered only 500,000 CTs in 2003 (Figure 13). TEU exports reached a low in 2000 and rebounded thereafter, but not to the levels experienced in the 1995-1997 period (Figure 14).



Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

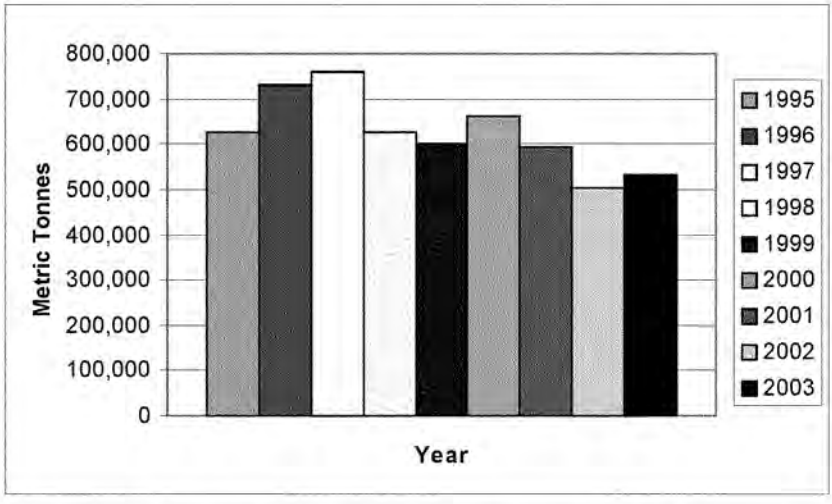
Figure 11. CTs of Imports to Jacksonville, 1995-2003

[9] Jacksonville's TEU import data for the years 1995-2003 were estimated.



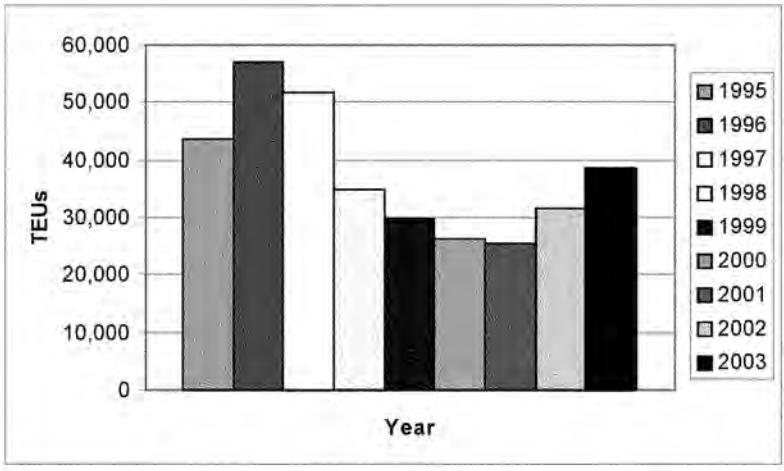
Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 12. TEUs of Imports to Jacksonville, 1995-2003



Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 13. CTs of Exports from Jacksonville, 1995-2003



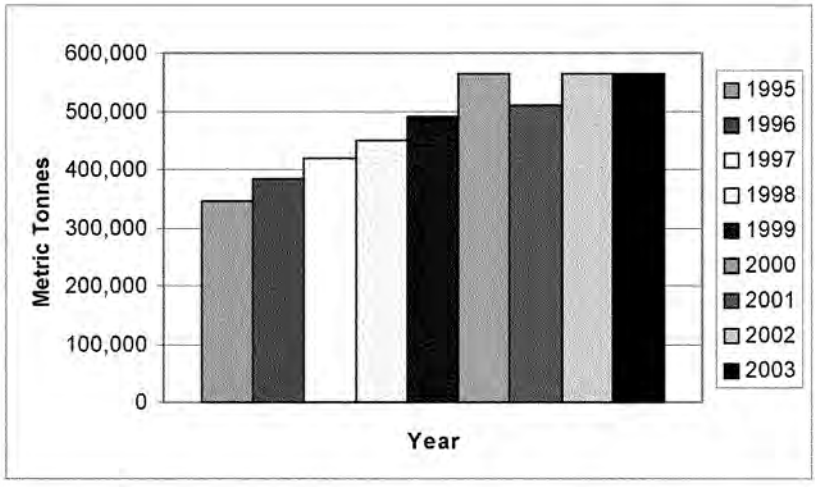
Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 14. TEUs of Exports from Jacksonville, 1995-2003

WILMINGTON

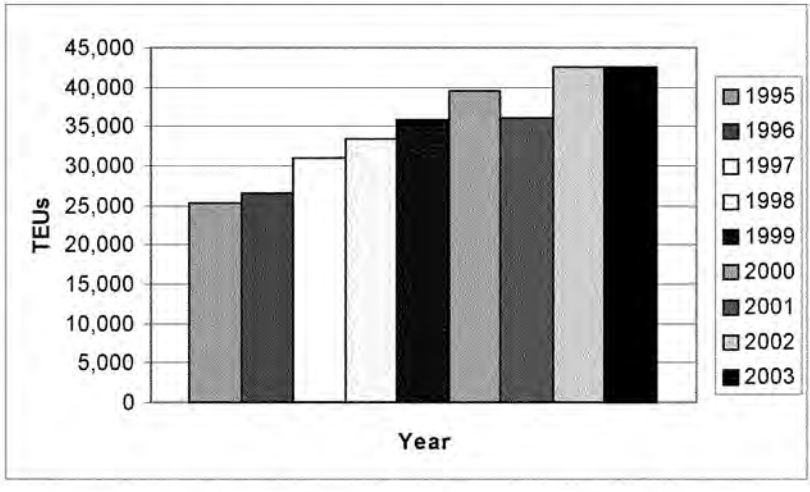
Wilmington experienced an increase in CT imports similar to that of Jacksonville during the nine-year period, rising from over 300,000 in 1995 to over 500,000 in 2003 (Figure 15). TEU imports followed a similar trend, rising from slightly over 25,000 in 1995 to nearly 42,000 in 2003 (Figure 16).

CT export volumes fluctuated during the nine-year period, reaching a low of 300,000 in 1999 and rebounding thereafter to about 400,000, but never reclaiming the highs of the 1995-1997 period (Figure 17). TEU imports declined from a high of over 50,000 in 1996 to less than 20,000 in 2000 and then to about 17,000 in 2003 (Figure 18).



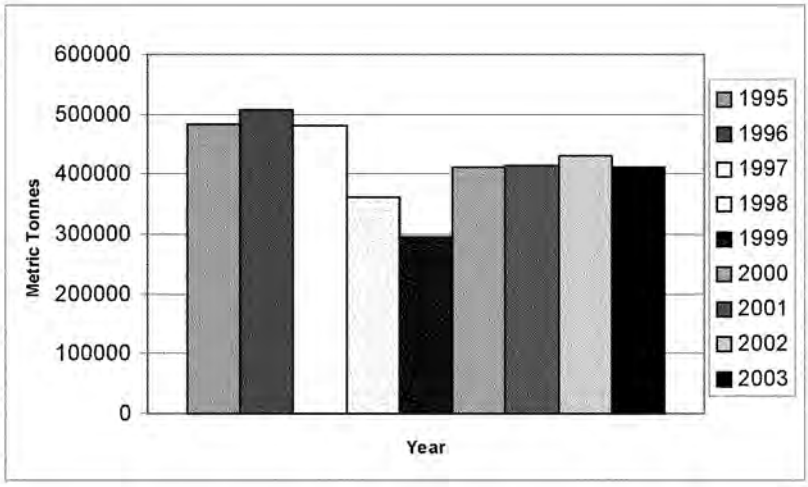
Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 15. CTs of Imports to Wilmington, 1995-2003



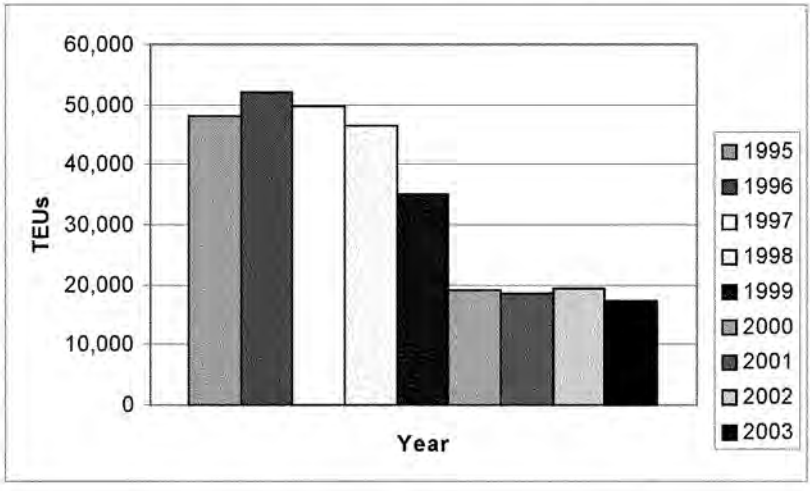
Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 16. TEUs of Imports to Wilmington, 1995-2003



Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 17. CTs of Exports from Wilmington, 1995-2003

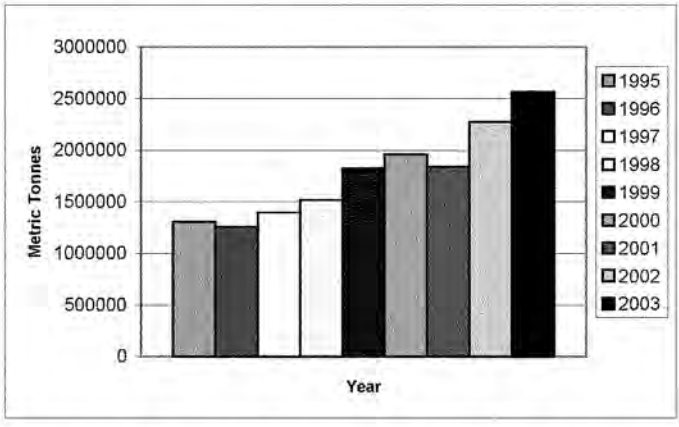


Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 18. TEUs of Exports from Wilmington, 1995-2003

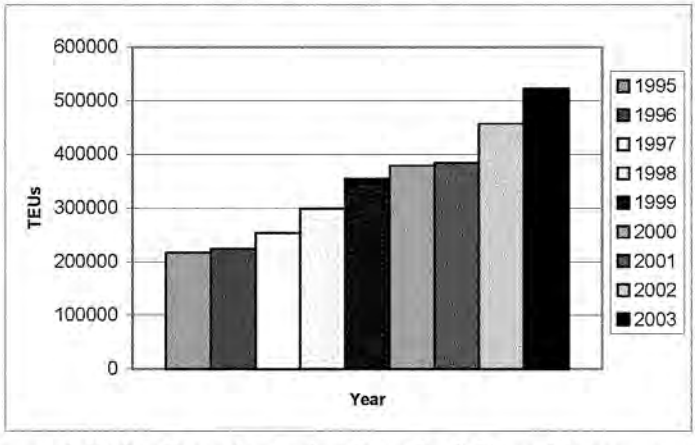
NORFOLK

Norfolk's volume of import CTs doubled during the nine-year period, rising from about 1.3 million in 1995 to 2.6 million in 2000 (Figure 19). TEU import volumes increased each year during the nine-year period, reaching over 500,000 in 2003, which was slightly lower than Charleston and Savannah (Figure 20).



Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

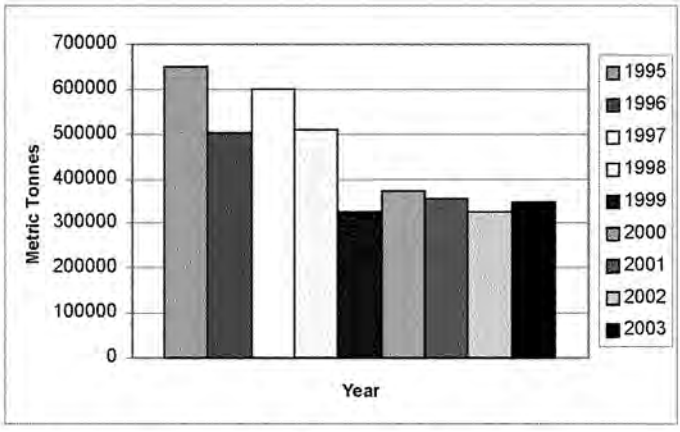
Figure 19. CTs of Imports to Norfolk, 1995-2003



Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

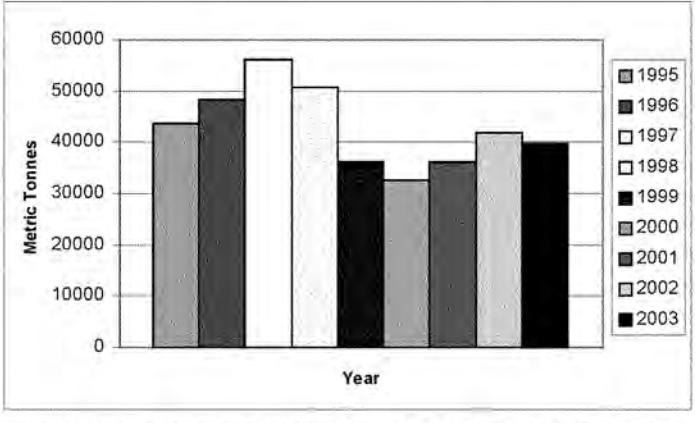
Figure 20. TEUs of Imports to Norfolk, 1995-2003

Norfolk's volume of CT exports decreased dramatically over the nine-year period, falling from nearly 650,000 in 1995 to above 300,000 in 2003 (Figure 21). TEU exports reached a peak in 1997 at about 56,000 and a low of slightly above 30,000 in 2000, then rose to 40,000 in 2003 (Figure 22).



Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 21. CTs of Exports from Norfolk, 1995-2003



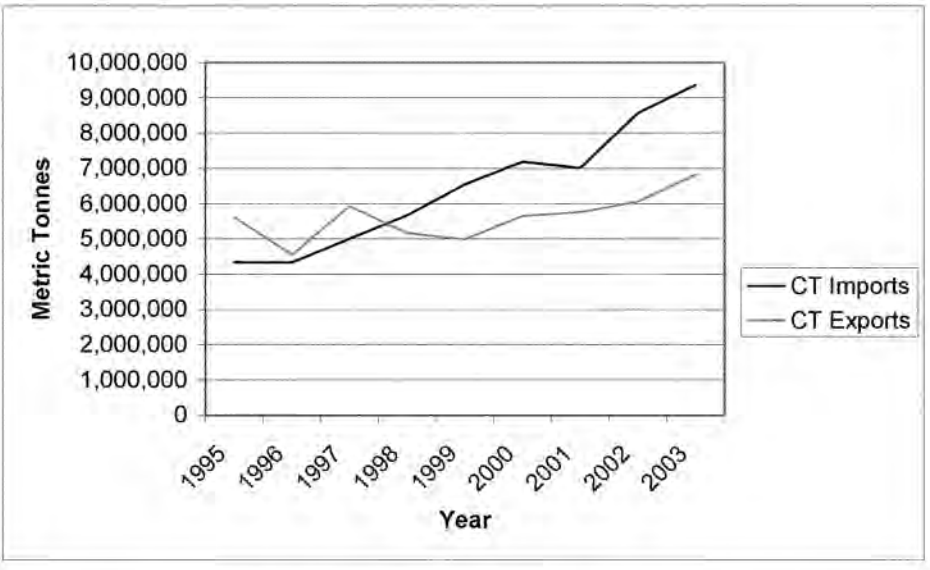
Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 22. TEUs of Exports from Norfolk, 1995-2003

WORLD REGION TOTALS

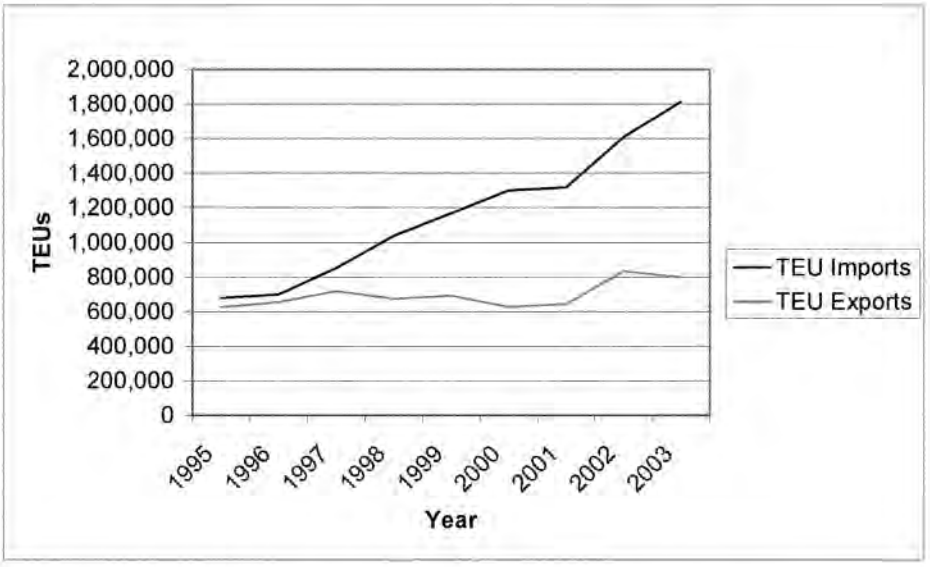
This section summarizes the study area totals for imported and exported CT and TEU volumes for the five world regions calling on the South Atlantic ports. The five world regions are Europe, South East Asia, Middle East/Mediterranean, North East Asia, and Oceania. Excluded are cargoes from other regions such as South America, the Caribbean and Central America, and Africa.

It is important to recognize that CT and TEU imports for the U.S. have been increasing at a much faster rate than CT and TEU exports. Import CTs increased by over 116 percent from 1995 to 2003, compared to a 21 percent increase in export CTs (Figure 23). Import TEUs increased by nearly 167 percent from 1995 to 2003, compared to a 28 percent increase in export TEUs (Figure 24). The tables and figures in this section reinforce the idea that there is a weak tonnage growth for exports compared to a very robust import growth in CTs and TEUs.



Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 23. Historic Trends of Imports and Exports during 1995-2003 in CTs for the South Atlantic Ports: Major World Hinterlands



Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 24. Historic Trends of Imports and Exports during 1995-2003 in TEUs for the South Atlantic Ports: Major World Hinterlands

All five of the world regions increased during the nine-year period in CT imports to the U.S. (Table 3). From 1995-2001, Europe accounted for the greatest volume of CT imports to the U.S. to the five South Atlantic ports. However, North East Asia accounted for the greatest amount of imports, had the greatest growth rate from 1995-2003, and accounted for the greatest amount of imports in 2002 and 2003.

Similarly, all five of the world regions increased during the same time period in TEU imports (Table 4). North East Asia experienced the greatest increase, rising from 236,595 TEUs in 1995 to 760,100 TEUs in 2003, and accounted for the greatest amount of imports in 2003.

All five of the world regions increased during the nine-year period in CT exports (Table 5). North East Asia experienced the greatest increase, rising from 2,151,849 CTs in 1995 to 2,863,648 CTs in 2003, and accounted for the greatest amount of exports in 2003.

With the exception of Oceania, all regions increased TEU export volumes over the nine-year period. Oceania experienced a decline from 31,626 TEUs in 1995 to 28,036 TEUs in 2003, but the 2003 volume exceeded the nine-year low of 22,858 TEUs in 2001 (Table 6). North East Asia

Table 3. CTs of Imports to South Atlantic Ports, by Selected World Regions, 1995-2003

Region	Year								
	1995	1996	1997	1998	1999	2000	2001	2002	2003
Europe	1,874,613	1,805,195	2,067,921	2,197,286	2,485,034	2,847,441	2,776,691	3,076,751	3,382,322
India/S.E. Asia	678,454	718,622	845,101	890,820	1,090,885	1,370,616	1,300,764	1,553,844	1,542,132
Middle East/ Med	371,553	365,313	457,577	502,386	568,955	511,151	554,011	609,400	602,169
North East Asia	1,303,722	1,315,396	1,522,817	1,983,537	2,293,794	2,359,037	2,200,555	3,131,108	3,640,005
Oceania	104,476	123,877	110,770	98,828	105,423	98,232	177,151	195,253	198,084
Total	4,332,818	4,328,403	5,004,186	5,672,857	6,544,091	7,186,477	7,009,172	8,566,356	9,364,712

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Table 4. TEUs of Imports to South Atlantic Ports, by Selected World Regions, 1995-2003

Region	Year								
	1995	1996	1997	1998	1999	2000	2001	2002	2003
Europe	273,073	273,299	341,851	403,434	441,910	504,645	475,168	539,283	575,010
India/S.E. Asia	109,214	126,406	144,198	169,672	192,780	212,864	245,123	289,661	337,243
Middle East/ Med	56,682	58,312	65,785	80,579	97,984	92,271	100,577	110,621	125,220
North East Asia	236,595	236,384	295,656	379,107	430,626	483,953	489,820	661,224	760,100
Oceania	4,097	4,530	5,031	5,637	5,895	6,294	7,771	9,103	14,543
Total	679,661	698,931	852,521	1,038,429	1,169,195	1,300,027	1,318,459	1,609,892	1,812,116

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Table 5. CTs of Exports from South Atlantic Ports, by Selected World Regions, 1995-2003

Region	Year								
	1995	1996	1997	1998	1999	2000	2001	2002	2003
Europe	2,290,013	2,189,990	2,455,700	2,235,820	1,968,656	2,184,749	2,288,899	2,269,290	2,520,508
India/S.E. Asia	518,782	557,855	554,143	354,770	400,509	473,380	531,012	578,269	649,130
Middle East/ Med	481,569	462,423	538,781	484,993	478,169	584,785	502,666	586,602	600,874
North East Asia	2,151,849	1,156,217	2,202,590	1,944,152	2,010,626	2,250,091	2,277,300	2,462,073	2,863,648
Oceania	178,071	180,853	176,660	140,903	135,192	159,022	157,067	155,582	188,248
Total	5,620,284	4,547,338	5,927,874	5,160,638	4,993,152	5,652,027	5,756,944	6,051,816	6,822,408

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Table 6. TEUs of Exports from South Atlantic Ports, by Selected World Regions, 1995-2003

Region	Year								
	1995	1996	1997	1998	1999	2000	2001	2002	2003
Europe	250,383	255,720	299,723	308,220	296,737	267,452	269,106	278,426	294,234
India/S.E. Asia	61,360	74,394	75,603	47,794	54,903	51,381	63,970	75,298	82,684
Middle East/ Med	57,637	62,434	75,593	71,696	68,864	65,415	52,794	65,162	74,410
North East Asia	224,455	231,516	237,791	220,538	247,792	216,986	234,832	387,987	320,435
Oceania	31,626	31,681	30,661	25,986	24,307	25,923	22,858	27,107	28,036
Total	625,461	655,745	719,371	674,234	692,603	627,157	643,560	833,980	799,799

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

experienced the greatest increase, rising from 224,455 TEUs in 1995 to 320,435 TEUs in 2003, and accounted for the greatest volume of exports in 2002 and 2003.

COMMODITY FLOWS

Commodity flows are discussed in this section for the period 1995-2003 through accumulated data for the five ports. The 10 commodity groups are agriculture, extractive, food, materials, consumer goods, chemicals, high technology, intermediate manufacturing, capital equipment, and motor vehicles. The tables below show the subtotals for the nine-year period.

Every commodity in the CT imports category increased over the nine-year period (Table 7). Relative to the other nine commodities, extractives increased the least (from 19,037 CTs in 1995 to 20,567 CTs in 2003), and consumer goods increased the most (from 318,373 CTs in 1995 to 1,469,443 CTs in 2003). Intermediate manufacturing had the highest import volume in 2003 (1,733,951 CTs).

All TEU import commodities increased except extractives, which declined from 4,624 TEUs in 1995 to 3,360 TEUs in 2003 (Table 8). Relative to the other nine commodities, consumer goods increased the most (from 111,389 TEUs in 1995 to 498,692 TEUs in 2003) and registered the highest volume in 2003.

All CT export commodities increased over the nine-year period, but at a lower rate than imports (Table 9). Relative to the other nine commodities, intermediate manufacturing increased the most from (316,759 CTs in 1995 to 416,683 CTs in 2003). Materials had the highest export volume in 2003 (2,649,881 CTs), which was significantly higher than CT imports during the same year.

TEU exports (Table 10) increased for eight of the 10 commodities. Declines were registered by high technology (from 64,439 TEUs in 1995 to 61,668 TEUs in 2003) and capital equipment (from 62,876 in 1995 to 60,037 TEUs in 2003). Relative to the other nine commodities, motor vehicles increased the most (from 34,024 TEUs in 1995 to 91,489 TEUs in 2003), and materials had the highest export volume in 2003 (305,633 TEUs).

Table 7. CTs of Imports to South Atlantic Ports from Selected World Regions, by Commodity, 1995-2003

Commodity	Year								
	1995	1996	1997	1998	1999	2000	2001	2002	2003
Agriculture	163,081	182,029	187,648	198,687	291,157	320,250	348,106	402,827	370,320
Extractive	19,037	36,155	34,100	30,695	24,532	31,370	18,047	15,204	20,567
Food	483,364	559,183	610,288	572,136	325,923	725,995	674,411	708,310	801,142
Materials	456,085	411,010	517,591	557,645	689,367	828,989	781,306	1,069,043	1,274,571
Consumer Goods	318,373	326,363	389,874	494,211	623,804	825,427	877,132	1,218,914	1,469,443
Chemicals	629,168	677,532	715,161	744,022	774,552	894,974	1,054,001	1,205,351	1,287,289
High Technology	684,262	679,078	768,537	847,867	983,760	1,092,996	917,185	1,150,869	1,181,110
Intermediate Manufacturing	908,957	819,675	1,037,310	1,320,431	1,561,092	1,504,800	1,432,811	1,692,080	1,733,951
Capital Equipment	560,202	605,950	693,223	811,933	881,110	886,132	831,405	984,819	1,058,269
Motor Vehicles	291,678	210,583	217,799	230,538	264,286	283,765	275,797	316,453	346,281
Total	4,514,207	4,507,558	5,171,531	5,808,165	6,419,583	7,394,698	7,210,201	8,763,870	9,542,943

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Table 8. TEUs of Imports to South Atlantic Ports from Selected World Regions, by Commodity, 1995-2003

Commodity	Year								
	1995	1996	1997	1998	1999	2000	2001	2002	2003
Agriculture	12,918	22,907	16,435	27,667	34,952	36,277	37,996	35,310	30,489
Extractive	4,624	3,652	3,103	4,878	5,205	5,241	2,136	2,383	3,360
Food	62,045	68,337	83,618	85,524	95,475	96,757	104,300	103,313	114,105
Materials	88,249	79,347	107,225	116,712	126,788	160,924	163,013	206,265	234,909
Consumer Goods	111,389	115,029	145,463	191,191	223,848	285,092	319,553	417,738	498,692
Chemicals	74,360	67,613	81,369	89,744	109,599	123,859	119,790	146,518	161,241
High Technology	131,788	132,163	158,929	177,619	198,718	212,530	189,645	225,716	232,019
Intermediate Manufacturing	94,895	97,529	116,960	150,769	184,420	195,057	192,935	226,396	262,010
Capital Equipment	82,472	91,516	111,979	148,737	149,017	146,231	144,455	166,209	181,954
Motor Vehicles	42,309	51,286	58,659	70,462	76,653	80,244	94,328	123,041	132,131
Total	705,049	729,379	883,740	1,063,303	1,204,675	1,342,212	1,368,151	1,652,889	1,850,910

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Table 9. CTs of Exports from South Atlantic Ports from Selected World Regions, by Commodity, 1995-2003

Commodity	Year								
	1995	1996	1997	1998	1999	2000	2001	2002	2003
Agriculture	338,750	300,235	344,319	361,767	328,089	349,424	349,743	502,102	628,879
Extractive	1,091,822	1,021,277	1,109,115	1,024,538	998,599	1,146,129	1,223,182	1,196,691	1,417,357
Food	794,458	915,110	1,022,731	911,534	936,045	1,116,725	1,047,159	997,846	1,013,609
Materials	2,250,812	2,210,272	2,269,527	1,951,429	1,999,872	2,226,936	2,276,353	2,500,670	2,649,881
Consumer Goods	92,149	113,533	156,906	96,177	93,419	102,464	99,876	106,845	139,058
Chemicals	663,880	588,311	650,255	570,912	538,908	557,346	593,715	669,242	775,573
High Technology	316,513	301,345	332,120	254,164	257,717	300,945	348,398	347,405	324,822
Intermediate Manufacturing	316,759	284,376	298,837	282,544	244,266	262,690	260,172	255,580	416,683
Capital Equipment	263,436	274,768	290,870	243,206	240,430	262,524	248,995	257,093	268,365
Motor Vehicles	153,257	139,991	196,761	152,041	122,430	158,949	189,385	189,703	180,365
Total	6,281,836	6,149,218	6,671,441	5,848,312	5,759,775	6,484,132	6,636,978	7,023,177	7,814,592

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Table 10. TEUs of Exports from South Atlantic Ports from Selected World Regions, by Commodity, 1995-2003

Commodity	Year								
	1995	1996	1997	1998	1999	2000	2001	2002	2003
Agriculture	61,739	67,661	75,055	69,125	57,681	61,503	60,017	100,030	104,695
Extractive	37,881	41,518	52,599	55,269	50,338	53,935	45,099	41,843	39,733
Food	82,888	80,936	88,448	83,166	94,306	89,445	87,034	101,736	96,039
Materials	272,367	305,420	304,515	271,549	282,605	241,980	251,195	269,790	305,633
Consumer Goods	38,959	46,400	65,936	36,267	34,220	32,137	32,583	33,471	39,905
Chemicals	94,345	79,835	92,060	85,666	86,474	88,505	67,026	103,348	107,073
High Technology	64,469	69,830	79,177	59,820	63,964	56,604	62,018	64,893	61,668
Inter. Manufact.	73,232	84,366	81,048	73,661	68,738	61,725	65,266	67,958	73,814
Capital Equipment	62,876	64,549	67,779	64,787	76,816	55,173	53,040	59,476	60,037
Motor Vehicles	34,024	38,471	51,988	57,533	64,118	64,652	77,022	84,637	91,489
Total	822,780	878,986	958,605	856,843	879,260	805,659	800,300	927,182	980,086

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

VI. SOUTH ATLANTIC WATERBORNE COMMERCE TO 2050 (Task 3)

The South Atlantic ports of Savannah, Charleston, Jacksonville, Wilmington, and Norfolk are described below in terms of commodity flows from five different world regions and the 10 commodity groups that are imported into and exported from these five ports. Each port has niches that will increase its market share by 2050 using this unconstrained forecast[10]. The five world regions are: Europe, India/SE Asia, Middle East/Mediterranean, NE Asia, and Oceania. The 10 commodity groups that will be discussed are agriculture, extractive, food, materials, consumer goods, chemicals, high technology, intermediate manufacturing, capital equipment, and motor vehicles. The output will be presented in containerized tonnes (CTs) and 20-foot equivalent units (TEUs).

A detailed review of projected imports, by commodity group and region of origin, to selected South Atlantic ports revealed discrepancies in selected commodity movements to the Port of Wilmington. These discrepancies resulted from anomalies in the projection model and manifested themselves as excessive growth in commodity movements over the projection period. Specifically, agriculture imports from Eastern Europe, India, NE Asia, North Europe, Europe (Other), and SE Asia, and intermediate manufactured goods from NE Asia to Port of Wilmington exhibited unrealistic growth patterns. For instance, agriculture imports into the Port of Wilmington from 2005 to 2050 were projected to increase from 717 CTs to 40,059 CTs from NE Asia (a 5,487 percent increase), from 2,330 CTs to 62,996 CTs from Europe (Other) (a 2,604 percent increase), and from 40,367 CTs to 407,952 CTs from SE Asia (a 911 percent increase). By comparison, agriculture commodity imports into Norfolk over the same time period are projected to increase from NE Asia by 23 percent, decrease from Europe (Other) by 44 percent, and decrease from SE Asia by 46 percent. Intermediate manufacturing movements from NE Asia show a similar disparity, increasing from 65,937 CTs in 2005 to 528,650 CTs by 2050, a 702 percent increase, compared to a projected increase of only 60 percent for corresponding movements into Norfolk.

The selected Wilmington projections were adjusted to bring the movements into alignment with the projections for the other South Atlantic ports. The adjustments were accomplished by applying the growth rate, by export region and commodity, as projected for Norfolk from 2005 to 2050 to the 2005 (base) commodity projections for Wilmington for the seven region/commodity movements cited above. The resulting adjusted projections are presented in the data that follows.[11]

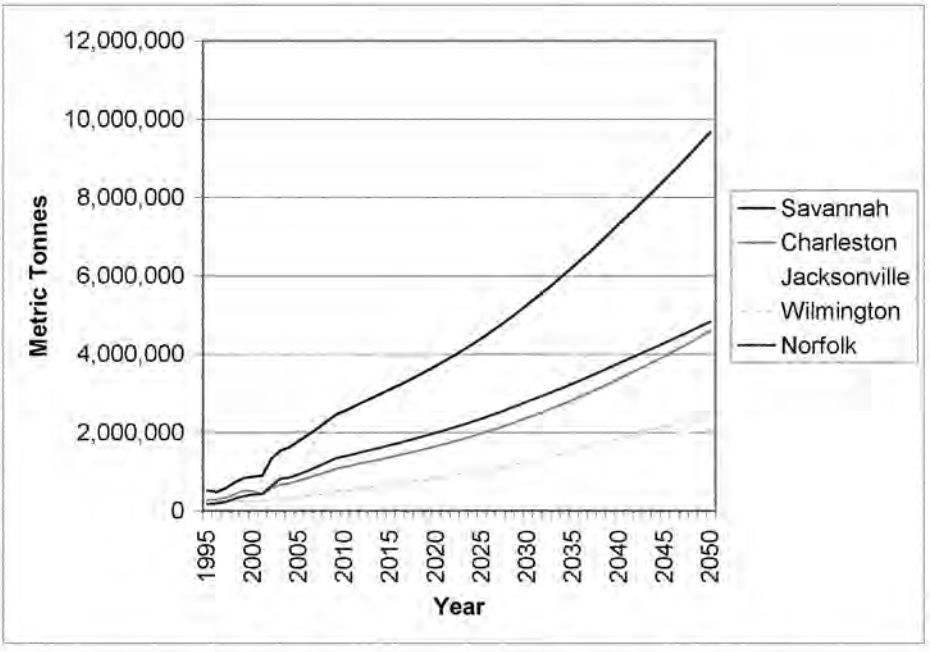
SAVANNAH

Savannah has one large container terminal. Based on the unconstrained forecast, Savannah is likely to capture a large percentage of CT imports from NE Asia relative to the other four ports

[10] The commodity forecast assumes sufficient port capacity during the entire period through 2050 and is referred to as "unconstrained" forecast.

[11] The adjustments to Wilmington were not regarded as negating the overall commodity projections or other South Atlantic ports and Norfolk. Wilmington is a niche port of very small size with respect to containerized cargo volume compared to the other South Atlantic container ports of Savannah, Charleston, and Norfolk.

(Figure 25). Trade with China and Korea is projected to increase. Savannah is projected to be the major recipient of this commerce relative to the other South Atlantic ports.

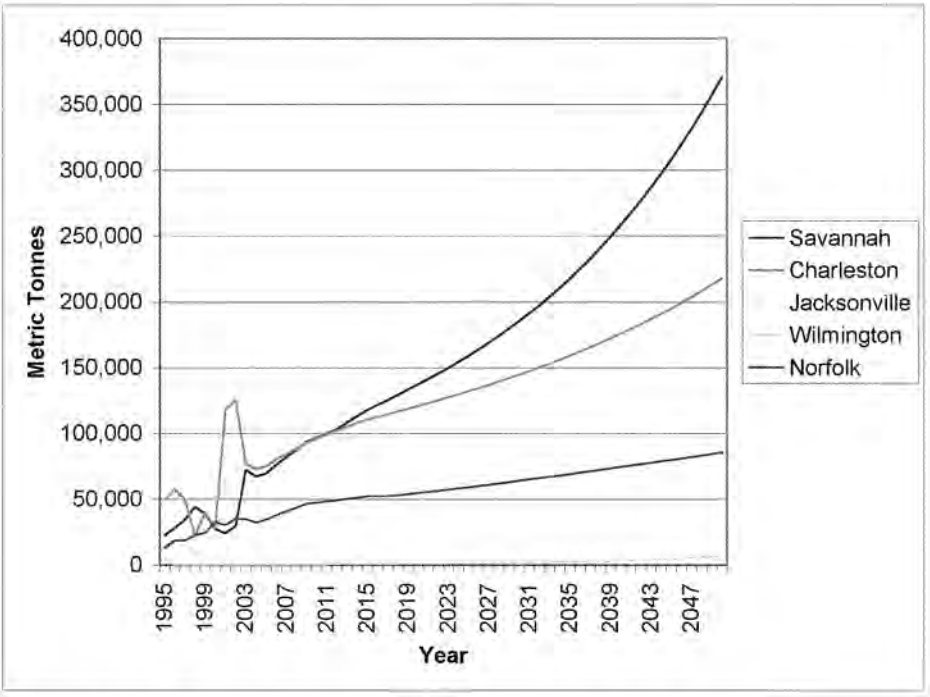


Notes: The commodity forecasts are "unconstrained" by any consideration of port capacity, investment, etc.

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 25. CTs of Imports to South Atlantic Ports from North East Asia, 1995-2050

Another niche that Savannah will attain is CT imports from the world region of Oceania (Figure 26). However, the Oceania volume is much smaller than that of NE Asia. The unconstrained forecast indicates that this volume will increase throughout the next 45 years.

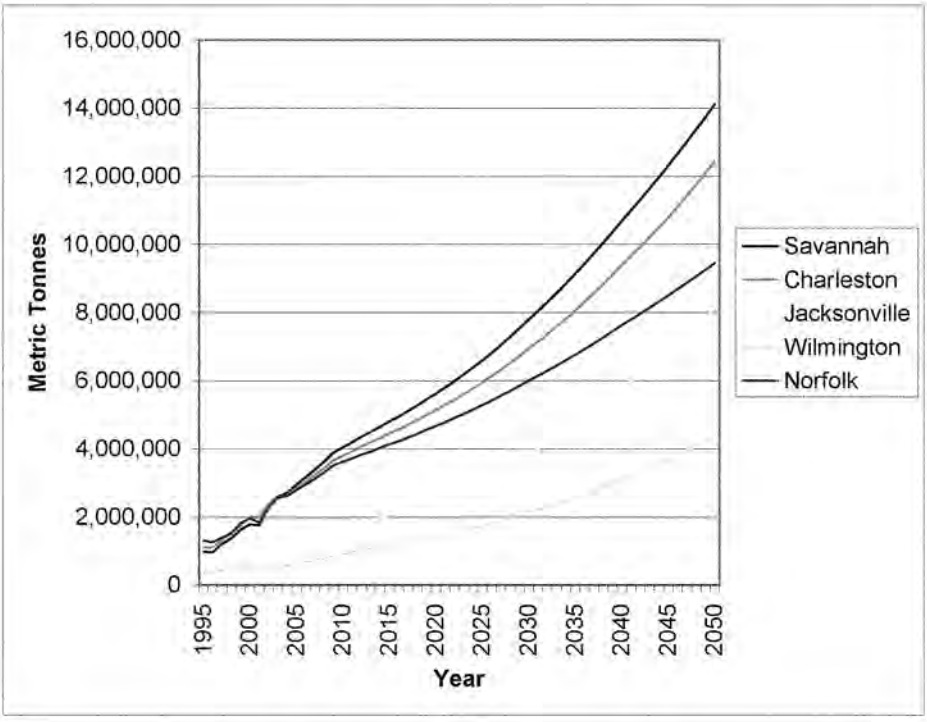


Notes: The commodity forecasts are "unconstrained" by any consideration of port capacity, investment, etc.

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 26. CTs of Imports to South Atlantic Ports from Oceania, 1995-2050

Based on the unconstrained forecast, when the subtotals of all five world regions are combined, Savannah would have the largest CT import volume in 2050, followed closely by Charleston and Norfolk and to a lesser degree by Jacksonville and Wilmington (Figure 27). In 2000, Savannah had less CT imports than Charleston and Norfolk. However, the projections indicate that there will be more growth relative to the other South Atlantic ports in this unconstrained forecast for the five world regions.

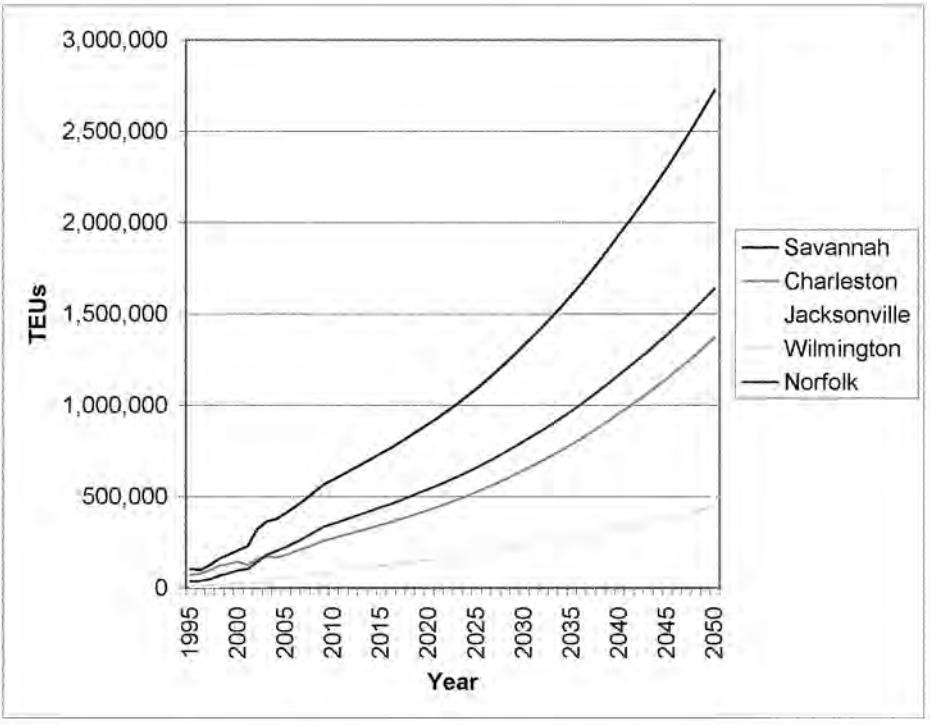


Notes: The commodity forecasts are "unconstrained" by any consideration of port capacity, investment, etc.

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 27. CTs of Imports for Selected/Combined Trade Routes, by South Atlantic Ports, 1995-2050

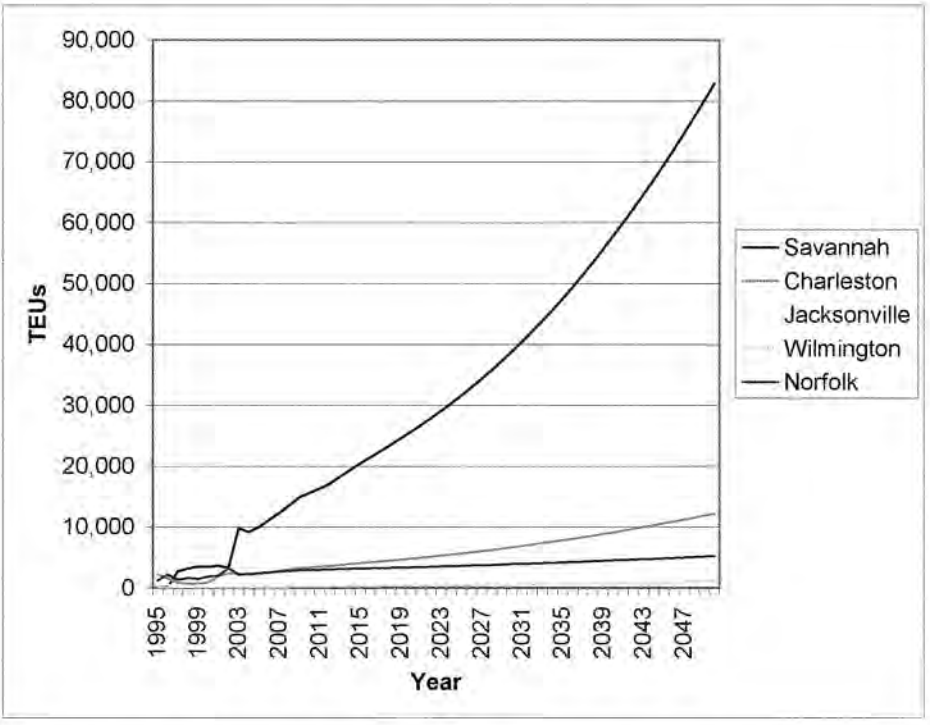
In terms of TEU import volumes, Savannah will have a large market share of the commerce from the world regions of NE Asia and Oceania (figures 28 and 29).



Notes: The commodity forecasts are "unconstrained" by any consideration of port capacity, investment, etc.

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 28. TEUs of Imports to South Atlantic Ports from North East Asia, 1995-2050

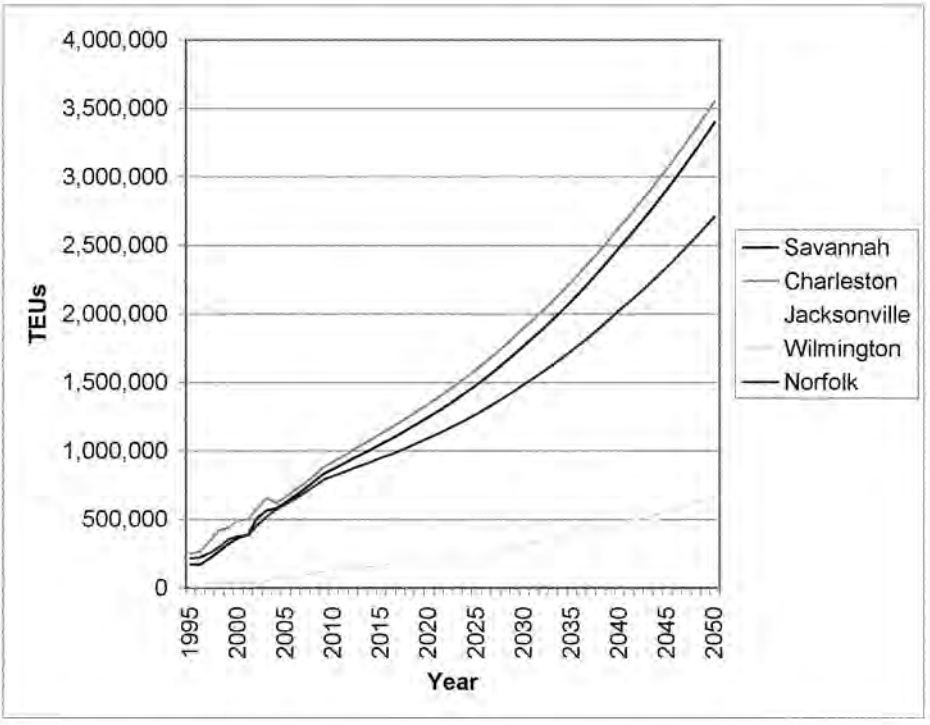


Notes: The commodity forecasts are "unconstrained" by any consideration of port capacity, investment, etc.

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 29. TEUs of Imports to South Atlantic Ports from Oceania, 1995-2050

NE Asia and Oceania will also be Savannah's leading world regions for CT exports. However, the unconstrained forecast indicates that Charleston will have the highest market share of CT export subtotals (Figure 30). TEU export volumes will be provided to the same world regions as TEU import volumes.



Notes: The commodity forecasts are "unconstrained" by any consideration of port capacity, investment, etc.

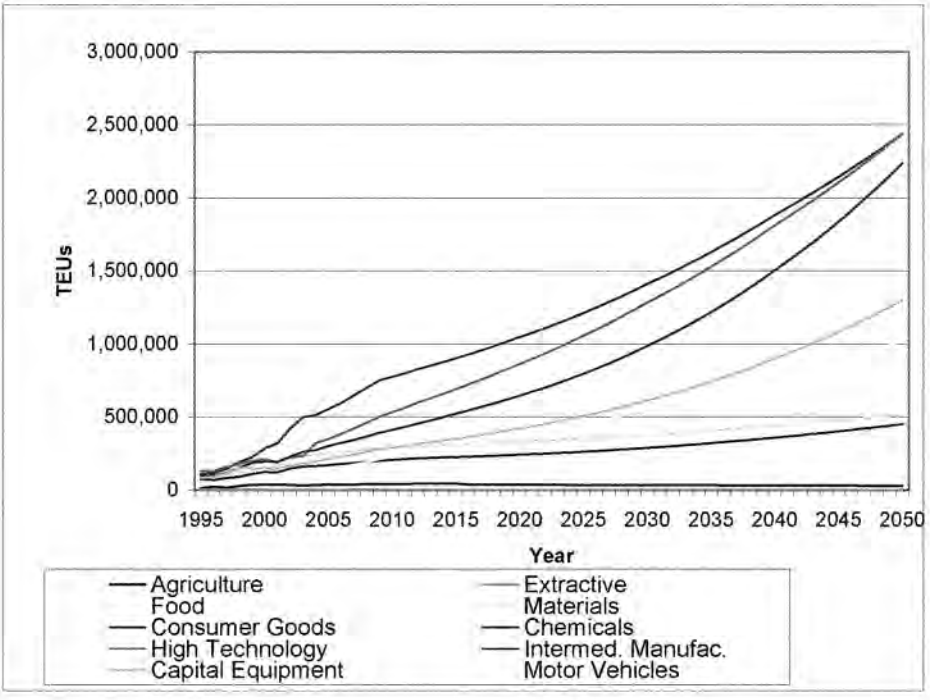
Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 30. TEUs of Imports for Selected/Combined Trade Routes, by South Atlantic Ports, 1995-2050

The unconstrained forecast indicates that Savannah will be the leading South Atlantic port for some commodity sectors by 2050. The leading CT import commodities will include consumer goods and capital equipment. The leading TEU import commodity groups will include consumer goods, chemicals, high technology, intermediate manufacturing, and capital equipment (Figure 31). By 2050, the unconstrained forecast indicates that high technology will be the largest import commodity group for the South Atlantic ports, followed by intermediate

manufacturing, chemicals, capital equipment, and consumer goods (Figure 32). All are leading commodity groups imported to Savannah as CTs or TEUs.

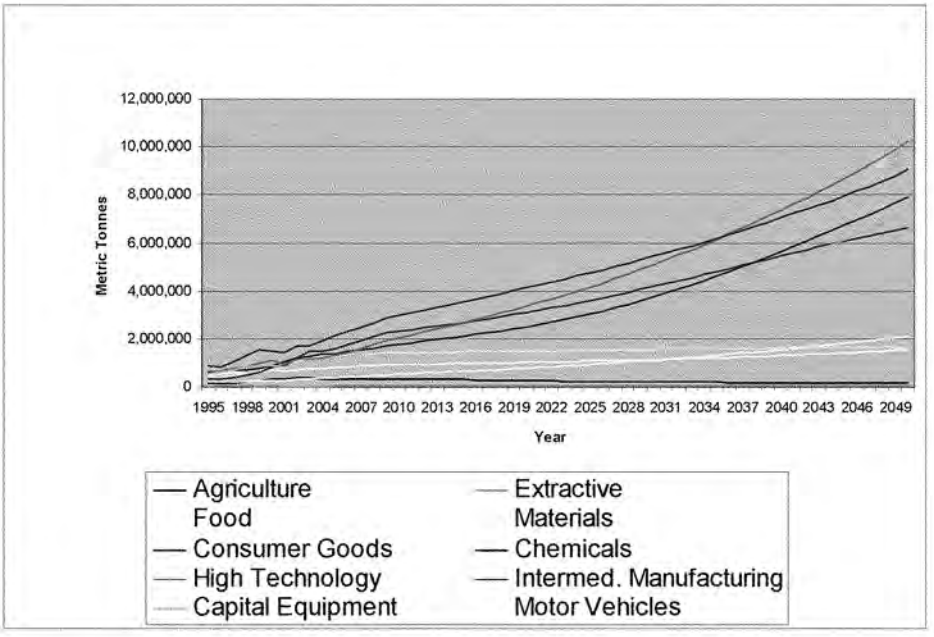
Subtotals for CT and TEU exports are similar to those of imports (figures 33 and 34).



Notes: The commodity forecasts are "unconstrained" by any consideration of port capacity, investment, etc.

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

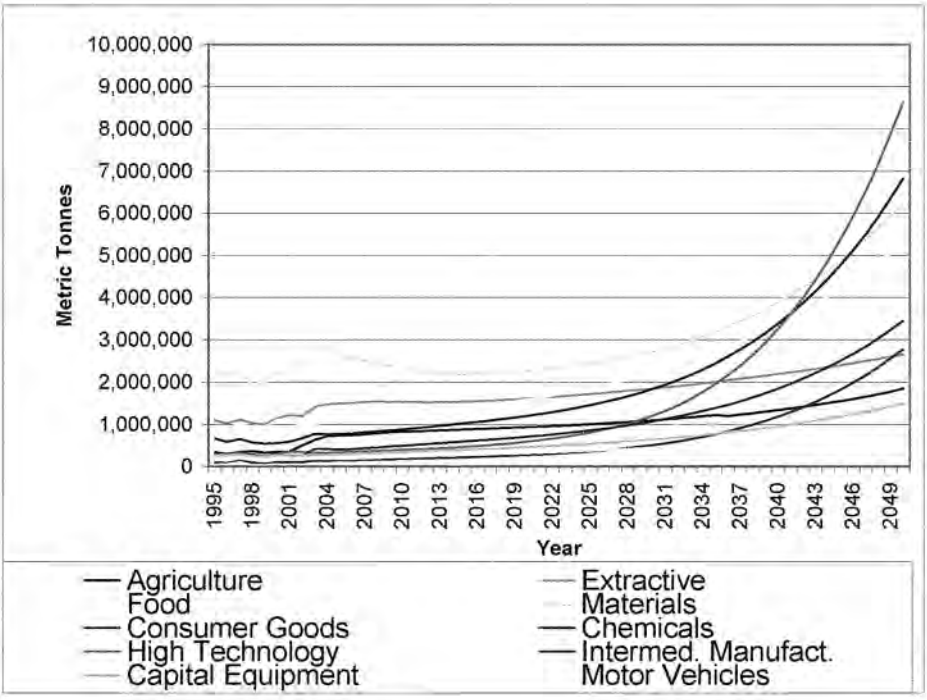
Figure 31. TEUs of Imports for Selected/Combined Trade Routes, by Commodity, 1995-2050



Notes: The commodity forecasts are "unconstrained" by any consideration of port capacity, investment, etc.

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

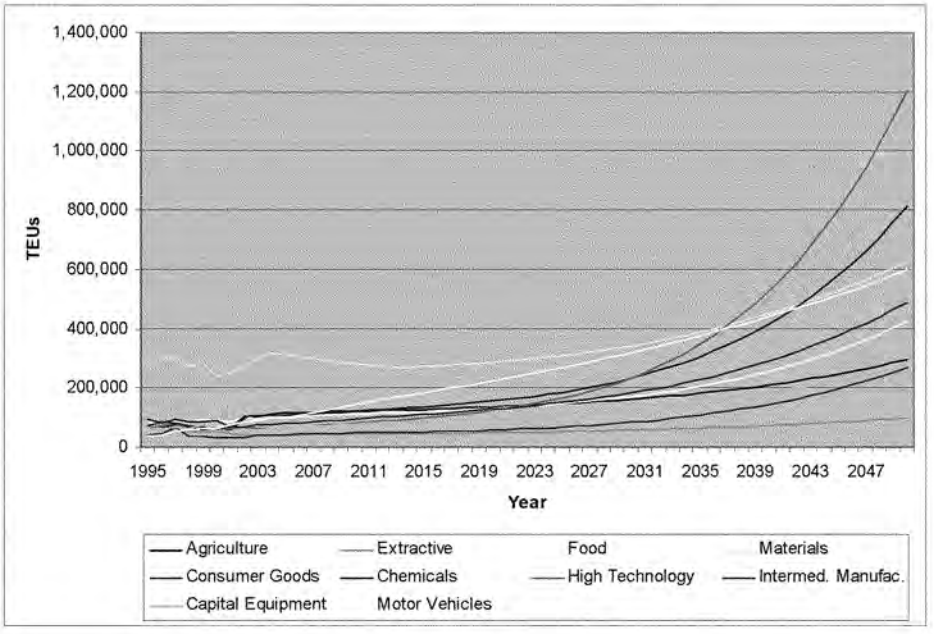
Figure 32. CTs of Imports for Selected/Combined Trade Routes, by Commodity, 1995-2050



Notes: The commodity forecasts are "unconstrained" by any consideration of port capacity, investment, etc.

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004), and G.E.C., Inc.

Figure 33. CTs of Exports for Selected/Combined Trade Routes, by Commodity, 1995-2050



Notes: The commodity forecasts are "unconstrained" by any consideration of port capacity, investment, etc.

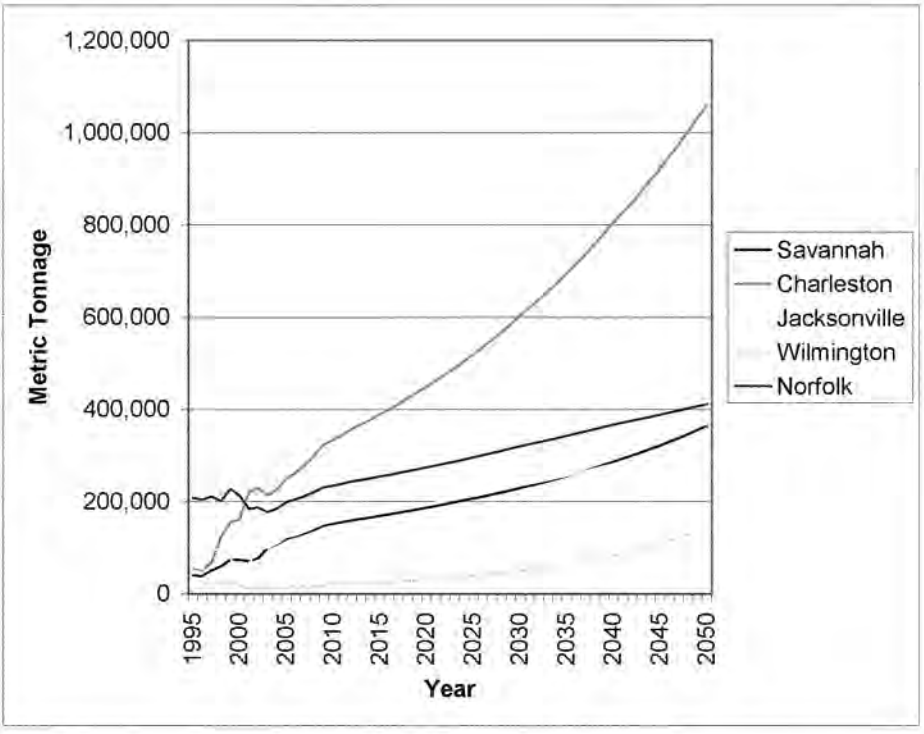
Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 34. TEUs of Exports for Selected/Combined Trade Routes, by Commodity, 1995-2050

CHARLESTON

Charleston has three main container terminals. In the unconstrained forecast that follows, Charleston has more of an importing focus in 2050 than in 2005.

Based on the unconstrained forecast, Charleston is projected to be the leader in 2050 CT imports from the Middle East/Mediterranean (Figure 35).

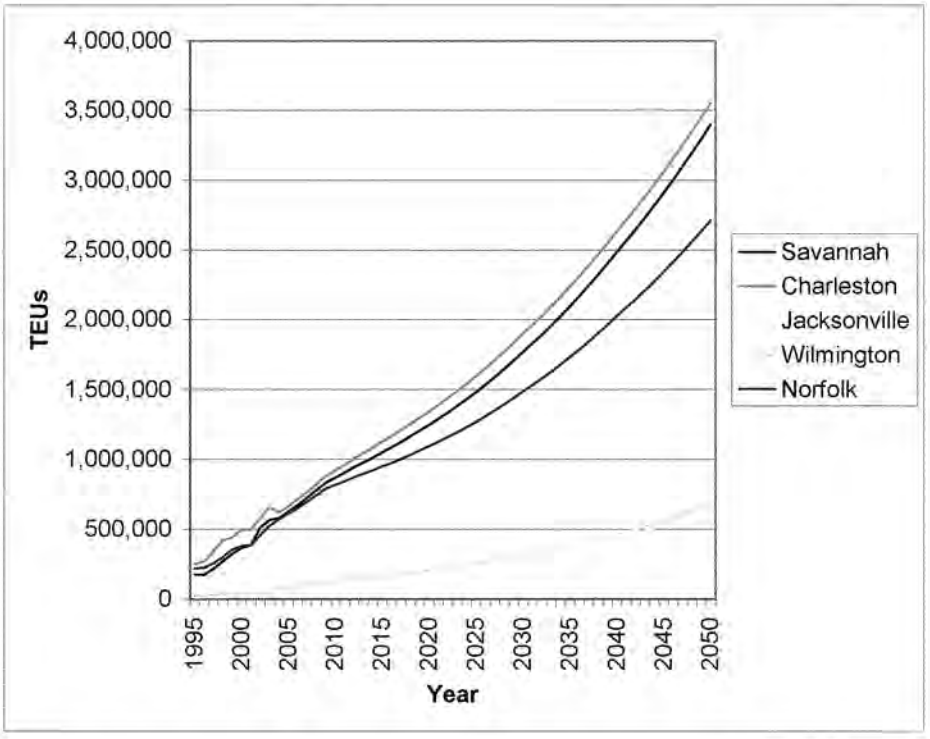


Notes: The commodity forecasts are "unconstrained" by any consideration of port capacity, investment, etc.

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 35. CTs of Imports to South Atlantic Ports from Middle East/Mediterranean, 1995-2050

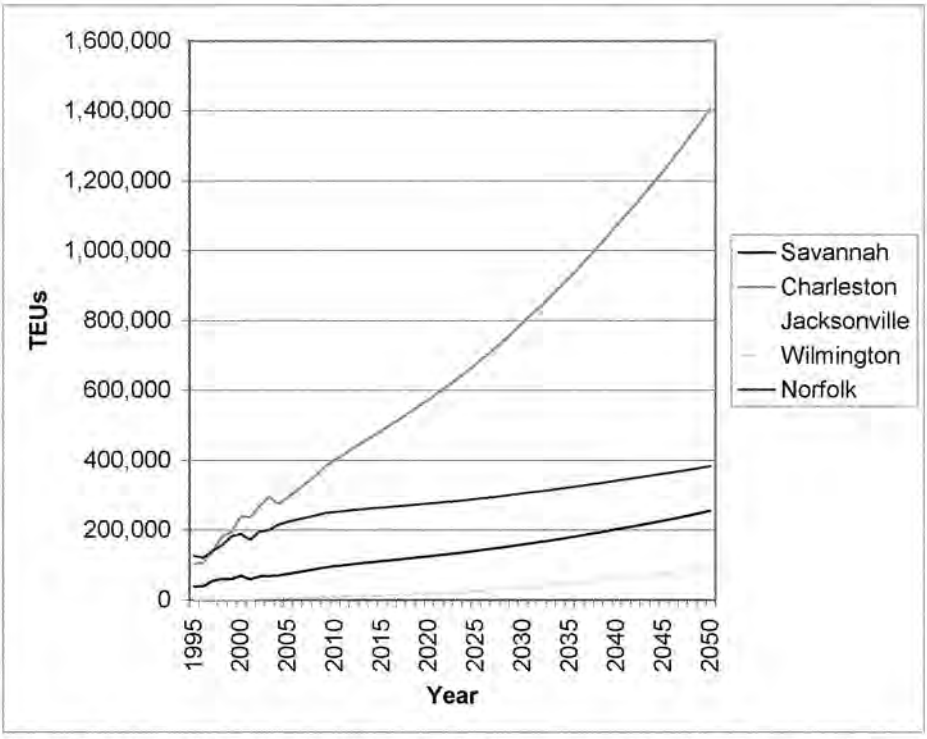
Charleston will control the largest share of imported TEUs (Figure 36). As trade with Europe and the Middle East/Mediterranean increases, the largest percentage of subtotals among the five South Atlantic ports will be registered by Charleston (figures 36, 37, and 38). TEU imports from Europe will be dominated by Charleston. The subtotals for imported TEU volumes will be competitive with Savannah and, to a lesser degree, Norfolk.



Notes: The commodity forecasts are "unconstrained" by any consideration of port capacity, investment, etc.

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

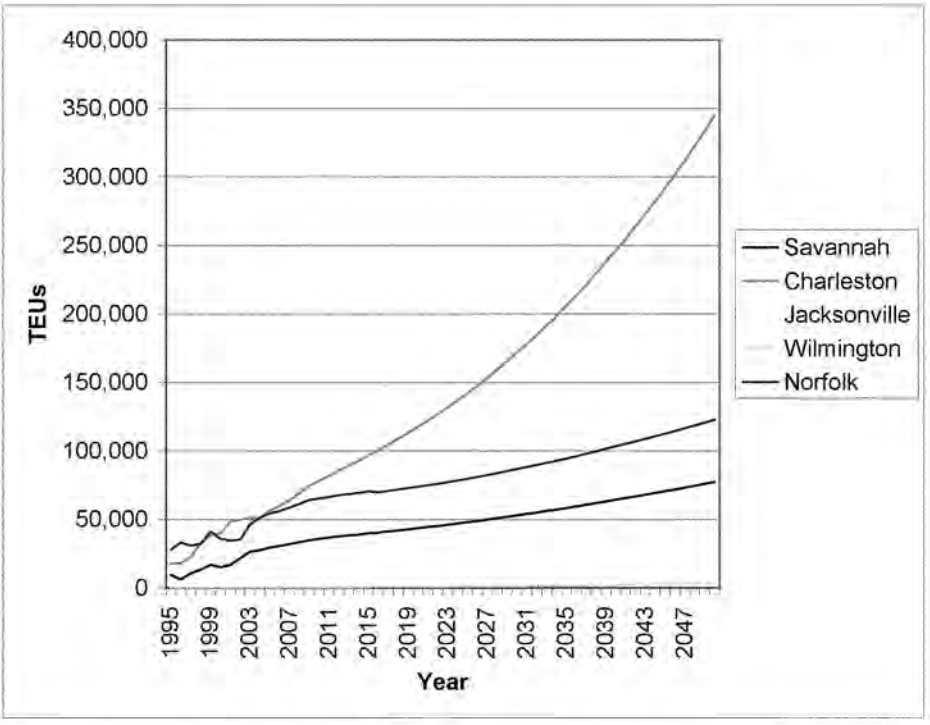
Figure 36. TEUs of Imports to Selected South Atlantic Ports, by South Atlantic Ports, 1995-2050



Notes: The commodity forecasts are "unconstrained" by any consideration of port capacity, investment, etc.

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 37. TEUs of Imports to South Atlantic Ports from Europe, 1995-2050

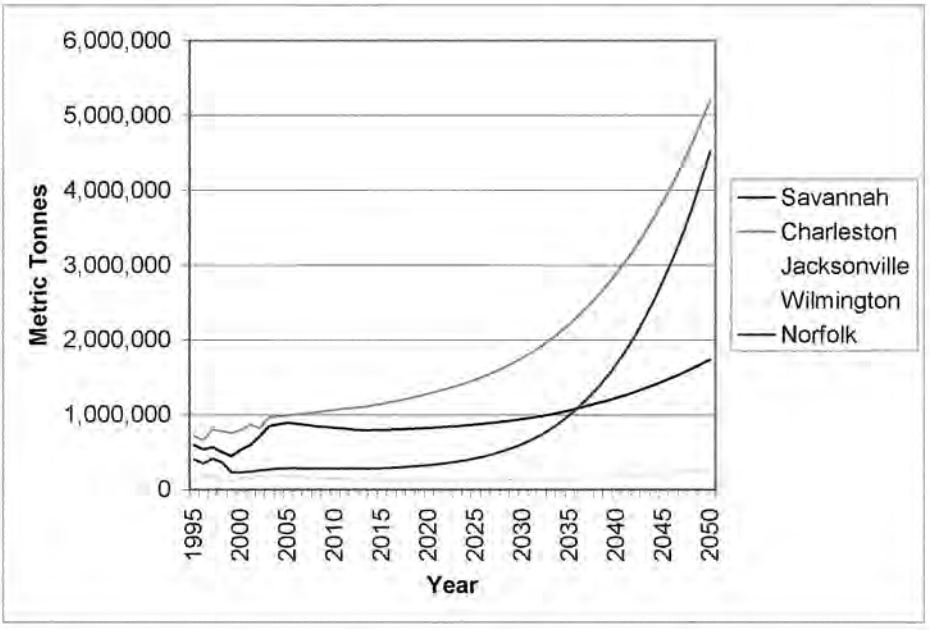


Notes: The commodity forecasts are "unconstrained" by any consideration of port capacity, investment, etc.

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 38. TEUs of Imports to South Atlantic Ports from Middle East/Mediterranean, 1995-2050

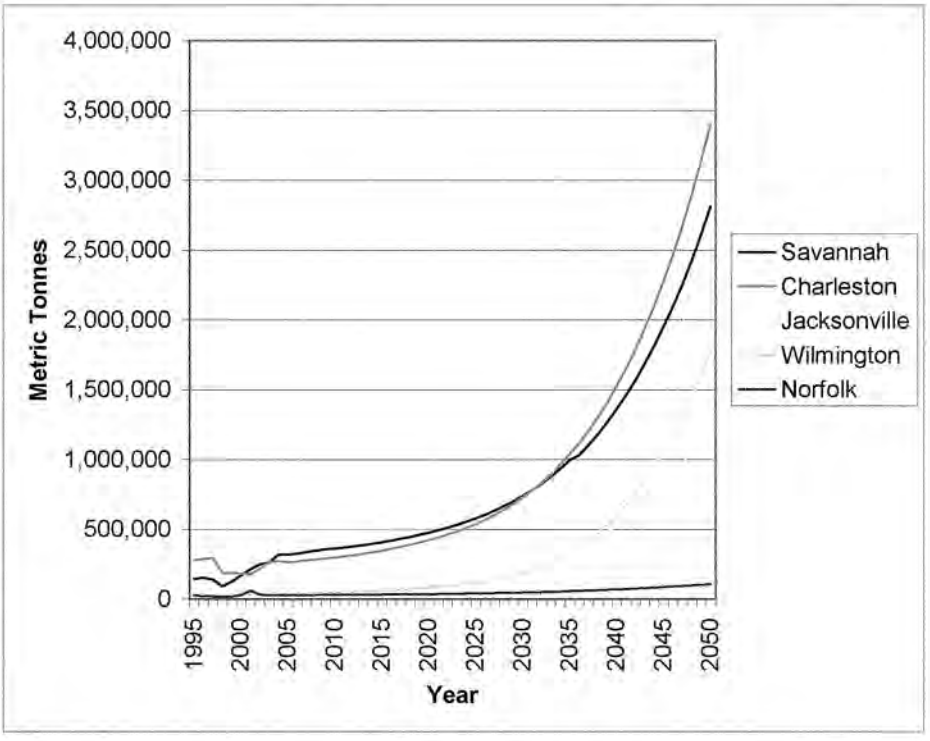
Charleston is projected to capture the largest share of CT export volumes to Europe, India/SE Asia, and Middle East/Mediterranean and the largest percentage of the subtotals (figures 39, 40, 41, and 42). The unconstrained forecast also indicates that Charleston will have the same market share for exported TEU world regions as exported CT world regions.



Notes: The commodity forecasts are "unconstrained" by any consideration of port capacity, investment, etc.

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

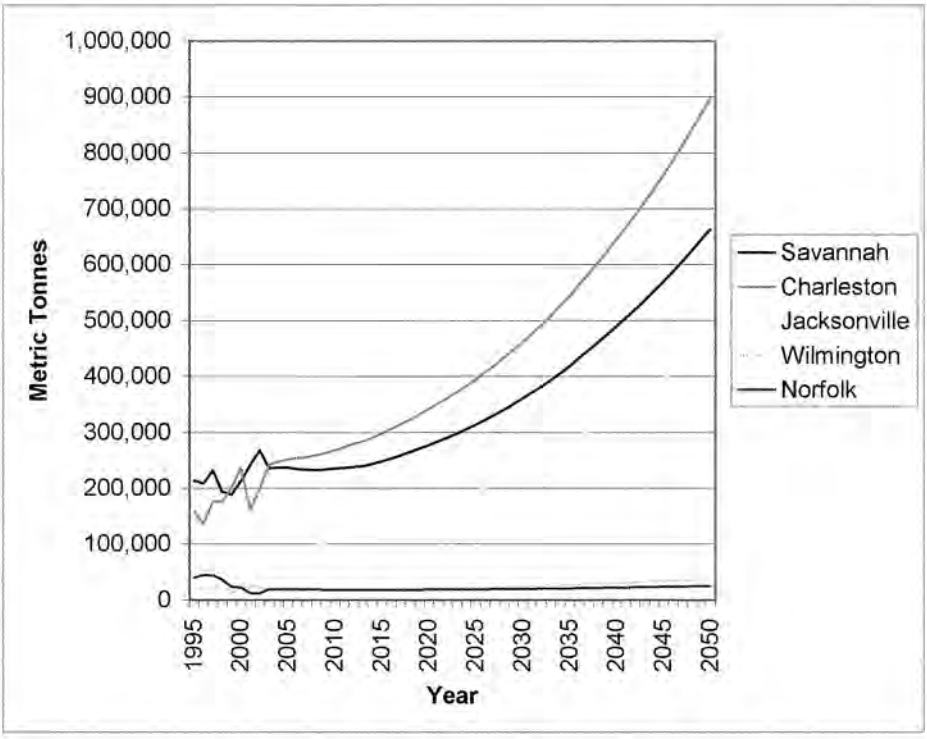
Figure 39. CTs of Exports from South Atlantic Ports to Europe, 1995-2050



Notes: The commodity forecasts are "unconstrained" by any consideration of port capacity, investment, etc.

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

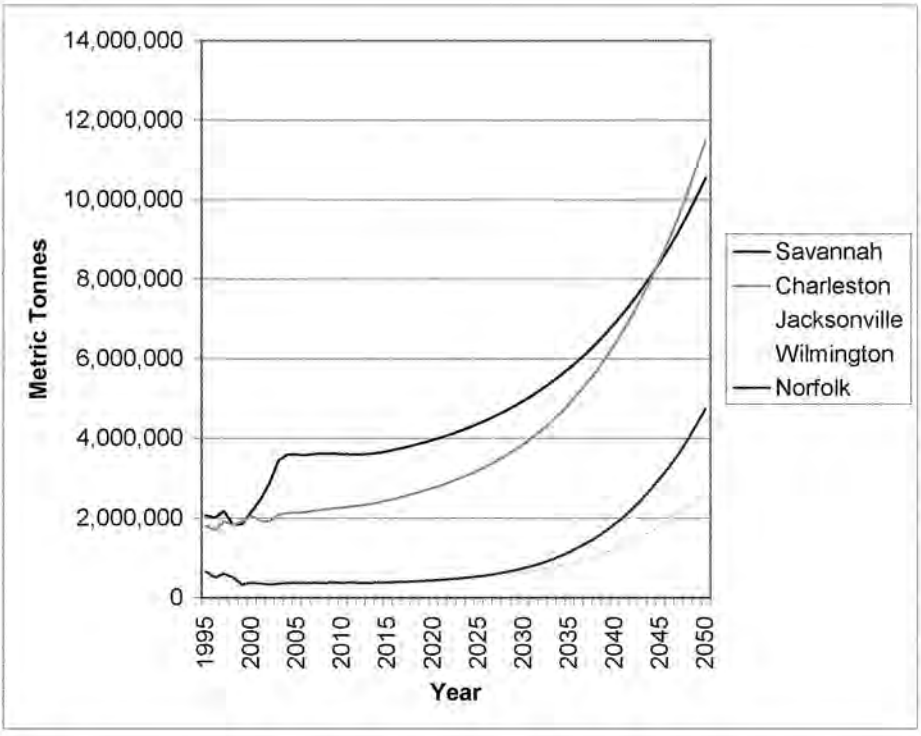
Figure 40. CTs of Exports from South Atlantic Ports to India/South East Asia, 1995-2050



Notes: The commodity forecasts are "unconstrained" by any consideration of port capacity, investment, etc.

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 41. CTs of Exports from South Atlantic Ports to Middle East/Mediterranean, 1995-2050



Notes: The commodity forecasts are "unconstrained" by any consideration of port capacity, investment, etc.

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 42. CTs of Exports for Selected/Combined Trade Routes, by South Atlantic Ports, 1995-2050

Based on the unconstrained forecast, Charleston is projected to be the leading South Atlantic port in terms of some commodity groups. The leading commodities in CT import volume will include materials, intermediate manufacturing, and motor vehicles. The leading commodity groups in TEU import volume will include materials and motor vehicles. In the year 2050, high technology should be the greatest CT import commodity group to the South Atlantic ports, followed by intermediate manufacturing, chemicals, capital equipment, and consumer goods (see

Figure 32). Imported TEU volumes will be similar, except that consumer goods will be replaced by motor vehicles in the top five commodity groups (see Figure 31).

Based on the unconstrained forecast, Charleston is projected to be the leading CT exporter in chemicals, intermediate manufacturing, and motor vehicles and the leading TEU exporter in the same commodities with the addition of capital equipment. In terms of the subtotals, the top five CT export commodity groups in 2050 are projected to be high technology, chemicals, materials, food, and intermediate manufacturing. The top five TEU export commodity groups are projected to be high technology, chemicals, materials, motor vehicles, and intermediate manufacturing.

JACKSONVILLE

Jacksonville has two major container and general cargo terminals, Blount Island and Talleyrand, with both receiving various shipments of container, RoRo, bulk, and multi-cargo types. The unconstrained forecast indicates that Jacksonville is projected to become a major South Atlantic port in imported CT volumes from Europe (Figure 43) other than Charleston.

Jacksonville is expected to develop niches in extractives and chemicals. Chemicals will have a large impact on the exports and imports of commodities by the five South Atlantic ports. Jacksonville is predicted to occupy a chemicals niche on the basis of imported CT volumes (Figure 44) and extractives (Figure 45). However, extractives will not be one of the top five commodity groups in the future.

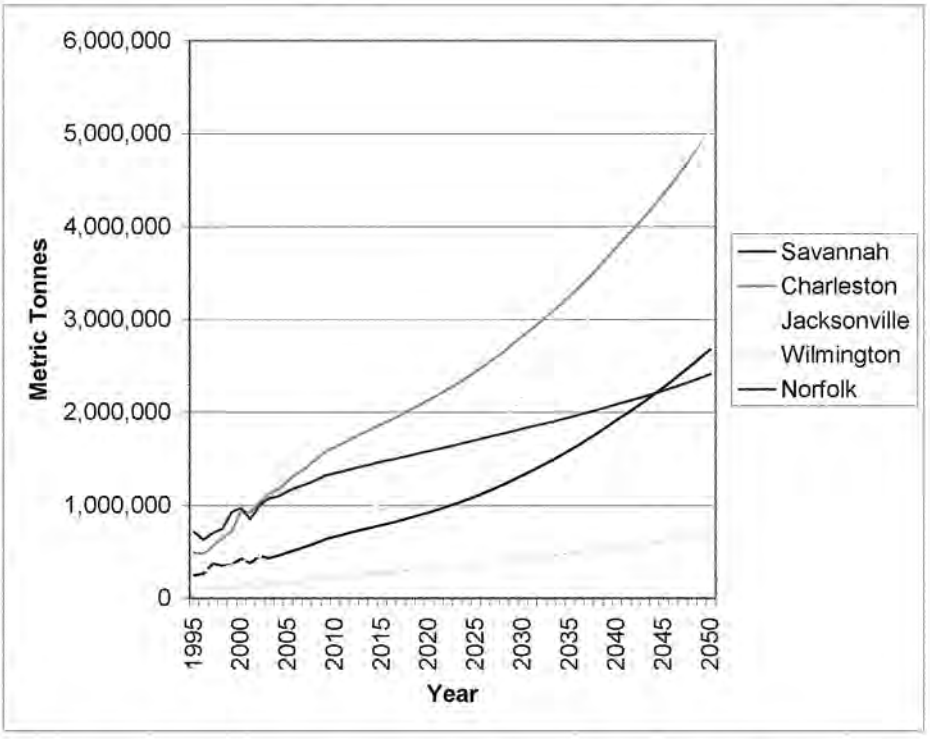
WILMINGTON

The Port of Wilmington has one main terminal and provides facilities for containerized, bulk, and breakbulk cargoes. Wilmington has the lowest container volume of the five South Atlantic ports. The unconstrained forecast indicates that Wilmington is projected to establish a niche in export CT and TEU volumes for high technology (figures 46 and 47). As indicated in figures 33 and 34 above, high technology should have the highest volume of any exported and imported commodity group for the South Atlantic ports.

NORFOLK

Norfolk is part of Hampton Roads, which includes Portsmouth and Newport News. These three terminals are responsible for a large percentage of the trade volume of the South Atlantic ports. Hampton Roads, like the other four ports, is centrally located for commercial traffic to numerous metropolitan regions of the United States.

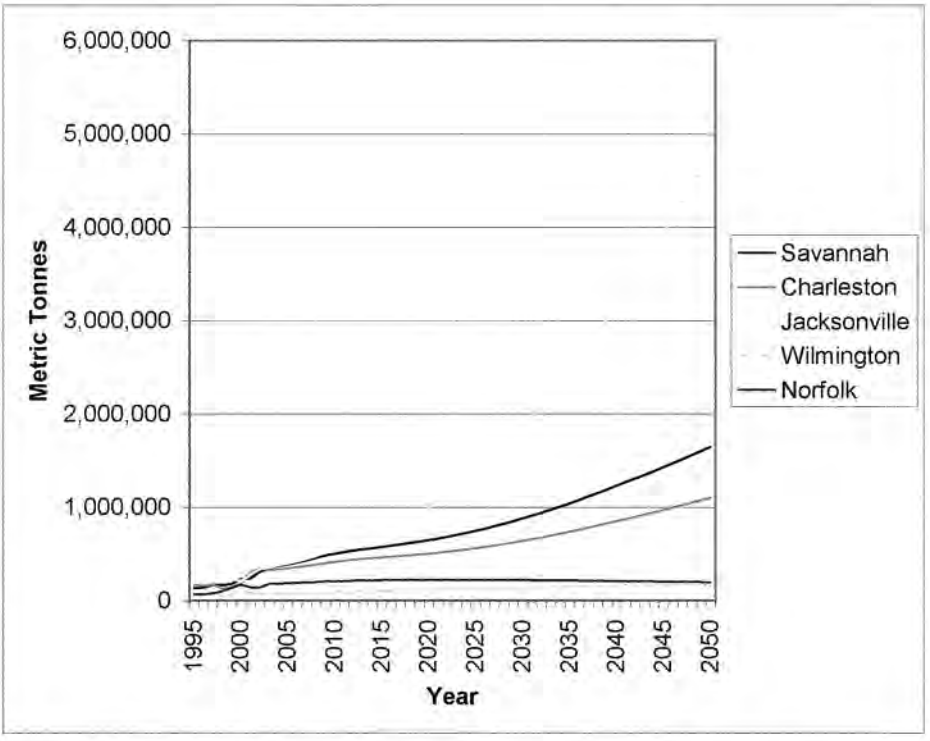
The unconstrained forecast indicates that Norfolk will have the highest percentage market share of CT and TEU volumes for the India/SE Asia region. Nearly 1,700,000 CTs are projected to be imported to Norfolk from this world region, with Charleston close behind. This is not the region with the highest volume of trade to Norfolk, but rather the region where Norfolk has the largest trade volume relative to the other four South Atlantic ports (Figure 48). Norfolk will also have the highest percentage of imported TEU volumes from this same world region (Figure 49).



Notes: The commodity forecasts are "unconstrained" by any consideration of port capacity, investment, etc.

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

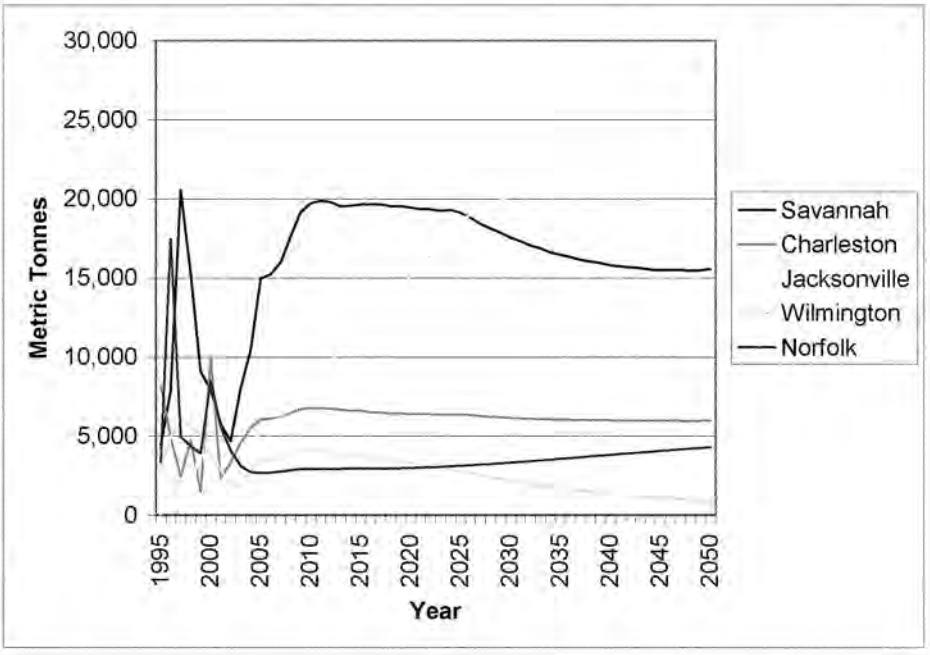
Figure 43. CTs of Imports to South Atlantic Ports from Europe, 1995-2050



Notes: The commodity forecasts are "unconstrained" by any consideration of port capacity, investment, etc.

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

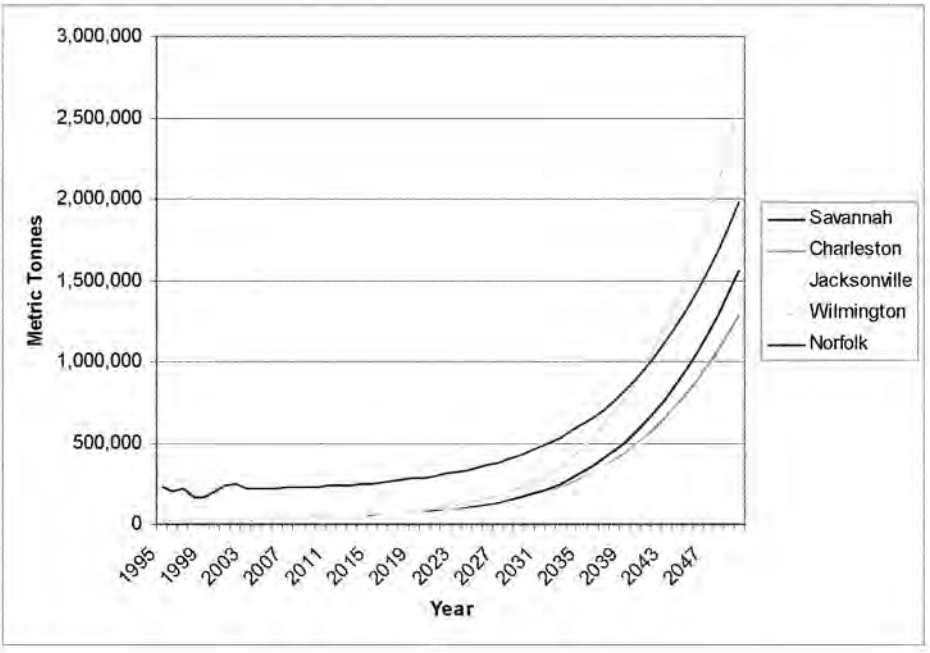
Figure 44. CTs of Imports for Selected Commodities, Chemicals, by South Atlantic Ports, 1995-2050



Notes: The commodity forecasts are "unconstrained" by any consideration of port capacity, investment, etc.

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

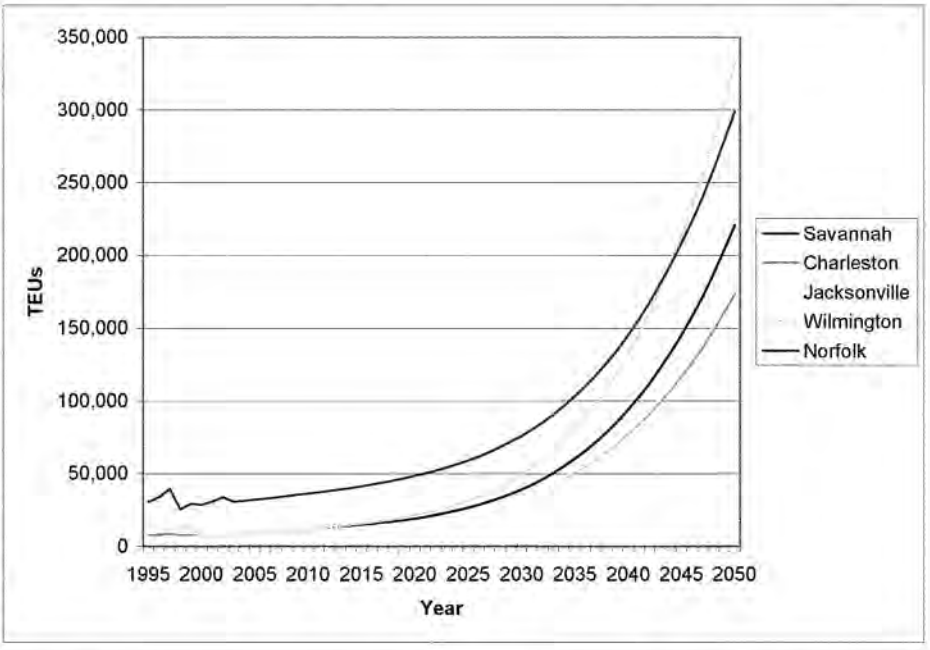
Figure 45. CTs of Imports for Selected Commodities, Extractives, by South Atlantic Ports, 1995-2050



Notes: The commodity forecasts are "unconstrained" by any consideration of port capacity, investment, etc.

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

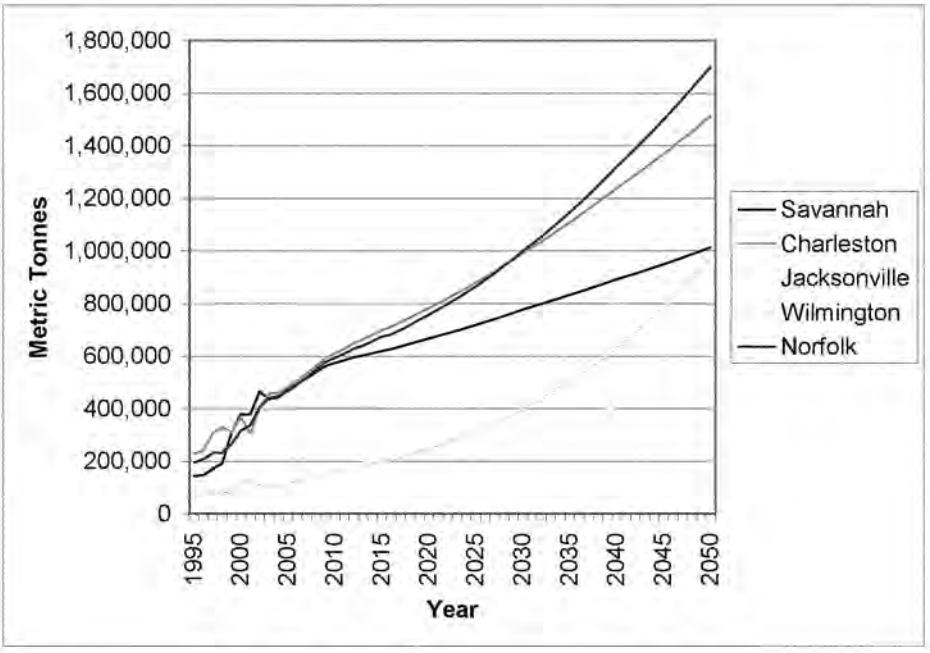
Figure 46. CTs of Exports for Selected Commodities, High Technology, by South Atlantic Ports, 1995-2050



Notes: The commodity forecasts are "unconstrained" by any consideration of port capacity, investment, etc.

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

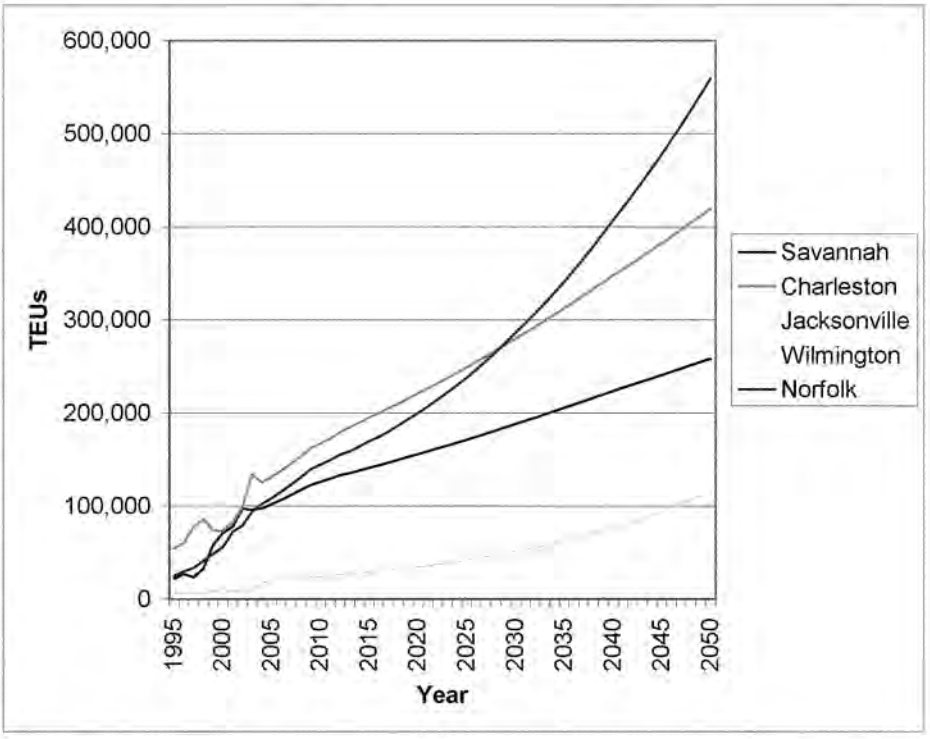
Figure 47. TEUs of Exports for Selected Commodities, High Technology, by South Atlantic Ports, 1995-2050



Notes: The commodity forecasts are "unconstrained" by any consideration of port capacity, investment, etc.

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 48. CTs of Imports to South Atlantic Ports from India/South East Asia, 1995-2050

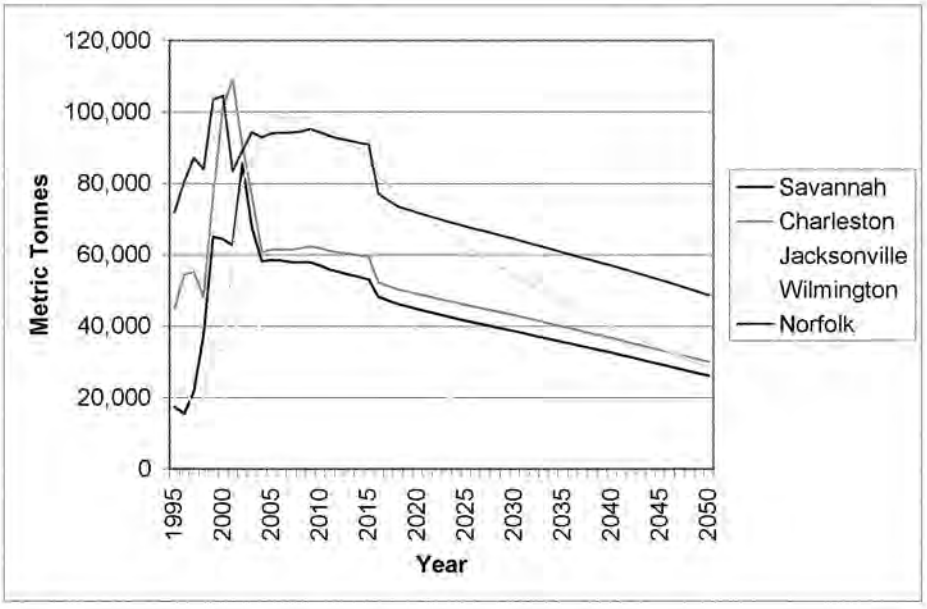


Notes: The commodity forecasts are "unconstrained" by any consideration of port capacity, investment, etc.

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 49. TEUs of Imports to South Atlantic Ports from India/South East Asia, 1995-2050

Norfolk is expected to be dominant in the agriculture trade, but agricultural volumes are expected to decline over the 50-year period (Figure 50).



Notes: The commodity forecasts are "unconstrained" by any consideration of port capacity, investment, etc.

Sources: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (2004); and G.E.C., Inc.

Figure 50. CTs of Imports for Selected Commodities, Agriculture, by South Atlantic Ports, 1995-2050

Based on the unconstrained forecast, Norfolk is expected to be the leader in CT imports for agriculture, food, consumer goods, and high technology. In addition, they should be strong TEU importers of agriculture, extractive, and food.

Norfolk should have control over the materials CT export market among the South Atlantic ports, along with agriculture, food, and consumer goods. Norfolk should also be dominant in TEU exports for agriculture, extractive, food, and materials.

VII. VESSEL FLEET COMPOSITION OF SOUTH ATLANTIC PORTS (Task 4)

This section describes the major lines/services that apply to the economic study area and the general sizes (TEU) of the container vessels calling at the ports of Norfolk, Charleston, Wilmington, and Jacksonville. This information will be used to compile vessel fleet costs, which will be developed using the applicable types and sizes from Savannah Harbor (Table 11) for the four competing ports. In addition, the port costs (all related expenses such as pilotage, tug assistance, wharfage and dockage) will be developed to include with voyage distances and cost for major trade routes.

The general sizes of the container vessels for the major lines/services applicable to the economic study area are based on the liner services and sailing schedules for each port and information taken from line websites. Most, but not all, line websites provide descriptions of their vessels by service and schedule.

NORFOLK

The Virginia Port Authority owns Norfolk International Terminal, Newport News Marine Terminal, and Portsmouth Marine Terminal. The discussion is based on terminal schedules from the end of June through July 2005.

Europe and the Far East, along with India, make up the largest percentage of world regions calling on these terminals. In these two large world regions P&O Nedlloyd is the most frequently calling shipline (Table 12). Based on a sample of 13 P&O Nedlloyd vessels calling Norfolk (Table 13), the average TEU capacity is 3,489. With respect to Europe, the lines P&O Nedlloyd, Hapag-Lloyd, and NYK occupy the services PAX (Pacific Atlantic Express, FE ECUS EU PEN) and GAX (Gulf Atlantic Express, EU ECUS/GULF). With respect to the Far East, the same lines plus OOCL occupy the service AEX (Asia East Coast Express, FE SUEZ ECUS PEN). A sample of three OOCL vessels calling Norfolk averaged 3,180 TEUs. A sample of 11 Hapag-Lloyd vessels calling Norfolk averaged 4,771 TEUs. These are the largest vessels relative to the other three major lines. A sample of three NYK vessels calling Norfolk, averaged 3,793 TEUs.

In the other world regions, P&O Nedlloyd calls the ports of Virginia from the Middle East, and HANJIN, Norasia, and United Arab sail from the Mediterranean regions in the MIX (Mediterranean India Express, ECUS MED) service.

Norfolk International Terminal (NIT) has a wide assortment of lines calling from the four world regions of Europe, the Far East, India, and the Mediterranean. P&O Nedlloyd and Hapag-Lloyd call on NIT the most each month, with Europe and Asia (Far East and India) as their main world region.

Table 11. Savannah Harbor Major Container Lines (2003)

Line	Service	World Area	Calls
Maersk-Sealand	USEC OCEANIA	ECUS AU PEN	23
MSC	MSCEU	ECUS EU GULF	10
MSC	NA CARIB CA TRANSATLANTIC	ECUS EU GULF	25
Subtotal		**ECUS EU GULF**	**35**
Maersk-Sealand	ATS	ECUS EU MED	25
P&O Nedlloyd, ZIM, and Unknown	GAMEX	ECUS MED	56
MSC	MED DIRECT	ECUS MED	3
Senator and USAC	MIX	ECUS MED	11
CMA CGM	TRANS	ECUS MED	5
Subtotal		**ECUS MED**	**75**
APL and Mitsui	APX	FE ECUS EU PEN	44
Hapag-Lloyd	PAX	FE ECUS EU PEN	97
Subtotal		**FE ECUS EU PEN**	**141**
ZIM	ZCS	**FE ECUS MED PEN**	**103**
Evergreen, Hyundai, Lloyd Triesto, and Unknown	AUE	FE ECUS PEN	51
Evergreen, Lloyd Triesto, and ZIM	AUX	FE ECUS PEN	24
Hanjin	AWE1	FE ECUS PEN	43
K Line and Yang Ming	AWE-3	FE ECUS PEN	35
Yang Ming and K Line	AWY	FE ECUS PEN	43
CMA CGM, CSCL, Hanjin, Hyundai, P&O Nedlloyd, and Unknown	CRX	FE ECUS PEN	43
NYK, OOCL, P&O Nedlloyd, and Unknown	ECX	FE ECUS PEN	94
Unknown	ECX2	FE ECUS PEN	5
P&O Nedlloyd	JSY	FE ECUS PEN	6
MSC	MSCFE	FE ECUS PEN	3
APL, Mitsui, and Unknown	NWAECS	FE ECUS PEN	14
APL and Mitsui	NYX	FE ECUS PEN	6
CSCL, P&O Nedlloyd, and Unknown	PEX 1/AAE	FE ECUS PEN	17
Maersk-Sealand	TP-7	FE ECUS PEN	53
MSC	TRANSPAC PEN	FE ECUS PEN	40
Hanjin, K Line, Yang Ming, and Unknown	UNALAW	FE ECUS PEN	18
Hanjin	UNALFE	FE ECUS PEN	9
Subtotal		**FE ECUS PEN**	**504**
Hapag-Lloyd, NYK, and P&O Nedlloyd	AEX	FE SUEZ ECUS PEN	72
Hanjin and Senator	AMA	FE SUEZ ECUS PEN	5
Hanjin and Senator	UNALMD	FE SUEZ ECUS PEN	31
Subtotal		**FE SUEZ ECUS PEN**	**108**
Contship, Hamburg SUD, and P&O Nedlloyd	EASTBOUND	**RTW EAST**	**50**
CMA CGM, Contship, P&O Nedlloyd, and Unknown	WESTBOUND	**RTW WEST**	**49**
MSC, Unknown, Hamburg SUD, Lloyd Triestino, Maersk-Sealand, Norasia, and P&O Nedlloyd	Unknown	**Unknown**	**60**
Unknown	Unknown	Unknown	13
Total			**1,264**
	Line with the most calls per world area (Savannah)		

Source: Savannah Harbor Economic Analysis: Vessel Fleet Forecasts, Parts 3 and 4 (2005).

Table 12. Ports of Virginia Major Container Lines (June and July 2005)

Line	World Area	Service	CALLS
P&O Nedlloyd	EUROPE	ACX	Weekly
P&O Nedlloyd	EUROPE	NAX	Weekly
P&O Nedlloyd, Hapag-Lloyd, and NYK	EUROPE	PAX	Weekly
P&O Nedlloyd, Hapag-Lloyd, and NYK	EUROPE	GAX	Weekly
P&O Nedlloyd	EUROPE	FAMEX	Weekly
Hapag-Lloyd	EUROPE	ATA (Portsmouth)	Weekly
Hapag-Lloyd NYK, and OOCL	EUROPE	ATX	Weekly
Hapag-Lloyd	EUROPE	AMX	Weekly
Hapag-Lloyd	EUROPE	EMX	Weekly
Hapag-Lloyd	EUROPE	ESX	Weekly
Hapag-Lloyd	EUROPE	AEX	Weekly
EVERGREEN	EUROPE	NUE	Weekly
K LINE	EUROPE	TASCO 1	Weekly
HANJIN	EUROPE	NTA	Weekly
Wallenius Wilhelmsen	EUROPE	NORTH AMERICA - EUROPE	10 DAYS
Maersk and Yang Ming	EUROPE	TA1	Weekly
Maersk	EUROPE	TA2	Weekly
Atlantic Container	EUROPE	B	Weekly
Atlantic Container	EUROPE	J	Weekly
American President and Hyundai America	EUROPE	ATS	Weekly
American President	EUROPE	MGS	Weekly
Mitsui OSK	EUROPE	APX	Weekly
Mitsui OSK	EUROPE	NYX	Weekly
Yang Ming	EUROPE	GAS	Weekly
COSCO	EUROPE	TAS3	Weekly
P&O Nedlloyd, Hapag-Lloyd, NYK, and OOCL	FAR EAST	AEX	Weekly
P&O Nedlloyd, Hapag-Lloyd, and OOCL	FAR EAST	PAX	Weekly
P&O Nedlloyd	FAR EAST	CRX	Weekly
P&O Nedlloyd	FAR EAST	ECX	Weekly
P&O Nedlloyd	FAR EAST	ECN	Weekly
CMA-CGM, Hapag-Lloyd, and CP Ships (Lykes)	INDIA	INDAMEX	Weekly
Hapag-Lloyd	FAR EAST	ECN	Weekly
EVERGREEN and Hyundai America	ASIA	NUE	Weekly
EVERGREEN	FAR EAST	NYK	Weekly
K LINE	FAR EAST	NATCO 4	Weekly
HANJIN and United Arab	FAR EAST	AWH	Weekly
HANJIN	FAR EAST	AWK	Weekly
HANJIN	FAR EAST	ICA*	Weekly
Wallenius Wilhelmsen	FAR EAST	ASIA - NORTH AMERICA	10 DAYS
NYK and OOCL	FAR EAST	ECS	Weekly
ZIM	FAR EAST	COS	Weekly
ZIM	FAR EAST	ECA	Weekly
Maersk	FAR EAST	TP3	Weekly
Maersk	FAR EAST	SZX (SUEZ ROUTE)	Weekly
Safmarine	FAR EAST	TP3	Weekly
American President	ASIA	IAX (INDIA)	Weekly
American President	FAR EAST	NYX	Weekly
American President	FAR EAST	APX (outbound from Norfolk)	Weekly

Table 12. Ports of Virginia Major Container Lines (June and July 2005)

Line	World Area	Service	CALLS
Hyundai America	FAR EAST	NYX	Weekly
Yang Ming	FAR EAST	AW1	Weekly
Yang Ming	FAR EAST	AW4	Weekly
COSCO	FAR EAST	AWE4	Weekly
P&O Nedlloyd	MIDDLE EAST	LOOP 5 JEBEL ALI and JEDDAH	Weekly
P&O Nedlloyd	MIDDLE EAST	AGX	Weekly
P&O Nedlloyd	MIDDLE EAST	APEX EAST	Weekly
EVERGREEN	MIDDE EAST	MECL	Weekly
Natl Ship Co of Saudi Arabia	MIDDLE EAST	WESTBOUND	Bi Monthly
CMA-CGM	MED	Amerigo	Weekly
Hapag-Lloyd	MED	AEX	Weekly
EVERGREEN	MED	MUS	Weekly
K LINE	MED	TASCO 3	Weekly
K LINE	MED	TASCO 4	Weekly
HANJIN, Norasia, and United Arab	MED	MIX	Weekly
TURKON	MED	USA LINE	8 DAYS
Mediterranean Shipping	MED	North Atlantic	Weekly
Maersk	MED	MED/GULF	Weekly
Maersk	MED	MECL	Weekly
Yang Ming	MED	TA3	Weekly
CMA-CGM and Norasia	RTW	RTW	Weekly
Hyundai America	RTW	APX	Weekly
Hamburg SUD NA	AUSTRALIA/NEW ZEALAND	AANZ (Eastbound)	Weekly
Australian National		Assume bi weekly b/c bi weekly in Savannah	Bi weekly
Gorthon			

Source: G.E.C., Inc., based on shipline websites.

Table 13. Norfolk International Terminal's Leading Lines and Their Vessels

P&O Nedlloyd	Hapag-Lloyd
P&O Nedlloyd Genoa	Tokyo Express
P&O Nedlloyd Caribbean	London Express
P&O Nedlloyd Jakarta	Bremen Express
P&O Nedlloyd Delft	New York Express
P&O Nedlloyd Detroit	Paris Express
P&O Nedlloyd Cartagena	Kobe Express
Enterprise	Singapore Express
P&O Nedlloyd Sydney	Rotterdam Express
P&O Nedlloyd Barossa Valley	Essen Express
P&O Nedlloyd Seattle	Antwerpen Express
Newport Bay	Hannover Express
Jervis Bay	
Endurance	

Source: G.E.C., Inc., based on shipline websites.

Maersk-Sealand calls at the Portsmouth Marine Terminal (PMT). Two vessels (Sealand Pride and Maersk Missouri) calling from Maersk-Sealand averaged 4,109 TEUs. At this terminal, Maersk-Sealand serves the world regions of Europe, Far East, and Mediterranean, with Hyundai American calling PMT to a lesser degree, followed by the other lines.

The third terminal, Newport News Marine Terminal (NNMT), is called most frequent by the Norasia shipline, with the services MIX and RTW (Round The World) all provided on a weekly basis. Mediterranean is the most often called world region at this terminal.

CHARLESTON

This port has three container terminals. Wando Welsh is the most frequently called terminal in Charleston, with most of its calls coming from Europe and, to a slightly less extent, the Caribbean, followed by the Far East and Mediterranean (Table 14).

Table 14. Port of Charleston Major Container Lines (January and February 2005)

Line	Service	World Area	Calls
APL	IAX	Asia - Indian Ocean	Weekly
China Shipping Container Lines, Gold Star Line, Norasia, and Zim	RTW	Asia - Indian Ocean	Weekly
CMA-CGM, Contship, Hapag-Lloyd, Lykes, MacAndrews, and Shpg Corp. of India	INDAMEX	Asia - Indian Ocean	Weekly
Evergreen and Maersk-Sealand	MECL	Asia - Indian Ocean	Weekly
MSC	Unknown	Asia - Indian Ocean	Weekly
P&O Nedlloyd	NSX	Asia - Indian Ocean	Weekly
Safmarine	USEC EXP	Asia - Indian Ocean	Weekly
APL and Hyundai	APX	Asia - Pacific	Weekly
China Shipping Container Lines, Evergreen, Gold Star Line, Norasia, and Zim	RTW	Asia - Pacific	Weekly
COSCO and Yang Ming	AWE 2	Asia - Pacific	Weekly
Hanjin	AWC	Asia - Pacific	Weekly
Hapag-Lloyd, NYK, OOCL, and P&O Nedlloyd	ECS	Asia - Pacific	Weekly
Hatsu Marine	NUE	Asia - Pacific	Weekly
K Line	NATCO-1	Asia - Pacific	Weekly
Lloyd Triestino	NUE	Asia - Pacific	Weekly
Maersk-Sealand	TP3	Asia - Pacific	Weekly
Maersk-Sealand	TP7	Asia - Pacific	Weekly
MOL	CNY/APX	Asia - Pacific	Weekly
MSC and Safmarine	Unknown	Asia - Pacific	Weekly
MSC	Unknown	Australia - New Zealand	Weekly
Alianca, APL, Hamburg Sud, and P&O Nedlloyd	Samba	Caribbean	Weekly
APL and Hyundai	APX	Caribbean	Weekly
CCNI, CMA-CGM, and CSAV	Americas	Caribbean	Weekly
China Shipping Container Lines, Gold Star Line, Norasia, and Zim	RTW	Caribbean	Weekly
CMA-CGM	TAS	Caribbean	Weekly
CMA-CGM	AMBRE	Caribbean	Weekly
Evergreen and Lloyd Triestino	NUE	Caribbean	Weekly
Hapag-Lloyd, NYK, OOCL, P&O Nedlloyd	ECS	Caribbean	Weekly
Libra, Montemar, and Safmarine	Unknown	Caribbean	Weekly
Lykes	USEC-ECSA2	Caribbean	Weekly
Maersk-Sealand, MSC, and Safmarine	AMEX	Caribbean	Weekly
Maersk-Sealand	Rumba	Caribbean	Weekly
Maersk-Sealand	TP3	Caribbean	Weekly

Table 14. Port of Charleston Major Container Lines (January and February 2005)

Line	Service	World Area	Calls
Maersk-Sealand and MOL	CNY/APX	Caribbean	Weekly
MSC	S Atlantic	Caribbean	Weekly
MSC	Arg Exp	Caribbean	Weekly
TMM	Atl-Ams2	Caribbean	Weekly
ACL	F	Europe - Atlantic	Weekly
ACL	N	Europe - Atlantic	Weekly
APL, Hapag-Lloyd, and Hyundai	APX	Europe - Atlantic	Weekly
APL, Hyundai, and MOL	ATS	Europe - Atlantic	Weekly
Atlanticargo and Star Shipping	Unknown	Europe - Atlantic	10 days
China Shipping Container Lines, Gold Star Line, Norasia, and Zim	RTW	Europe - Atlantic	Weekly
CMA-CGM	TAS	Europe - Atlantic	Weekly
CMA-CGM	TA4	Europe - Atlantic	Weekly
COSCO, Hanjin, K Line, and Yang Ming	TAS 1	Europe - Atlantic	Weekly
Evergreen and Lloyd Triestino	NUE	Europe - Atlantic	Weekly
Hapag-Lloyd, NYK, OOCL, and P&O Nedlloyd	GAX	Europe - Atlantic	Weekly
Hapag-Lloyd and OOCL	GMX	Europe - Atlantic	Weekly
Lykes and TMM	GASS 1	Europe - Atlantic	Weekly
Lykes and TMM	GASS 2	Europe - Atlantic	Weekly
Lykes and TMM	GASS 3	Europe - Atlantic	Weekly
Maersk-Sealand	TA1	Europe - Atlantic	Weekly
Maersk-Sealand	TA2	Europe - Atlantic	Weekly
MOL	CNY/APX	Europe - Atlantic	Weekly
MSC	S Atlantic	Europe - Atlantic	Weekly
NYK and OOCL	ATX/SGX	Europe - Atlantic	Weekly
P&O Nedlloyd	MAX	Europe - Atlantic	Weekly
P&O Nedlloyd	SGX	Europe - Atlantic	Weekly
Zim	AUE	Europe - Atlantic	Weekly
APL	IAX	Mediterranean	Weekly
APL	MDX	Mediterranean	Weekly
APL	MGS	Mediterranean	Weekly
China Shipping Container Lines, Gold Star Line, Norasia, and Zim	RTW	Mediterranean	Weekly
CMA-CGM, Contship, Hapag-Lloyd, Lykes, MacAndrews, and Shpg Corp. of India	INDAMEX	Mediterranean	Weekly
CMA-CGM	TA4	Mediterranean	Weekly
COSCO, Hanjin, K Line, and Yang Ming	TAS 3	Mediterranean	Weekly
Hapag-Lloyd	AMX	Mediterranean	6 days
Hapag-Lloyd	ES 1	Mediterranean	Weekly
Hapag-Lloyd	ES 2	Mediterranean	Weekly
Hapag-Lloyd and Maersk-Sealand	MEDEX	Mediterranean	Weekly
Maersk-Sealand	MECL	Mediterranean	Weekly
Maersk-Sealand	Med/Gulf	Mediterranean	Weekly
P&O Nedlloyd	FAMEX	Mediterranean	6 days
P&O Nedlloyd	NSX	Mediterranean	Weekly
Safmarine	USEC EXP	Mediterranean	Weekly
Turkon	USA LINE	Mediterranean	8 days
Zim	Med Atl	Mediterranean	Weekly

Source: G.E.C., Inc., based on shipline websites.

The North Charleston Terminal (NC) received an equal amount of calls from the world regions of Asia-Indian Ocean, Caribbean, and Mediterranean, with the service INDAMEX calling most frequently from Asia-Indian Ocean and Mediterranean. The Columbus Street Terminal received the most calls from Europe with the TAS1 (Transatlantic Service Loop 1, FE ECUS PEN) service.

As a whole, Charleston receives an equal amount of calls from the four world regions of Asia, Caribbean, Europe, and Mediterranean. The lines and services from each of these major world regions are as follows:

- Asia was represented the most by the service INDAMEX, and the lines using this service were CMA-CGM, Contship, Hapag-Lloyd, Lykes, and Shipping Corporation of India.

- Caribbean was represented the most by the services RTW and ECS. The lines using RTW service were China Shipping Container Lines, Gold Star Line, Norasia, and Zim; and the lines using ECS service were Hapag-Lloyd, NYK, OOCL, and P&O Nedlloyd.

- Europe was represented the most by the services RTW and GAX. The same lines as the Caribbean region used the RTW service. GAX was represented by Hapag-Lloyd, NYK, OOCL, and P&O Nedlloyd. The P&O Nedlloyd vessels P&O Nedlloyd Clarence, P&O Nedlloyd Seattle, P&O Nedlloyd Maxima, and P&O Nedlloyd Genoa averaged 2,853 TEUs.

- Mediterranean was represented the most by the service INDAMEX. A sample of three unnamed CMA-CGM vessels calling Charleston averaged 1,917 TEUs.

WILMINGTON

Wilmington is the smallest of the ports in this analysis. Although large international shiplines call on this port, each line has only one service on a weekly, monthly, or bi-monthly schedule.

The service AUX (Asia USA Express) calls on Wilmington with the lines ZIM, Lloyd Triestino, Evergreen, and Hatsu Marine (Table 15). All lines call from the Far East world region. Another service, AWE3 (Asia-US East Coast Loop-3), calls on Wilmington with the lines COSCO, K Line, and Yang Ming from the Far East world region. The average TEU is 3,837 based on the six Yang Ming vessels Yang Ming South, Yang Ming West, Yang Ming Hamburg, Yang Ming Zenith, Yang Ming Kaohsiung, and Yang Ming Shanghai. TEU information on the other ship lines was not available.

Table 15. Port of Wilmington Major Container Lines (July 2005)

Line	Service	World Area	Calls
Yang Ming	AW3	FAR EAST	Weekly
Zim	AUX	FAR EAST	Weekly
Lloyd Triestino, Evergreen, and Hatsu	AUX	FAR EAST	Weekly
COSCO	AWE3	FAR EAST	Weekly
Hanjin	AWY	FAR EAST	Weekly
K Line	NATCO 2 (AWE3)	FAR EAST	Weekly
NSCSA	Westbound	MIDDLE EAST	Bi-Monthly
UASC	Unknown	MIDDLE EAST	Monthly

Source: G.E.C., Inc., based on shipline websites.

JACKSONVILLE

Jacksonville has two main terminals, Blount Island and Talleyrand. From a container shipping point of view, the Caribbean world region dominates Jacksonville. These vessels are much smaller relative to the other services calling South Atlantic ports.

The ship lines calling Jacksonville have a smaller world percentage market share compared to the other three ports discussed in this section of the report. As a result, the services are primarily from country to country in the same region (Caribbean). Only Mediterranean Shipping Company has an interregional service to Jacksonville from the Far East and Europe/Mediterranean (South Atlantic/Gulf to Northern England and United Kingdom service) to Talleyrand Terminal. Seafreight Line calls on Blount Island for its Caribbean services (Table 16). Their container vessels average 1,100 TEUs based on the vessels Stadt Rendsburg, Stadt Berlin, and Stadt Luneburg. Hamburg Sud calls on Jacksonville with a service to South America. Although this report does not focus on services to South America, the average of the three vessels calling this port (Cap San Lorenzo, Alexandra, and Cap San Marco) is 2,711 TEUs. The one vessel (Sea Cloud) documented for Crowley liner service calling Jacksonville is 600 TEUs. Sea Star's two vessels (El Morro and El Yunque) average 1,129 TEUs.

Table 16. Port of Jacksonville Major Container Lines (June 2005)

Line	World Area	Specific Area	Calls	Terminal	Cargo Type
Horizon Lines	Puerto Rico	Caribbean	Weekly	Blount Island	Container
Sea Star Line	Puerto Rico		Weekly	Blount Island	Container
Trailer Bridge	Puerto Rico		Weekly	Blount Island	Container
Crowley Liner Service	Puerto Rico		Weekly	Talleyrand	Container
Frontier Liner	Dominican Republic		Weekly	Blount Island	Container
Crowley Liner Service	Barbados		Weekly	Talleyrand	Container
Frontier Liner	St. Thomas		Weekly	Blount Island	Container
Mediterranean Shipping	St. Croix		Weekly	Talleyrand	Container
Seafreight Line	St. Vincent		Weekly	Blount Island	Container
Seafreight Line	Trinidad		Weekly	Blount Island	Container
Seafreight Line	Aruba		Weekly	Blount Island	Container
Seafreight Line	Bonaire		Weekly	Blount Island	Container

Table 16. Port of Jacksonville Major Container Lines (June 2005)

Line	World Area	Specific Area	Calls	Terminal	Cargo Type
Seafreight Line	Curacao		Weekly	Blount Island	Container
Seafreight Line	Guyana		Weekly	Blount Island	Container
Seafreight Line	Jamaica		Weekly	Blount Island	Container
Seafreight Line	Surinam		Weekly	Blount Island	Container
Crowley Liner Service	Bahamas		Weekly	Talleyrand	Container
Mediterranean Shipping	Bahamas		Weekly	Talleyrand	Container
Pioneer Shipping	Bahamas		Weekly	Talleyrand	Container
Crowley Liner Service	Mexico		Weekly	Talleyrand	Container
Mediterranean Shipping		Asia/Far East	Weekly	Talleyrand	Container
Mediterranean Shipping		Europe/Mediterranean	Weekly	Talleyrand	Container

Source: G.E.C., Inc., based on shipline websites.

VIII. CURRENT COST OF COMMODITY MOVEMENTS - SAVANNAH HARBOR WITHOUT-PROJECT CONDITIONS (Task 5)

Multiport analysis is divided into three cost components: sea (vessel), port, and land transportation (truck and rail intermodal). Vessel and related port costs will be linked to domestic transport costs to develop a "total delivered transportation cost" for cargoes and hinterlands served by rail intermodal and truck. The delivered total transportation cost will be developed for without- and with-project conditions to reflect the incremental changes in the competitive position of Savannah Harbor under the with-project conditions.

SEA COST

The NED benefits model calculates the sea (vessel) cost for the port legs before and after the three benefiting services call Savannah Harbor. The three benefiting services consist of a Far East (FE) East Coast United States (ECUS) deployment through the Suez Canal (SUEZ), a FE ECUS deployment that calls Europe (EU) before returning to the ECUS and FE, and a similar FE ECUS deployment that calls the Mediterranean (MED) before returning to the ECUS and FE. The three benefiting services operate vessels in a pendulum deployment between the FE, ECUS, and/or EU/MED as appropriate.[1]

Table 17 shows the port leg nautical distances for Savannah and the other four South Atlantic and Mid-Atlantic ports covered by the multiport analysis (Norfolk, Wilmington, Charleston, and Jacksonville deployments) for the FE services through Suez (AEX), Transatlantic portion of FE Panama Canal Services, EU (PAX), and MED (ZCS). These are particular services calling Savannah Harbor that would be enabled to call at deeper sailing drafts not otherwise constrained by the Panama Canal. It should be noted that all of these services calling Savannah are doing so in conjunction with other ECUS or contiguous foreign ports that precede and follow calls at Savannah Harbor.[2] These calls reflect comparatively short distances over which vessels are draft constrained by Savannah Harbor compared to authorized drafts at other ECUS or adjacent foreign ports called in conjunction with Savannah Harbor.[3]

The port leg distances of the three benefiting services as seen in tables 17 and 18 are shown as if these services were effectively calling at the alternative ports (Norfolk, Wilmington, Charleston, and Jacksonville) in direct competition with Savannah.[4] These distances were used to calculate the sea cost component associated with the use of these ports in place of Savannah Harbor as part of the multiport spreadsheet analysis. Appendix C tables 3.1 and 3.2 show the sea cost inputs

[1] The benefiting services are abbreviated as FE SUEZ ECUS PEN, FE ECUS EU PEN, and FE ECUS MED PEN. Pendulum (PEN) services are characterized by vessel deployments that swing back and forth between major world areas rather than a circular itinerary.

[2] Savannah Harbor has the same authorized depth as Wilmington, is greater than Jacksonville, and is less than Charleston and Norfolk. Channel depths at foreign ports called by benefiting services serving Savannah in conjunction with other ECUS ports are typically greater than Savannah (refer to Table 4.1).

[3] Further descriptive information on the benefiting services can be found in the vessel fleet forecast, Part 6, and the NED benefits model.

[4] To some degree, this is already in effect, with Savannah Harbor benefiting service rotations including calls at Norfolk and New York.

used to calculate the benefiting services in Appendix C Table 3.3. Appendix D presents growth trends for major foreign ports associated with the benefiting services to indicate the large volumes of trade and growth therein represented by these ports.

Table 17. Port Leg Nautical Distances Eastbound

Port (depth)		Inbound		Outbound	
Savannah (42)					
AEX	New York	594	Savannah	394	Norfolk
PAX	Manzanillo	1,562	Savannah	394	Norfolk
ZCS	Kingston	1,063	Savannah	594	New York
Norfolk (42 - 50)					
AEX	New York	200	Norfolk	200	New York
PAX	Manzanillo	1,778	Norfolk	200	New York
ZCS	Kingston	1,279	Norfolk	200	New York
Wilmington (42)					
AEX	New York	462	Wilmington	262	Norfolk
PAX	Manzanillo	1,612	Wilmington	262	Norfolk
ZCS	Kingston	1,115	Wilmington	462	New York
Charleston (45)					
AEX	New York	533	Charleston	353	Norfolk
PAX	Manzanillo	1,563	Charleston	353	Norfolk
ZCS	Kingston	1,064	Charleston	533	New York
Jacksonville (41)					
AEX	New York	674	Jacksonville	474	Norfolk
PAX	Manzanillo	1,515	Jacksonville	474	Norfolk
ZCS	Kingston	1,016	Jacksonville	674	New York

Notes: Manzanillo is in Panama, and Kingston is in Jamaica.
AEX is an Asian Suez Canal ECUS Service, PAX is an Asian ECUS EU Service, and ZCS is an Asian ECUS Med Service.
Norfolk marine container terminals have authorized channel depths ranging from 42 to 50 feet.
Although authorized as a 40-foot project, Jacksonville indicates 41 feet.

Source: G.E.C., Inc., developed from *Distances Between Ports.*

Table 18. Port Leg Nautical Distances Westbound

Port (depth)		Inbound		Outbound	
Savannah (42)					
PAX	Norfolk	394	Savannah	1,562	Manzanillo
ZCS	New York	594	Savannah	1,063	Kingston
Norfolk (42 - 50)					
PAX	New York	200	Norfolk	1,778	Manzanillo
ZCS	New York	200	Norfolk	1,279	Kingston
Wilmington (42)					
PAX	Norfolk	262	Wilmington	1,612	Manzanillo
ZCS	New York	462	Wilmington	1,115	Kingston
Charleston (45)					
PAX	Norfolk	353	Charleston	1,563	Manzanillo
ZCS	New York	533	Charleston	1,064	Kingston
Jacksonville (41)					
PAX	Norfolk	474	Jacksonville	1,515	Manzanillo
ZCS	New York	674	Jacksonville	1,016	Kingston

Notes: Manzanillo is in Panama, and Kingston is in Jamaica.
Norfolk marine container terminals have authorized channel depths ranging from 42 to 50 feet.
Although authorized as a 40-foot project, Jacksonville indicates 41 feet.

Source: G.E.C., Inc., developed from *Distances Between Ports.*

Calculating Sea Cost

Savannah Harbor's current sea cost ($/TEU) at a depth of 42 feet (without-project conditions) for the three benefiting trade routes is presented in Table 19. The sea (vessel) cost is developed in the same way as the NED benefits model without-project conditions. It reflects the average total voyage cost for the legs that precede and follow Savannah Harbor calls for the three benefiting services. For multiport total cost input purposes, it is expressed per TEU rather than as the average total voyage cost per tonne of cargo. The multiport cost spreadsheet contains user-defined variables (tonnes per TEU) for each of the services and directions. A default value of 10 tonnes is used for the sea cost calculations in Table 19 and ensuing expressions of sea cost.

Table 19. Current Sea Cost for Benefiting Trade Routes Calling Savannah Harbor ($/TEU)

FE ECUS MED PEN		
Feet	Inbound ($)	Outbound ($)
42	33.09	16.08
FE ECUS EU PEN		
42	47.43	10.69
FE SUEZ ECUS PEN		
42	10.81	10.76

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

PORT COST

The second component in determining current total transportation cost is port cost, which includes wharfage, dockage, pilotage, tuggage, and container loading, unloading, and handling. The average cargo weight (tonnes) per TEU for each trade route and direction was used to obtain the port cost for tonnage-related items such as wharfage. The information in Table 20 was obtained through a desktop review of each port's terminal tariff and through communications with individual associations. The terminal tariff contains governing rates, rules, and regulations of marine services provided by these ports' authorities and terminal operators.

Table 20. Port Cost for Five South Atlantic Ports

Port	Wharfage $/ton	Dockage $/foot	Container Charges $/TEU	Pilotage $/TEU	Tuggage $/TEU
Norfolk	$3.23	$8.69	$150	$2.44	$1.33
Wilmington	$2.81	$9.47	$150	$2.33	$1.33
Charleston	$3.65	$7.75	$150	$2.33	$1.33
Savannah	$3.50	$10.55	$150	$2.30	$1.33
Jacksonville	$3.00	$7.79	$150	$2.19	$1.33

Notes: Dockage charges stated per linear foot of vessel.
Some cost inputs have been estimated.

Source: Port tariffs from Norfolk, Wilmington, Charleston, Savannah, and Jacksonville websites and communications with individual associations.

Dockage is defined as the charges made or assessed against a vessel for berthing or making fast to any dock, wharf, pier mooring device, or other facility of the terminals and applies to vessels so berthed. Dockage charges are usually computed on the LOA (Length Overall) of vessels as

published in Lloyd's Register of Shipping. Dockage is usually based on a minimum 24-hour period, including fractions thereof rounded to the nearest full day.[5]

Wharfage is defined as the use of wharves in the receiving and delivering of cargo to ships, barges, or other watercraft while lying alongside the wharf properties of the terminal, including cargo received or delivered to barges, lighters, or other watercraft lying alongside of such vessels, or taken from or delivered to the water. Wharfage rates are usually stated in dollars per 2,000 pound ton for containerized cargoes.[6]

Pilotage is the activity in which a pilot guides a vessel within the harbor limits to ensure navigational safety. Tuggage is the activity in which a tugboat pulls or pushes larger vessels. All port charges to the vessel such as dockage, pilotage, and tuggage are assigned to average TEUs assumed to be handled by each service inbound and outbound. The average TEUs per service call inbound and outbound is a user-supplied variable in the multiport spreadsheet. The default value for purposes of this analysis is set at 1,500 TEUs per call.

A composite of other port-related costs under the heading "container charges" is also used on a TEU basis to capture port loading, unloading, and container handling charges on throughputs, exclusive of other tariff items previously noted such as wharfage and dockage. The container handling costs would include other related charges, where applicable, for such things as equipment rental, fresh water, storage, demurrage, terminal security, stevedoring, crane rentals, and special services. Container handling costs were assumed to be similar among the ports because of standardized inputs (labor and equipment). In practice, container throughput port costs may vary on individual components, but for overall total charges per TEU the costs are relatively similar for major lines and cargo volumes.[7]

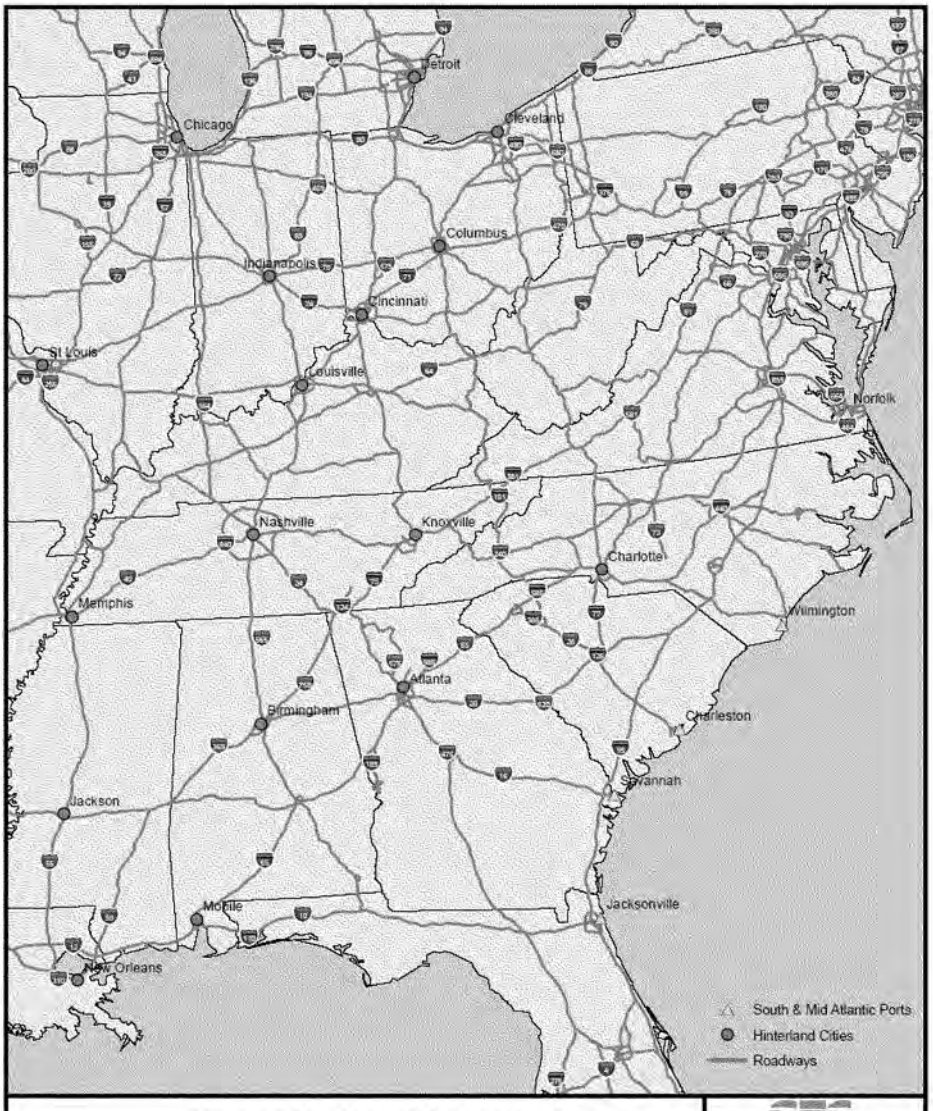
LAND TRANSPORTATION COST

There are two sets of land transportation costs for truck and rail intermodal services. Table 5 contains the highway mileages for major southeast U.S. ports and hinterlands. Figure 51 is a map showing the five Mid-Atlantic and South Atlantic ports and the 17 selected hinterland cities. In addition, Figure 52 shows the Interstate Highway System from the five Mid-Atlantic and South Atlantic ports.

The major competitive cargoes for overlapping hinterlands related to a total delivered cost basis would customarily exclude local imports and exports in close proximity to the port and most likely focus on containerized imports that move by rail or truck to interior hinterland destinations greater than or equal to 250 miles from Savannah (Table 21). This assumption is based on containerized import cargoes that dominate the shared hinterlands of these ports, compared to containerized exports, which tend to be less substantial in volume and/or value and more

[5] Container vessels calling ECUS ports normally are at berth less than 24 hours unless there are extenuating circumstances related to the vessel or availability of port services.
[6] All costs per short ton were converted for metric purposes.
[7] Steamship lines will negotiate container handling charges with the ports, often with various volume incentives and discounts.

N
Detroit
Chicago
Cleveland
Columbus
Indianapolis
Cincinnati
St Louis
Louisville
Norfolk
Nashville
Knoxville
Charlotte
Memphis
Wilmington
Atlanta
Birmingham
Charleston
Savannah
Jackson
Jacksonville
Mobile
New Orleans
South & Mid Atlantic Ports
Hinterland Cities
Domestic Hinterland for Five Mid and South Atlantic Coast Ports
GEC
Figure: 51
Date: September 2005
Scale: 1 inch equals 120 miles
Source: GEC
Map Author: G. Sigrest



INTERSTATE HIGHWAY SYSTEM

Five Mid and South Atlantic Ports
and the Domestic Hinterland

GEC
Figure: 52
Date: September 2005
Scale: 1 inch equals 120 miles
Source: GEC
Map Author: G. Sigrest

localized in nature.[8] Of particular interest to this analysis are the Norfolk Southern and CSX intermodal rail terminals served by Savannah compared to other ports in determining the competitive rail hinterland for intermodal movements, since the Midwest hinterland (particularly Chicago) is heavily oriented toward rail.[9]

Table 21. Highway Distances in Miles from Port Cities to Hinterland Cities

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Savannah	683	504	637	803	629	394	249	252
Charleston	778	638	778	847	695	461	315	200
Norfolk	1,034	894	916	913	947	713	566	327
Jacksonville	546	404	733	900	727	493	345	384
Wilmington	868	728	843	952	785	551	405	196

Table 21 (cont'd). Highway Distances in Miles from Port Cities to Hinterland Cities

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Savannah	497	415	659	664	725	770	953	925	764
Charleston	541	364	607	613	673	718	901	875	713
Norfolk	705	519	654	699	594	765	885	709	558
Jacksonville	594	548	768	796	857	879	1,100	1,057	897
Wilmington	668	491	693	658	658	804	987	862	700

Notes: Savannah mileage is for Garden City, Georgia, and Charleston mileage is for North Charleston, South Carolina.

Source: Rand McNally Tripmaker.

Calculating Truck Cost

Table 21 indicates that the shortest truck travel distance (about 200 miles) is from Wilmington, North Carolina, to Charlotte, North Carolina. The greatest distance (1,100 miles) is Jacksonville to Chicago. Table 22 shows the incremental highway mileages for major southeast U.S. ports and hinterlands. The incremental highway mileages are good indications of the larger distances trucks travel compared to competing ports. For example, in the first column of Table 22, Jacksonville has a zero, representing it as the closest port to New Orleans. Savannah is 137 miles farther than Jacksonville to New Orleans, Charleston is 232 miles farther than Jacksonville

[8] For example, forest products such as wood pulp and clay are major containerized exports from Savannah.
[9] Although there are instances in which containerized cargo imports are handled to and from the cities of competing ports (for example, Jacksonville imports handled through Savannah imports), most ports regard local cargo to be dominated primarily (but not exclusively) by them. The Port of New York/New Jersey, for example, regards local cargoes as including an approximate tri-state area within a 250-mile radius of the port.

to New Orleans, Wilmington is 322 miles farther than Jacksonville to New Orleans, and Norfolk is 488 miles farther than Jacksonville to New Orleans.

Table 22. Incremental Highway Mileages for Major Southeast U.S. Ports and Hinterlands

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Savannah	137	100	0	0	0	0	0	56
Charleston	232	234	141	44	66	67	66	4
Norfolk	488	490	279	110	318	319	317	131
Jacksonville	0	0	96	97	98	99	96	188
Wilmington	322	324	206	149	156	157	156	0

Table 22 (cont'd). Incremental Highway Mileages for Major Southeast U.S. Ports and Hinterlands

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Savannah	0	51	52	51	131	52	68	216	206
Charleston	44	0	0	0	79	0	16	166	155
Norfolk	208	155	47	86	0	47	0	0	0
Jacksonville	97	184	161	183	263	161	215	348	339
Wilmington	171	127	86	45	64	86	102	153	142

Note: Savannah mileage is for Garden City, Georgia, and Charleston mileage is for North Charleston, South Carolina.

Source: Rand McNally Tripmaker.

For purposes of this analysis, truck costs will determine the calculation of land costs unless otherwise stated. The spreadsheet model allows the use of a mixture of rail intermodal and truck costs to be specified by the user. However, rail intermodal does not serve all the hinterland cities directly with all the competing ports; and, as subsequently noted, rail intermodal may not be a close substitute for truck service unless there are special circumstances.

Table 23 shows the average distances in miles that a particular truck would travel from each of the five southeastern U.S. ports. Based on these distances, Savannah appears to be more centrally located, because its average distance to these 17 hinterland cities is 619 miles. Savannah is followed in average distance to hinterland cities by Charleston, Wilmington, Jacksonville, and Norfolk. Norfolk has an average distance of 729 miles to the 17 hinterland cities. The relatively similar standard deviation statistic for each port average indicates a similar dispersion of hinterland city distances for each port's average distance.

Truck costs are based on one hour of pickup time at origin and one hour of delivery time at destination. Driving time is based on the highway distances between ports and hinterland cities shown in Table 21, which are divided by an average underway speed of 55 miles per hour. The

total truck idle hours (one hour for pickup and one hour for delivery) and driving hours (distance in miles divided by 55 miles per hour) were multiplied by default values of $40 per hour for pickup and delivery idling time and $60 per hour for driving time. The difference between idle time and drive time reflects fuel consumption and related costs.

Table 23. Average Distances in Miles Traveled from Each Southeastern Port

Port Cities	Miles (Standard Deviation)
Savannah	619 (208)
Charleston	630 (200)
Wilmington	697 (202)
Jacksonville	708 (231)
Norfolk	729 (185)

Notes: Savannah mileage is for Garden City, Georgia, and Charleston mileage is for North Charleston, South Carolina. The standard deviation in Table 23 is a measure of how widely dispersed the 17 hinterland cities are from the average distance in miles traveled from each southeastern port.

Source: G.E.C., Inc.

Table 24 shows the truck costs for Savannah Harbor associated with traveling to the 17 hinterland cities. Based on the travel distances and the truck cost per hour, the truck land cost/TEU was calculated.[10] The hinterland city with the most expensive truck land cost/TEU from Savannah is Chicago ($559.82). The hinterland city with the least expensive truck land cost/TEU from Savannah is Atlanta ($175.82). Section IV provides more detail regarding the cost analysis of competing Mid-Atlantic and South Atlantic ports.

Table 24. Truck Costs for Savannah Associated with Hinterland Cities

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Pickup Time in Hours	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Delivery Time in Hours	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Driving Time in Hours	12.42	9.16	11.58	14.60	11.44	7.16	4.53	4.58
Pickup/Delivery Cost	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00
Driving Cost	$745.09	$549.82	$694.91	$876.00	$686.18	$429.82	$271.64	$274.91
Total Truck Land Cost	$825.09	$629.82	$774.91	$956.00	$766.18	$509.82	$351.64	$354.91
Truck Land Cost/TEU	$412.55	$314.91	$387.45	$478.00	$383.09	$254.91	$175.82	$177.45

[10] Land costs were developed per TEU so that they could be added to port and sea costs per TEU. For trucks, a common trip would be a 40-foot container (two TEUs) or two 20-foot containers (two TEUs).

Table 24 (cont'd). Truck Costs for Savannah Associated with Hinterland Cities

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Pickup Time in Hours	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Delivery Time in Hours	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Driving Time in Hours	9.04	7.55	11.98	12.07	13.18	14.00	17.33	16.82	13.89
Pickup/Delivery Cost	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00
Driving Cost	$542.18	$452.73	$718.91	$724.36	$790.91	$840.00	$1,039.64	$1,009.09	$833.45
Total Truck Land Cost	$622.18	$532.73	$798.91	$804.36	$870.91	$920.00	$1,119.64	$1,089.09	$913.45
Truck Land Cost/TEU	$311.09	$266.36	$399.45	$402.18	$435.45	$460.00	$559.82	$544.55	$456.73

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Direct Rail Services

Rail intermodal rates for the movement of marine containers between ports and hinterland cities are not available in the public domain. Rail intermodal movements of trailers and containers are exempt from any public regulation pertaining to pricing or services provided. In lieu of formal tariffs, there are rail rate circulars that can serve as indicators of the maximum charges for container movements. The rail rate circulars are not binding, and the rates are privately negotiated between the shipper and the railroad and specified in contracts.[11] Steamship lines acting as rail intermodal shippers on behalf of their clients typically receive substantial volume discounts from the railroads.[12] The rail intermodal marine container sector is regarded as very price competitive.

The rail charges paid by the steamship line on behalf of its customer do not include all the costs to move the container between the port and the shipper. The rail rate includes only payment for rail service, which is between rail terminals, including railcar loading and unloading of marine containers. It is the responsibility of the steamship line (shipper) to get the marine container to the railroad and then to the final destination from the delivering rail terminal (for exports, the opposite would apply). The rail service and related charge does not include expenses associated with the delivery of the container to and from the terminals and the ports and customers. Marine containers are typically drayed to and from the rail terminals by local trucking companies using chassis supplied by the steamship companies. The truck drayage fees are negotiated based on volume and driving time as reflected by typical traffic flow patterns. Drayage charges for congested urban areas and/or low-volume movements that may lack backhauls of other container movements in opposite directions tend to be higher than less congested areas where truck delays

[11] The contracts typically have non-disclosure provisions prohibiting release of the data without mutual consent of the parties.

[12] The volume discounts vary widely and can fluctuate based on volume, but typically range from 25 to 50 percent of the tariff circular.

are infrequent and/or there is a higher volume of containers moving by truck both to and from the rail terminals.

As mentioned above, of particular interest to this analysis are the Norfolk Southern and CSX intermodal rail terminals because of their major presence at the Mideastern and Southeastern ports and hinterland cities. Appendix A tables 1.1 and 1.2 show the direct rail destinations for each of four Mid-Atlantic and South Atlantic port cities and other terminals (Savannah, Norfolk, Charleston, and Jacksonville) by both rail companies. Wilmington does not have a dedicated rail intermodal service.

Appendix A tables 1.1 and 1.2 indicate the ports (excluding Wilmington) for which Norfolk Southern (NS) and CSX have direct rail intermodal services between port cities and 17 hinterland cities. Both NS and CSX both have direct rail intermodal services to Chicago from the four ports. In addition, Norfolk Southern has niche cities by supplying direct services to Atlanta, Cincinnati, Memphis, and Louisville from the ports or terminals adjacent to port cities at Savannah, Norfolk, Charleston, and Jacksonville. Figure 53 shows railroad destinations for NS.[13]

Appendix A Table 1.2 indicates that most CSX direct rail services are to Memphis, particularly from the port cities of Savannah, Charleston, and Jacksonville. In addition, CSX in New Orleans is used in Savannah, Charleston, and Jacksonville for direct rail services. Figure 54 shows railroad destinations for CSX.

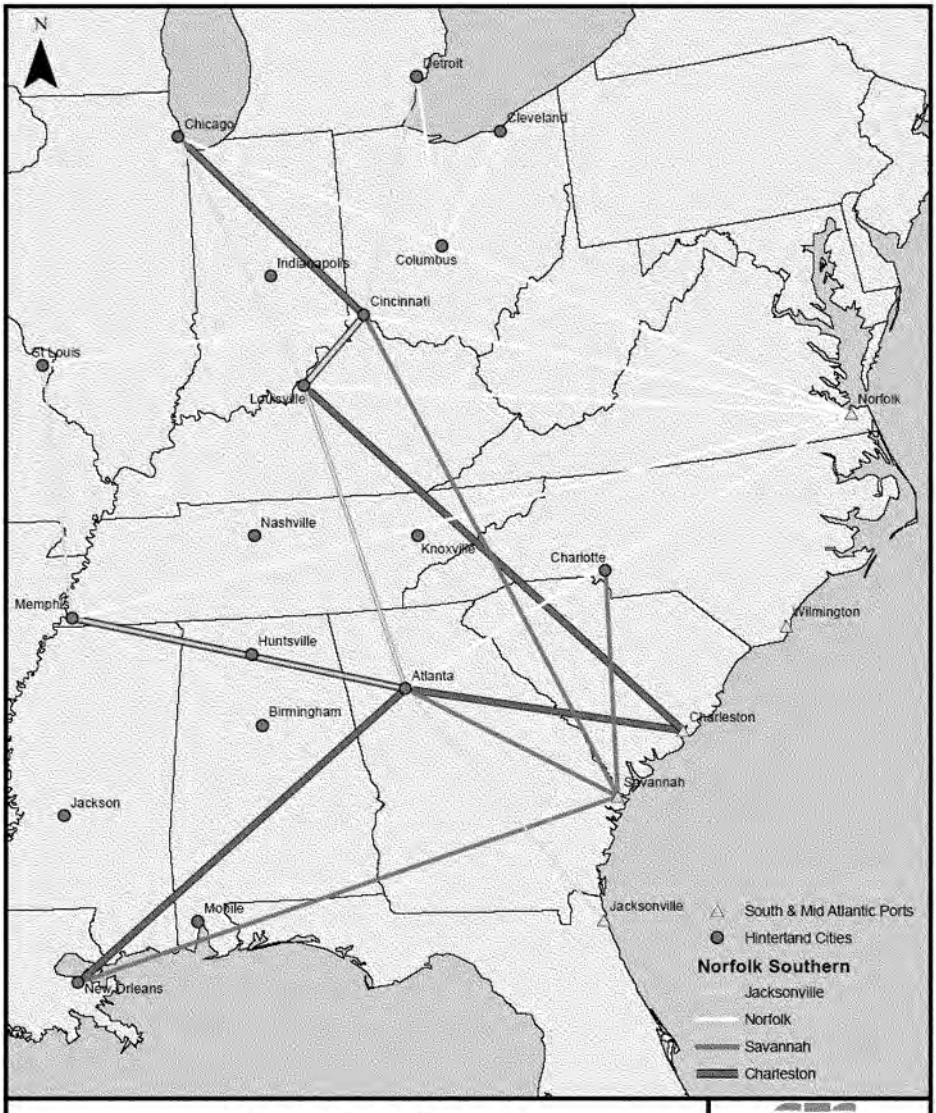
Calculating Rail Cost

Railroad intermodal (trailer and container on flatcar) services compete with trucks on a cost and service basis. Rail service is commonly regarded as less expensive, but often less reliable and slower. Trucks characteristically handle most of the East Coast port containers moving less than approximately 500 miles.[14] The rail share is commonly less than 25 percent of the total container volume at individual ports, although this varies widely from Norfolk, which is more heavily rail compared to less rail intensive ports for marine containers such as Charleston, Savannah, and Jacksonville. Typically, rail marine container movements reflect longer distances, unbalanced movements (load/empty cycles), and multiple lot volumes (for example, retailers). The marine containers handled by rail often exceed maximum highway weight limits (about 48,000 pounds or 24 short tons) or involve repositioning empty containers.

Rail intermodal-related rates and total charges are shown in tables 24, 25, and 26. Rail intermodal service competes with truck rates, which are usually reflective of highway distances in relation to vehicle operating costs.

[13] Not all railroads, NS and CSX, have direct intermodal services between all port cities and hinterland cities, depending on routes and system configurations.

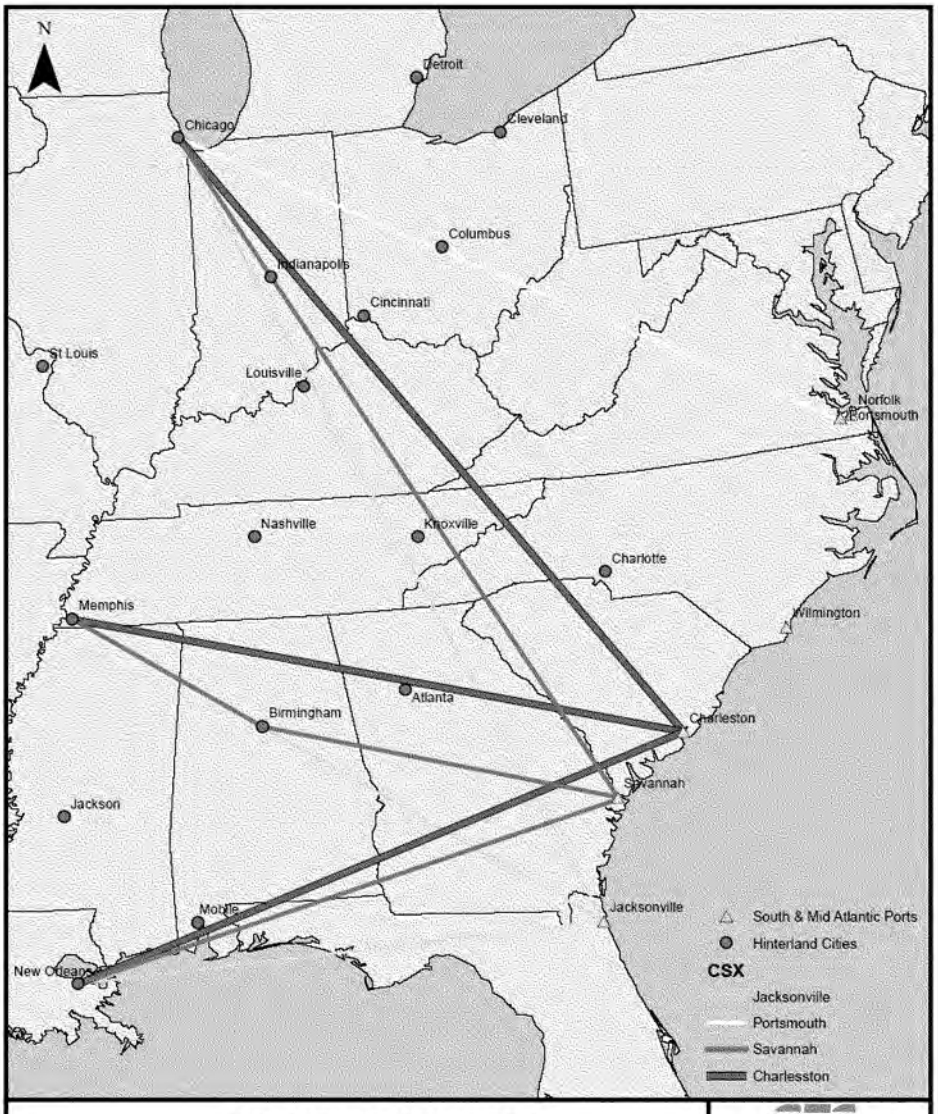
[14] Five hundred miles is regard as a proxy for the typical distance that a single driver can legally attain under maximum driving hours before a mandatory rest period.



RAILROAD DESIGNATION

Intermodal Cities Served from the Five Mid and South Atlantic Ports for Norfolk Southern

GEC
Figure: 53
Date: September 2005
Scale:1 inch equals 120 miles
Source: GEC
Map Author: G. Sigrest



RAILROAD DESIGNATION

Intermodal Cities Served from the Five Mid and South Atlantic Ports for CSX

GEC
Figure: 54
Date: September 2005
Scale:1 inch equals 120 miles
Source: GEC
Map Author: G. Sigrest

Table 25. Estimated Rail Terminal-to-Terminal Hinterland Rates ($/FEU)

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Savannah	0.00	0.00	573.30	722.70	0.00	0.00	298.80	0.00
Charleston	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Norfolk	930.60	0.00	824.40	0.00	0.00	0.00	509.40	0.00
Jacksonville	491.40	0.00	659.70	0.00	0.00	443.70	414.00	460.80
Wilmington	781.20	0.00	758.70	856.80	0.00	495.90	364.50	0.00

Table 25 (cont'd). Estimated Rail Terminal-to-Terminal Hinterland Rates ($/FEU)

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Savannah	0.00	0.00	593.10	597.60	652.50	0.00	857.70	832.50	687.60
Charleston	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Norfolk	0.00	0.00	588.60	629.10	0.00	0.00	796.50	0.00	0.00
Jacksonville	0.00	0.00	691.20	716.40	0.00	0.00	990.00	0.00	0.00
Wilmington	0.00	0.00	623.70	592.20	0.00	0.00	888.30	775.80	0.00

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 26. Estimated Rail/Truck Intermodal Port to Hinterland Terminal Rates ($/FEU)

Port Cities		New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
	Drayage	100.00	100.00	150.00	150.00	100.00	100.00	150.00	150.00
Savannah	30.00	0.00	0.00	753.30	902.70	0.00	0.00	478.80	0.00
Charleston	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Norfolk	30.00	1060.60	0.00	1004.40	0.00	0.00	0.00	689.40	0.00
Jacksonville	100.00	691.40	0.00	909.70	0.00	0.00	643.70	664.00	710.80
Wilmington	100.00	981.20	0.00	1,008.70	1,106.80	0.00	695.90	614.50	426.40

Table 26 (cont'd). Estimated Rail/Truck Intermodal Port to Hinterland Terminal Rates ($/FEU)

Port Cities		Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
	Drayage	100.00	100.00	100.00	150.00	150.00	150.00	150.00	150.00	150.00
Savannah	30.00	0.00	0.00	723.10	777.60	832.50	0.00	1037.70	1012.50	867.60
Charleston	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Norfolk	30.00	0.00	0.00	718.60	809.10	0.00	0.00	976.50	0.00	0.00
Jacksonville	100.00	0.00	0.00	891.20	966.40	0.00	0.00	1240.00	0.00	0.00
Wilmington	100.00	0.00	0.00	823.70	842.20	0.00	0.00	1138.30	1025.80	0.00

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Rail marine container rates for terminal-to-terminal movements are estimated in Table 25 based on the highway mileages in Table 21. A review of Norfolk Southern rates from the circular indicate that for a 40-foot container, the typical rate per mile is about $1.20 for distances more than 400 miles and about $1.60 per mile for shorter distances. Steamship lines were assumed to have a 25 percent volume discount, effectively paying $0.90 per mile for distances more than 400 miles and $1.20 per mile for shorter distances. The rail terminal-to-terminal rates in Table 25 are based on $0.90 per mile for all distances other than fewer than 400 miles.

The total costs of a rail intermodal movement include drayage of the marine container between the port and the rail terminal (imports) and the destination rail terminal and the importer. Table 26 includes estimated local drayage costs between ports and rail terminals and at destination terminals. The destination terminals assume local delivery within a 25-mile radius of the rail terminal. The port drayage costs in Table 26 reflect $30 and $100 charges. The $30 drayage reflects near-dock rail access from the port that does not require the use of licensed vehicles for public streets and roads. The $100 drayage reflects the use of licensed commercial vehicles and drivers to access rail terminals that are not in or otherwise adjacent to the port.

Drayage at destination cities varies based on time, congestion, and distance. Less congested urban areas are assumed to have $100 drayage. Larger, more congested urban areas are assumed to have higher drayage costs of $150.[15] Truck drayage charges do not vary based on the size of the container. A 20-foot container is drayed for the same price as a 40-foot container because there is no difference in driving time.

Table 27 expresses the total rail intermodal costs associated with marine containers on a TEU basis by dividing the 40-foot equivalent unit (FEU) cost in Table 26 by a factor of two. Although there are separate rail rates for 20-foot marine containers (one TEU), these rates are normally more than one-half of a 40-foot container, reflecting the fact that some of the costs are the same regardless of box size (for example, rail car loading and unloading). The truck rates in Table 24 are for a 40-foot marine container and are divided by a factor of two to establish a TEU basis consistent with other multiport cost inputs (sea and port). Likewise, rail rates are presented in a TEU context.[16]

Table 27. Estimated Rail/Truck Intermodal Port to Hinterland Terminal Rates ($/TEU)

Port Cities		New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
	Drayage	100.00	100.00	150.00	150.00	100.00	100.00	150.00	150.00
Savannah	30.00	0.00	0.00	376.65	451.35	0.00	0.00	239.40	0.00
Charleston	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Norfolk	30.00	530.30	0.00	502.20	0.00	0.00	0.00	344.70	0.00
Jacksonville	100.00	345.70	0.00	454.85	0.00	0.00	321.85	332.00	355.40
Wilmington	100.00	490.60	0.00	504.35	553.40	0.00	347.95	307.25	213.20

[15] Drayage costs are a user input that can be specified separately for each port (marine terminal) and hinterland city.
[16] The intermodal total costs for a 20-foot container are higher than one-half of a 40-foot container because of proportionally higher rail rates on a mile basis (to reflect similar loading and unloading costs), and truck drayage would be the nearly the same as a 40-foot box container.

Table 27. (cont'd). Estimated Rail/Truck Intermodal Port to Hinterland Terminal Rates ($/TEU)

Port Cities		Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
	Drayage	100.00	100.00	100.00	150.00	150.00	150.00	150.00	150.00	150.00
Savannah	30.00	0.00	0.00	361.55	388.80	416.25	0.00	518.85	506.25	433.80
Charleston	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Norfolk	30.00	0.00	0.00	359.30	404.55	0.00	0.00	488.25	0.00	0.00
Jacksonville	100.00	0.00	0.00	445.60	483.20	0.00	0.00	620.00	0.00	0.00
Wilmington	100.00	0.00	0.00	411.85	421.10	0.00	0.00	569.15	512.90	0.00

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

TOTAL DELIVERED TRANSPORTATION COST

Table 28 shows Savannah Harbor total cost without the project (existing 42-foot channel) using as an example the service FE ECUS MED PEN Inbound. Total cost is calculated by adding the sea, port, and land cost. Currently, Savannah Harbor's most expensive hinterland city is Chicago (total cost of $791.81, of which about 72 percent is land cost). The least expensive hinterland city for Savannah Harbor is Atlanta ($407.81).

Table 28. Savannah Harbor Total Cost, Existing Conditions, Inbound FE ECUS MED PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$33.09	$33.09	$33.09	$33.09	$33.09	$33.09	$33.09	$33.09
Port Cost Total	$198.90	$198.90	$198.90	$198.90	$198.90	$198.90	$198.90	$198.90
Land Cost Total	$412.55	$314.91	$387.45	$478.00	$383.09	$254.91	$175.82	$177.45
Total Cost	$644.54	$546.90	$619.45	$710.00	$615.09	$486.90	$407.81	$409.45

Table 28 (cont'd). Savannah Harbor Total Cost, Existing Conditions, Inbound FE ECUS MED PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$33.09	$33.09	$33.09	$33.09	$33.09	$33.09	$33.09	$33.09	$33.09
Port Cost Total	$198.90	$198.90	$198.90	$198.90	$198.90	$198.90	$198.90	$198.90	$198.90
Land Cost Total	$311.09	$266.36	$399.45	$402.18	$435.45	$460.00	$559.82	$544.55	$456.73
Total Cost	$543.09	$498.36	$631.45	$634.18	$667.45	$692.00	$791.81	$776.54	$688.72

Notes: All land costs are based on truck costs.
Some cost inputs have been estimated.

Source: G.E.C., Inc.

IX. DETERMINE CURRENT COST OF ALTERNATIVE MOVEMENT (Task 6)

The steps cited in Section VIII for Savannah Harbor were repeated for the alternative Mid-Atlantic and South Atlantic ports (Norfolk, Charleston, Wilmington, and Jacksonville) to link vessel and port costs to hinterland rail intermodal and truck costs. This analysis shows the inputs needed to make a cost comparison between the ports.

Table 29 shows sea costs for benefiting services using as an example the Port of Wilmington. The highest sea cost ($/TEU) inbound is the service FE ECUS EU PEN ($40.22). The highest sea cost ($/TEU) outbound is the service FE ECUS MED PEN ($10.47). The input values to calculate the sea cost for the competing ports Charleston, Norfolk, and Jacksonville can be found in Appendix B tables 2.1 to 2.7. The sea cost for benefiting services for the additional competing ports can be found in Appendix B tables 2.8 to 2.12.

Table 29. Wilmington Sea Cost for Benefiting Services

Inbound	**FE ECUS MED PEN**	**FE ECUS EU PEN**	**FE SUEZ ECUS PEN**
Voyage Hours	48.47826	70.08696	18.78049
Voyage Days	2.019928	2.92029	0.78252
Total Voyage Cost ($)	$69,425	$100,370	$37,835
Sea Cost ($/TEU)	$28.38	$40.20	$7.32
Outbound			
Voyage Hours	20.08696	11.3913	10.65041
Voyage Days	0.836957	0.474638	0.443767
Total Voyage Cost ($)	$28,766	$16,313	$21,456
Sea Cost ($/TEU)	$10.47	$5.95	$5.85

Notes: Some cost inputs have been estimated.
It is assumed that a vessel's volume per port call loaded and unloaded is 1,500 TEUs.

Source: G.E.C., Inc.

The basic NED benefits framework for developing Savannah Harbor sea (voyage) costs was applied to the other ports, adjusting for the vessel voyage distances for particular services (refer to Table 17). The input for total voyage tonnes for which average total sea cost is computed was adjusted to reflect the different authorized depths at the other harbors and prevailing underkeel clearances. For all ports except Jacksonville, the average total at sea cost per TEU is less than Savannah Harbor because of greater authorized channel depths. The Norfolk terminals have different depths, of which two are greater than Savannah Harbor (Norfolk International and Newport News), and one is equal to Savannah Harbor (Portsmouth).

MID-ATLANTIC AND SOUTH ATLANTIC PORTS SEA COST

Mid-Atlantic and South Atlantic Port Costs

Table 30 shows the estimated port costs for the five Mid-Atlantic and South Atlantic ports using as an example the service FE ECUS MED PEN. Total port costs consist of wharfage, dockage, tuggage, pilotage and container charges. Table 30 shows that Savannah has the highest estimated port costs per TEU ($198.90), and Wilmington has the lowest port costs per TEU ($190.64).[17] Port costs for the services FE ECUS EU PEN and FE SUEZ ECUS PEN are presented in Appendix B tables 2.13 and 2.14.

Table 30. Port Costs for Five Mid-Atlantic and South Atlantic Ports, FE ECUS MED PEN

Port	Wharfage $/TEU	Dockage $/TEU	Container Charges $/TEU	Pilotage $/TEU	Tuggage $/TEU	Total Port Costs $/TEU
Norfolk – Portsmouth	35.60	5.51	150	2.33	1.33	194.77
Norfolk – Newport News	35.60	5.51	150	2.37	1.33	194.82
Norfolk International	35.60	5.51	150	2.44	1.33	194.89
Wilmington	30.97	6.00	150	2.33	1.33	190.64
Charleston	40.23	4.91	150	2.33	1.33	198.81
Savannah 42 feet	38.58	6.69	150	2.30	1.33	198.90
Jacksonville	33.07	4.94	150	2.19	1.33	191.53

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Mid-Atlantic and South Atlantic Port Comparison for Truck Cost

Table 31 shows the truck costs for the 17 hinterland cities using Norfolk as an example. The Norfolk truck land cost/TEU is the most expensive for New Orleans and the least expensive for Charlotte. Truck cost is primarily related to the distance from the port city to the hinterland (refer to Table 21). The truck costs for alternative ports in relation to hinterland cities are presented in Appendix B tables 2.15 to 2.17.

Table 32 compares the land transportation costs per TEU for the five Mid-Atlantic and South Atlantic ports based on truck cost. Chicago is the most expensive land destination city for Savannah ($559.82), Charleston ($531.45), Jacksonville ($640.00), and Wilmington ($578.36). Norfolk's most expensive land destination city is New Orleans ($604.00).

[17] Port costs are estimated.

Table 31. Truck Costs for Norfolk Associated with Hinterland Cities

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Pickup Time in Hours	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Delivery Time in Hours	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Driving Time in Hours	18.80	16.25	16.65	16.60	17.22	12.96	10.29	5.95
Pickup/Delivery Cost	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00
Driving Cost	$1,128.00	$975.27	$999.27	$996.00	$1,033.09	$777.82	$617.45	$356.73
Total Truck Land Cost	$1,208.00	$1,055.27	$1,079.27	$1,076.00	$1,113.09	$857.82	$697.45	$436.73
Truck Land Cost/TEU	$604.00	$527.64	$539.64	$538.00	$556.55	$428.91	$348.73	$218.36

Table 31(cont'd). Truck Costs for Norfolk Associated with Hinterland Cities

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Pickup Time in Hours	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Delivery Time in Hours	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Driving Time in Hours	12.82	9.44	11.89	12.71	10.80	13.91	16.09	12.89	10.15
Pickup/Delivery Cost	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00
Driving Cost	$769.09	$566.18	$713.45	$762.55	$648.00	$834.55	$965.45	$773.45	$608.73
Total Truck Land Cost	$849.09	$646.18	$793.45	$842.55	$728.00	$914.55	$1,045.45	$853.45	$688.73
Truck Land Cost/TEU	$424.55	$323.09	$396.73	$421.27	$364.00	$457.27	$522.73	$426.73	$344.36

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 32. Land Cost per TEU Based on Truck Cost for Five Mid-Atlantic and South Atlantic Ports

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Savannah	$412.55	$314.91	$387.45	$478.00	$383.09	$254.91	$175.82	$177.45
Charleston	$464.36	$388.00	$464.36	$502.00	$419.09	$291.45	$211.82	$149.09
Norfolk	$604.00	$527.64	$539.64	$538.00	$556.55	$428.91	$348.73	$218.36
Jacksonville	$337.82	$260.36	$439.82	$530.91	$436.55	$308.91	$228.18	$249.45
Wilmington	$513.45	$437.09	$499.82	$559.27	$468.18	$340.55	$260.91	$146.91

Table 32 (cont'd). Land Cost per TEU Based on Truck Cost for Five Mid-Atlantic and South Atlantic Ports

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Savannah	$311.09	$266.36	$399.45	$402.18	$435.45	$460.00	$559.82	$544.55	$456.73
Charleston	$335.09	$238.55	$371.09	$374.36	$407.09	$431.64	$531.45	$517.27	$428.91
Norfolk	$424.55	$323.09	$396.73	$421.27	$364.00	$457.27	$522.73	$426.73	$344.36
Jacksonville	$364.00	$338.91	$458.91	$474.18	$507.45	$519.45	$640.00	$616.55	$529.27
Wilmington	$404.36	$307.82	$418.00	$398.91	$398.91	$478.55	$578.36	$510.18	$421.82

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Mid-Atlantic and South Atlantic Port Comparison for Total Cost

The total delivered transportation cost is calculated by adding the at sea, port, and land cost components. Total land transportation cost is calculated by the truck cost or rail cost, assuming that specific ports have a direct rail service to one of the 17 hinterland cities. However, for this report, total land cost will be assumed on a truck cost basis. Total cost comparisons for the five Mid-Atlantic and South Atlantic ports at Savannah's 42-foot depth without-project conditions are presented in Appendix C tables 3.10 to 3.50.

Least Total Transportation Cost

The total sea, port, and land transportation cost was calculated for the five Mid-Atlantic and South Atlantic ports with destinations for cargo to the 17 hinterland cities. Table 33 provides a synopsis of the incremental differences in least cost for the competing Mid-Atlantic and South Atlantic ports at a depth of 42 feet (without project) with travel destination inbound using the service FE ECUS MED PEN as an example. The numbers in Table 33 are incremental differences in total transportation cost on a TEU basis. For example, the port with the least cost associated with the hinterland city New Orleans is Jacksonville, represented by zero in Table 33: and Portsmouth (Norfolk) is $264.93 dollars more expensive to transport cargo to New Orleans on the inbound service route FE ECUS MED PEN. Since land cost is the highest cost of transportation per TEU, the port with the most central location to the hinterland cities would generally have the least incremental cost, other things being equal.

Table 23 above showed that Savannah had the lowest average highway distance between hinterland cities (619 miles) compared to the other ports (Jacksonville, Charleston, Wilmington and Norfolk). Table 33 shows that Savannah is the least total cost port to six hinterland cities, consisting of Memphis, St. Louis, Jackson, Birmingham, Atlanta, and Nashville. Figures 55 - 59 show the domestic hinterland and the incremental difference in least total transportation cost for Savannah Harbor compared to the other Mid-Atlantic and South Atlantic ports based on dollars per TEU. The other incremental cost services at 42 feet outbound and inbound can be seen on the excel CD tab Least Cost SH 42 ft.

Hinterland Cities Less than $50 Difference in Total Cost (Without Project)

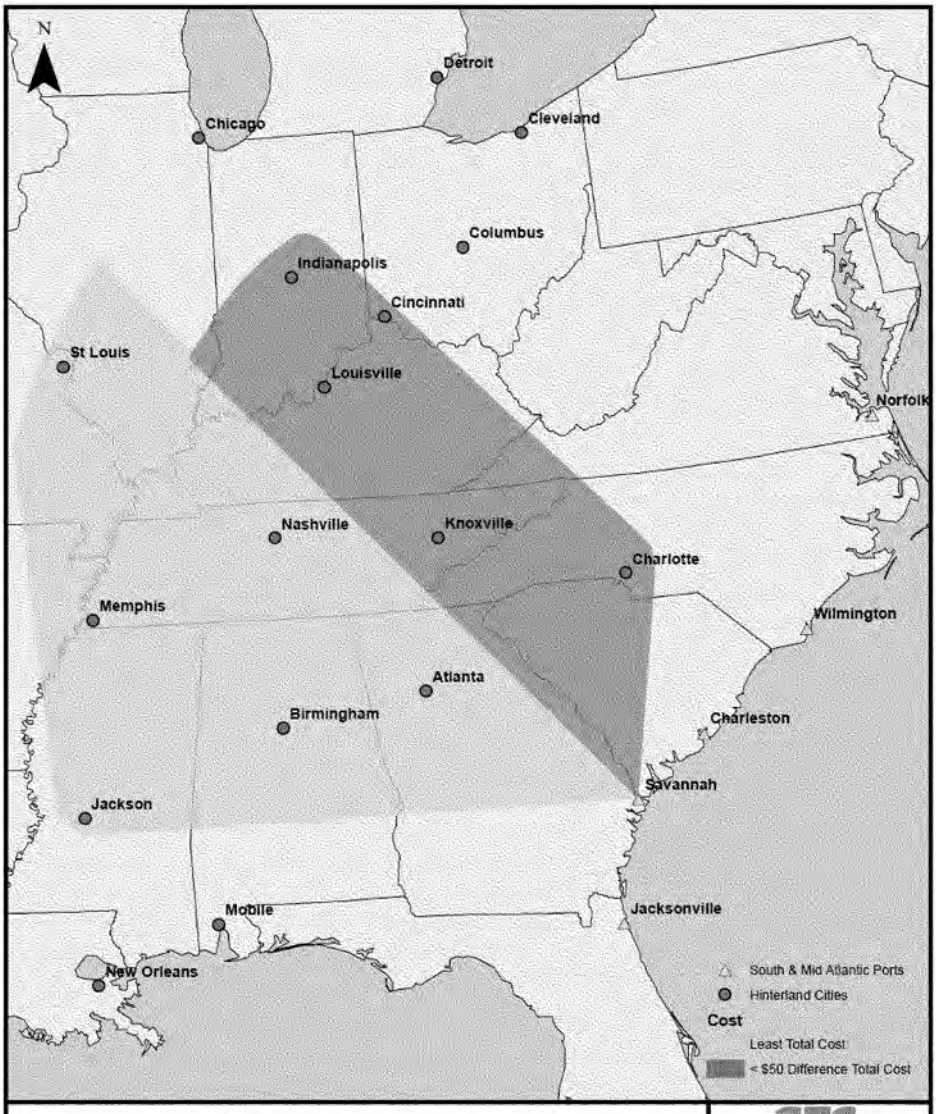
Hinterland cities with less than $50 difference in total cost that overlap each other are: St. Louis, Jackson, Memphis, Birmingham, Atlanta, Nashville, Charlotte, Louisville, Cincinnati, Indianapolis, and Columbia. The hinterland cities of St. Louis, Jackson, Birmingham, Atlanta, and Nashville are overlapped by the port cities of Jacksonville and Charleston. The hinterland city of Charlotte is overlapped by the port cities of Savannah and Charleston. The hinterland cities of Louisville, Cincinnati, and Indianapolis are overlapped by the port cities of Savannah, Wilmington, and Norfolk International Terminal. The hinterland city of Columbus, Ohio, is overlapped by the port cities of Charleston and Wilmington. The two hinterland cities of Knoxville and Chicago all are less than $50 difference in total cost but do not overlap with other Mid-Atlantic and South Atlantic ports.

Table 33. Incremental Differences in Least Cost for Competing Ports at 42 Feet, Inbound FE ECUS MED PEN

	Mid-Atlantic and South Atlantic Ports				
	Difference in Total Cost				
Hinterland	*Jacksonville* $	Savannah $	Charleston $	Wilmington $	Norfolk $
New Orleans	0.00	86.74	126.63	174.67	264.93
Mobile	0.00	66.55	127.72	175.76	266.02
Memphis	40.36	0.00	64.98	99.39	138.92
St. Louis	40.90	0.00	12.08	68.29	46.74
Jackson	41.45	0.00	24.08	72.11	160.19
Birmingham	41.99	0.00	24.62	72.66	160.74
Atlanta	40.36	0.00	24.08	72.11	159.65
Charlotte	103.52	43.52	3.23	0.00	71.17
Nashville	40.90	0.00	12.08	80.29	100.19
Knoxville	100.28	39.74	0.00	68.22	83.21
Louisville	87.74	40.29	0.00	45.86	24.30
Cincinnati	99.74	39.74	0.00	23.49	45.57
Columbus	35.19	44.43	84.71	144.71	0.00
Indianapolis	87.74	40.29	0.00	45.86	24.30
Chicago	118.52	50.35	10.06	55.92	0.00
Detroit	191.07	131.08	91.88	83.74	0.00
Cleveland	186.16	125.62	85.88	77.74	0.00

Notes: Highlighted cells denote least total transportation delivered costs for particular hinterland cities and ports. Some cost inputs have been estimated.

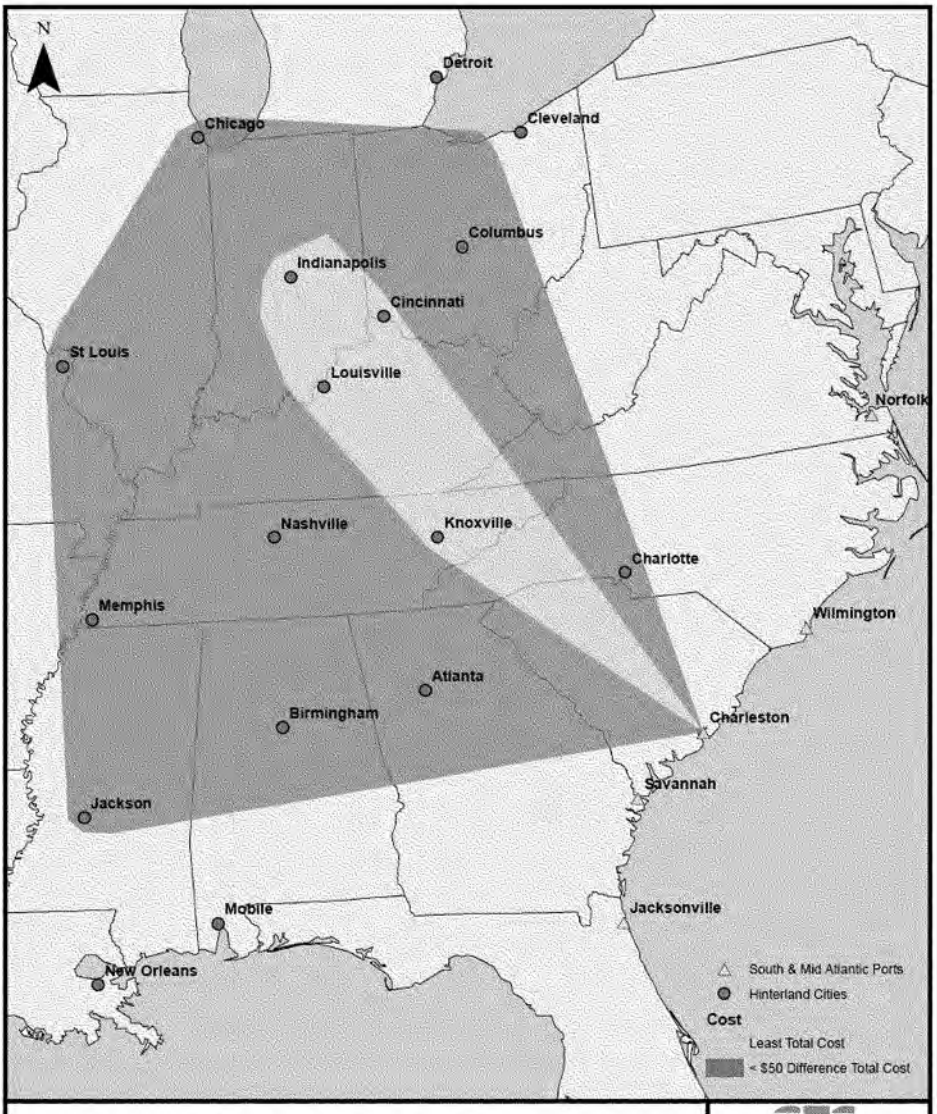
Source: G.E.C., Inc.



Incremental Difference in Least Total Transportation Cost for Savannah Compared to the other Mid and South Atlantic Ports ($/TEU) (Without Project)

Note: Some cost inputs have been estimated and need further development

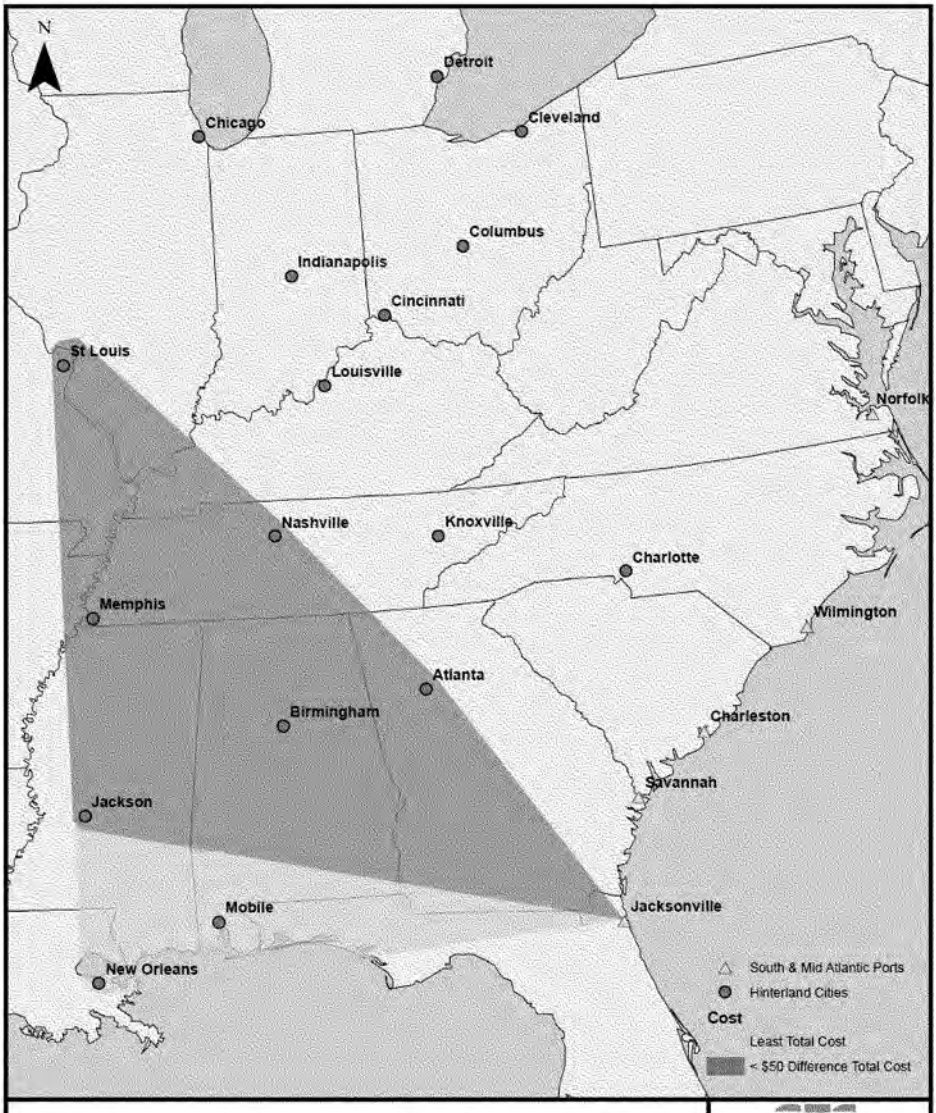
Figure: 55
Date: March 2006
Scale:1 inch equals 120 miles
Source: GEC
Map Author: C. Perez



Incremental Difference in Least Total Transportation Cost for Charleston Compared to the other Mid and South Atlantic Ports ($/TEU) (Without Project)

Note: Some cost inputs have been estimated and need further development

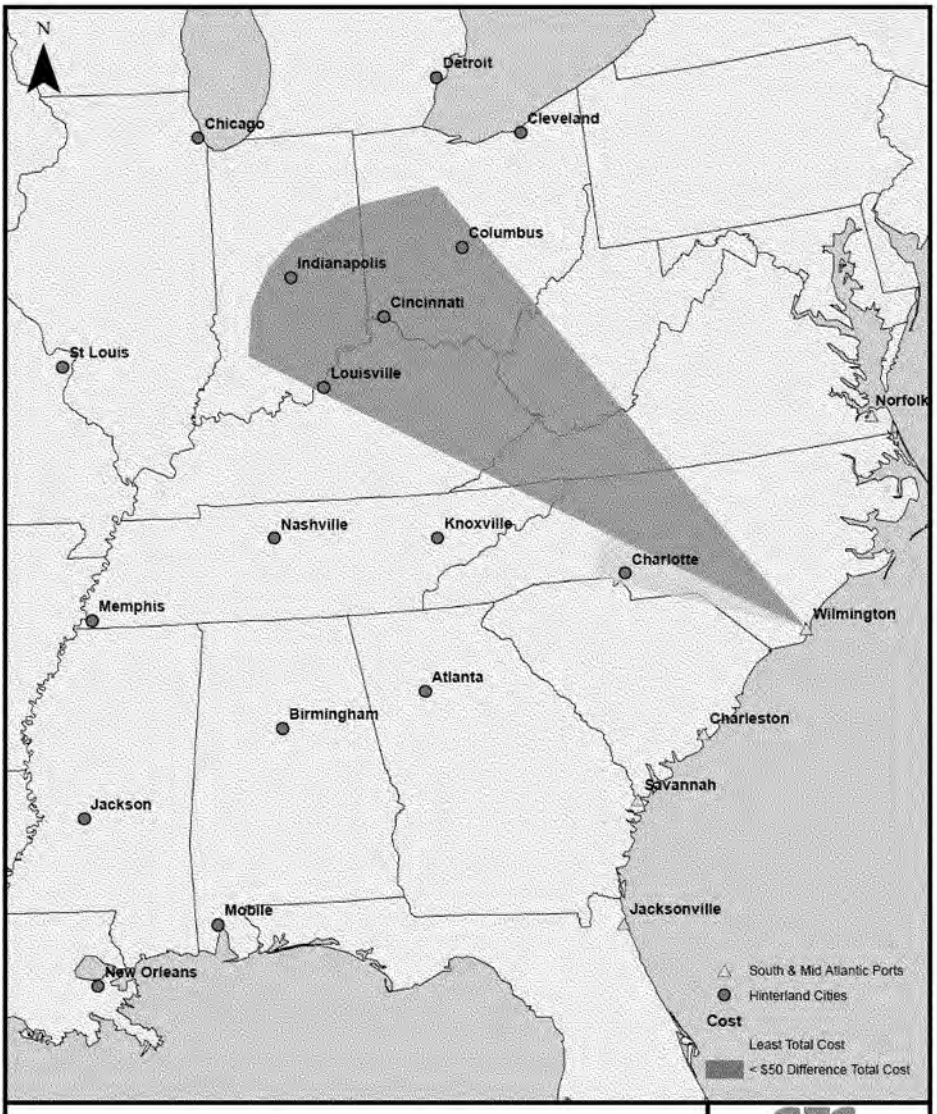
Figure: 56
Date: March 2006
Scale:1 inch equals 120 miles
Source: GEC
Map Author: C. Perez



Incremental Difference in Least Total Transportation Cost for Jacksonville Compared to the other Mid and South Atlantic Ports ($/TEU) (Without Project)

Note: Some cost inputs have been estimated and need further development

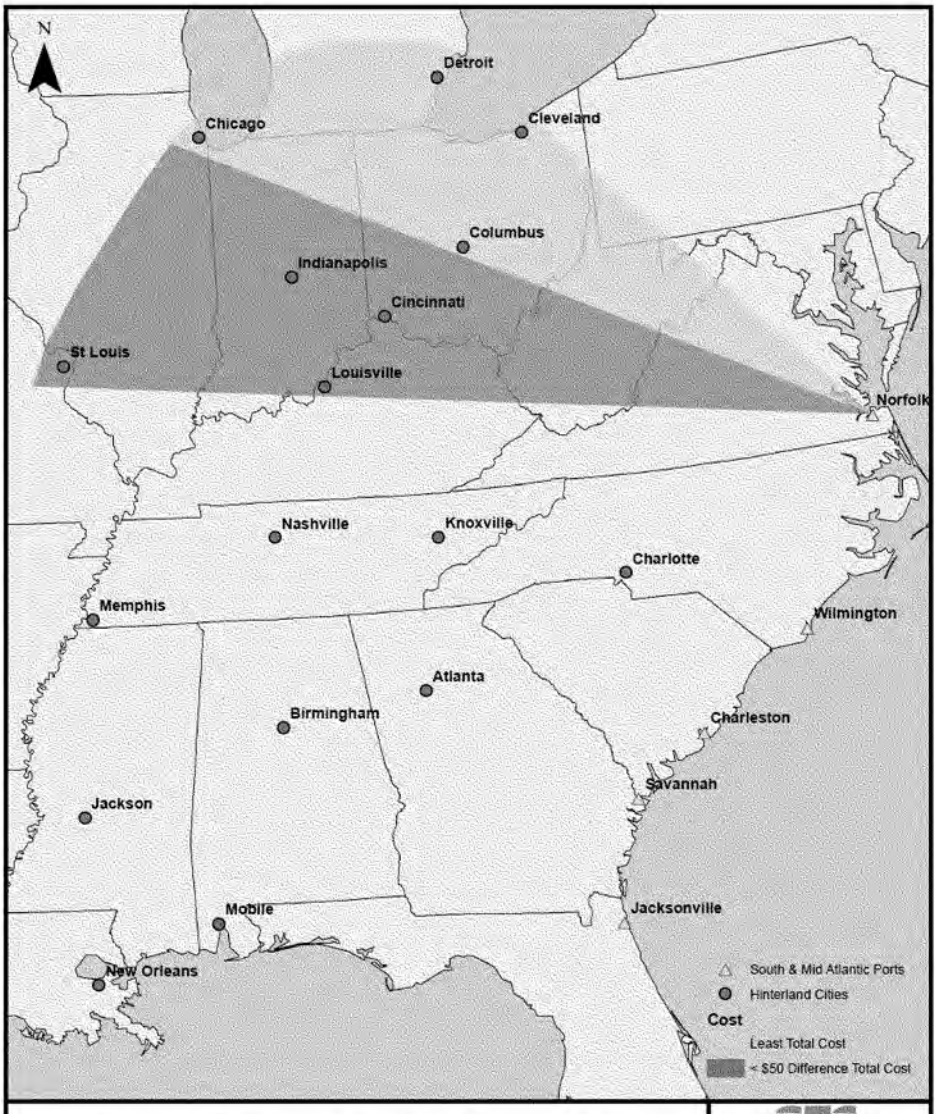
GEC
Figure: 57
Date: March 2006
Scale:1 inch equals 120 miles
Source: GEC
Map Author: C. Perez



Incremental Difference in Least Total Transportation Cost for Wilmington Compared to the other Mid and South Atlantic Ports ($/TEU) (Without Project)

Note: Some cost inputs have been estimated and need further development

Figure: 58
Date: March 2006
Scale:1 inch equals 120 miles
Source: GEC
Map Author: C. Perez



Incremental Difference in Least Total Transportation Cost for Norfolk Compared to the other Mid and South Atlantic Ports ($/TEU) (Without Project)

Note: Some cost inputs have been estimated and need further development

GEC
Figure: 59
Date: March 2006
Scale:1 inch equals 120 miles
Source: GEC
Map Author: C. Perez

X. DETERMINE FUTURE COST OF COMMODITY MOVEMENTS - SAVANNAH HARBOR WITH-PROJECT CONDITIONS (Task 7)

The incremental costs between ports and overlapping hinterlands were developed based on the differences between the total transportation costs for Savannah Harbor and competing ports under with-project conditions. The Savannah Harbor without-project analysis calculates average total sea cost for total voyage tonnes based on the current depth (42 feet), reflecting the methodology developed for the derivation of NED benefits. The Savannah Harbor with-project analysis calculates average total sea cost for total voyage tonnes at depths of 43 feet through 48 feet to derive NED benefits as the reduction in average total cost per voyage tonne. Consistent with the NED benefits methodology, Savannah Harbor with-project sea costs are developed for the estimated total voyage tonnage for the port legs that precede and follow Savannah Harbor.[18] As a result of greater depths at Savannah Harbor, the voyage tonnage will increase and average total cost per tonne will decrease.[19]

For multiport comparison, the change in average total cost per voyage tonne is expressed on a TEU basis, which differs from the expressed NED benefits based on the change in voyage tonnage. The conversion from voyage tonnes to TEUs is a user-specified variable in the multiport analysis for each trade route and direction. The default value is assumed to be ten tonnes per TEU.

Table 34 shows the Savannah Harbor average total sea costs based on a deep-draft channel improvement depth of 45 feet. FE ECUS EU PEN will have the highest sea cost ($/TEU) inbound ($35.76), and this service will also have the least expensive sea cost ($/TEU) outbound ($8.28) because of port distances that precede and follow Savannah Harbor (refer to Table 17). The most expensive sea cost ($/TEU) outbound will be the FE ECUS MED PEN service ($12.45). Voyage hours, days, and total voyage cost for the additional deep-draft channel improvement depths of 43 feet to 48 feet (45 feet is presented below) are presented in Appendix C tables 3.5 to 3.9. Consistent with the NED benefits methodology, total voyage cost at sea stays the same for different Savannah Harbor depths. Average total cost per voyage ton declines as a function of greater sailing depths because of increased tons of cargo.

Table 35 summarizes Savannah Harbor average total sea costs (in dollars per TEU) for inbound and outbound for each foot increase in depth associated with the three trade routes. The average total sea costs ($/TEU) are specified for all depths and do not distinguish among the vessel maximum sailing drafts for the different services. The user must determine the maximum vessel sailing drafts from with-project draft distributions as the appropriate comparison for other ports.[20]

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[18] These benefits are exclusive of other benefits such as reductions in tidal delays.

[19] Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: NED Benefits Model Final Report (May 2006).

[20] For the sailing draft distributions inbound and outbound for the benefiting services for Savannah Harbor, refer to tables 7-1 through 7-6 in Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Vessel Fleet Forecasts, Part 7, Final Report (August 2005).

Table 34. Savannah Sea Costs Based on 45-Foot Depth

Inbound	FE ECUS MED PEN	FE ECUS EU PEN	FE SUEZ ECUS PEN
Voyage Hours	46.21739	67.91304	24.14634
Voyage Days	1.925725	2.82971	1.006098
Total Voyage Cost ($)	$66,187	$97,257	$48,645
Sea Cost ($/TEU)	$24.79	$35.76	$8.84
Outbound			
Voyage Hours	25.82609	17.13043	16.01626
Voyage Days	1.076087	0.713768	0.667344
Total Voyage Cost ($)	$36,985	$24,532	$32,266
Sea Cost ($/TEU)	$12.45	$8.28	$8.06

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 35. Average Total Sea Cost for Savannah Harbor for Three World Trade Routes, With-Project Conditions ($/TEU)

	FE ECUS MED PEN		FE ECUS EU PEN		FE SUEZ ECUS PEN	
Feet	Inbound ($)	Outbound ($)	Inbound ($)	Outbound ($)	Inbound ($)	Outbound ($)
43	29.77	14.66	42.78	9.75	10.06	9.68
44	27.05	13.47	38.95	8.95	9.41	8.79
45	24.79	12.45	35.76	8.28	8.84	8.06
46	22.88	11.58	33.04	7.70	8.33	7.44
47	21.24	10.83	30.72	7.19	7.88	6.90
48	19.82	10.16	28.69	6.75	7.47	6.44

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Calculating With-Project Port and Land Cost

The without-project conditions analysis identified the sea, port, and land transportation costs. The only unit cost change under the with-project conditions is the average total sea costs per unit of cargo carried (total voyage tonnes or total TEUs). Cargo handling costs at the ports and land transportation costs per TEU will not change.[21] As a result, total cost expressed in dollars per TEU under the with-project conditions will change in proportion to the increased voyage cargoes from deeper sailing drafts.

[21] The multiport analysis assumes that increased cargo carried under with project conditions will have the same unit costs for port and land elements. It assumes that there is sufficient excess capacity such that there is no change in unit costs for port and land components of total cost.

Calculating With-Project Total Cost

Table 36 shows the total cost for Savannah Harbor for hinterland cities using as an example the world trade service FE ECUS MED PEN inbound at a depth of 45 feet by factoring in all the inputs for sea, port, and land cost. At this depth, the most expensive city to transport goods would be Chicago ($788.50/TEU), and the least expensive city would be Atlanta ($404.50/TEU).[22] The total cost analysis for competitive ports at 45 feet for Savannah Harbor is presented in Appendix C tables 3.10 to 3.50. Total cost calculations for depths of 43 feet to 48 feet (45 feet is presented below) for the three world trade routes can be found in the Excel CD.

Table 36. Savannah Total Cost for Hinterland, 45 Feet, Inbound FE ECUS MED PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$24.79	$24.79	$24.79	$24.79	$24.79	$24.79	$24.79	$24.79
Port Cost Total	$198.92	$198.92	$198.92	$198.92	$198.92	$198.92	$198.92	$198.92
Land Cost Total	$412.55	$314.91	$387.45	$478.00	$383.09	$254.91	$175.82	$177.45
Total Cost	$636.28	$538.65	$611.19	$701.74	$606.83	$478.65	$399.55	$401.19

Table 36 (cont'd). Savannah Total Cost for Hinterland, 45 Feet, Inbound FE ECUS MED PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$24.79	$24.79	$24.79	$24.79	$24.79	$24.79	$24.79	$24.79	$24.79
Port Cost Total	$198.92	$198.92	$198.92	$198.92	$198.92	$198.92	$198.92	$198.92	$198.92
Land Cost Total	$311.09	$266.36	$399.45	$402.18	$435.45	$460.00	$559.82	$544.55	$456.73
Total Cost	$534.83	$490.10	$623.19	$625.92	$659.19	$683.74	$783.55	$768.28	$680.46

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Calculating With-Project Least Cost

Table 37 shows the incremental differences in least total transportation cost for competing ports at 45 feet depth using as an example the world trade route FE ECUS MED PEN inbound for the 17 hinterland cities. Table 37 has the same pattern as Table 17, which shows the Savannah Harbor least total cost for particular hinterland cities. Savannah will have the least cost among the Mid-Atlantic and South Atlantic ports, primarily because it has the most central location among the 17 cities. This is the final comparison between Savannah Harbor and the four competing Mid-Atlantic and South Atlantic ports. The excel CD presents the least total cost among competing ports for depths up to 48 feet for the three world trade routes. Least total cost

[22] The vessel cost component of the total transportation cost is for the sea distance between the preceding port inbound to Savannah for imports.

for the depths from 43 feet to 48 feet (45 feet is shown below) shows the changes to total cost among the five Mid-Atlantic and South Atlantic ports.

Table 37. Incremental Differences in Least Cost for Competing Ports, 45 Feet, Inbound FE ECUS MED PEN

	Mid-Atlantic and South Atlantic Ports				
	Difference in Total Cost				
Hinterland	*Jacksonville* $	Savannah $	Charleston $	Wilmington $	Norfolk $
New Orleans	0.00	78.43	126.63	174.67	264.93
Mobile	0.00	58.29	127.72	175.76	266.02
Memphis	48.61	0.00	73.24	107.24	147.18
St. Louis	49.16	0.00	20.33	76.55	55.00
Jackson	49.71	0.00	32.33	80.37	168.45
Birmingham	50.25	0.00	32.88	80.92	169.00
Atlanta	48.61	0.00	32.33	80.37	167.91
Charlotte	103.52	35.26	3.23	0.00	71.17
Nashville	49.16	0.00	20.33	88.55	108.45
Knoxville	100.28	31.48	0.00	68.22	83.21
Louisville	87.74	32.03	0.00	45.86	24.30
Cincinnati	99.74	31.48	0.00	23.49	45.57
Columbus	144.71	76.46	44.43	35.19	0.00
Indianapolis	87.74	32.03	0.00	45.86	24.30
Chicago	118.52	42.09	10.06	55.92	0.00
Detroit	191.07	122.82	91.88	83.74	0.00
Cleveland	186.76	117.37	85.88	77.74	0.00

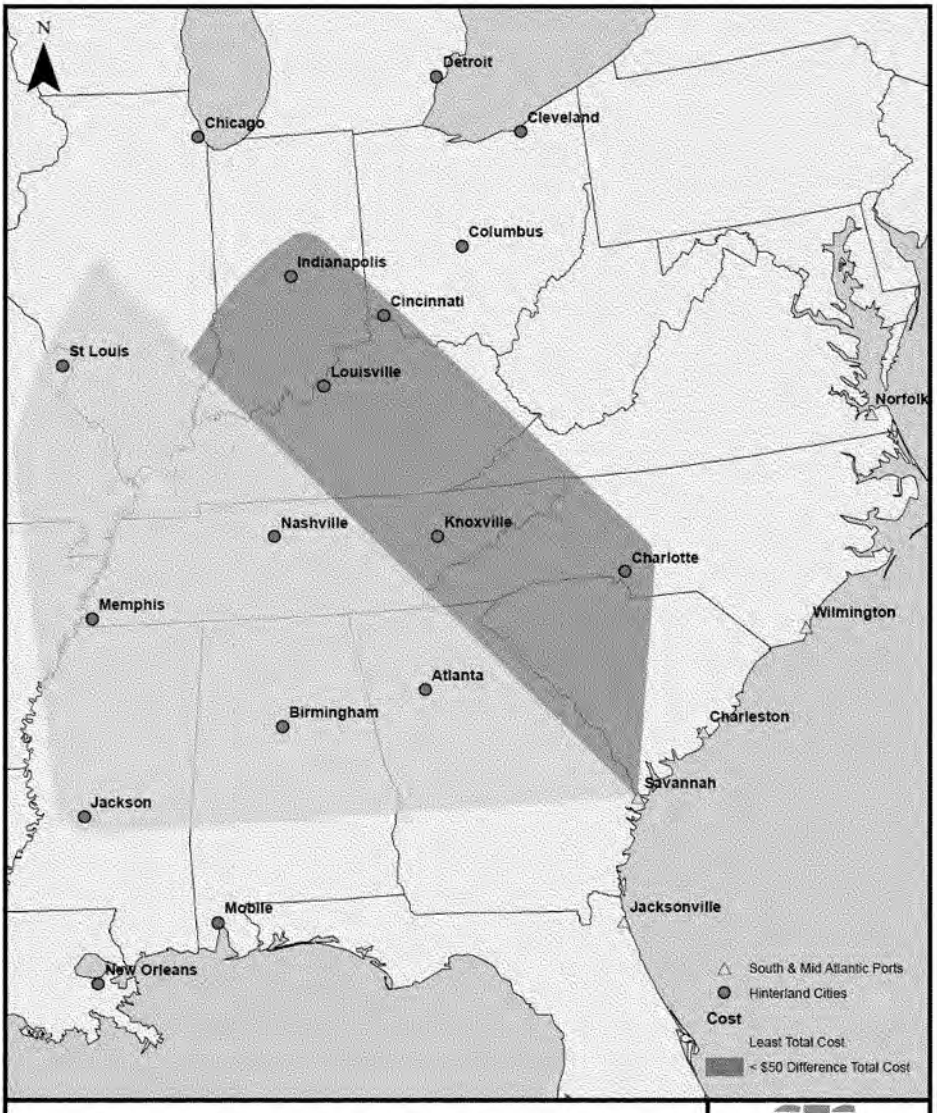
Notes: Highlighted cells denote least total transportation delivered cost for particular hinterland cities and ports.
Some cost inputs have been estimated.

Source: G.E.C., Inc.

Hinterland Cities
Less than $50 Difference in Total Cost (45 Foot Project)

Figure 60 shows the difference in least total cost and less than $50 difference in total cost for competing ports and hinterlands at 45 feet for Savannah.

Hinterland cities with less than $50 Difference in total cost that overlap each other are essentially the same as hinterland cities less than $50 difference in total cost without project.



Incremental Difference in Least Total Transportation Cost for Savannah Compared to the other Mid and South Atlantic Ports ($/TEU) (45 Foot Project)

Note: Some cost inputs have been estimated and need further development

GEC
Figure: 60
Date: March 2006
Scale:1 inch equals 120 miles
Source: GEC
Map Author: C. Perez

XI. DETERMINE USE OF HARBOR AND CHANNEL WITH AND WITHOUT PROJECT (Task 8)

A multiport least total cost analysis spreadsheet was developed to capture the effects of with-project conditions on the least total transportation cost for containerized cargo through Savannah Harbor and adjacent ports for a domestic hinterland defined by 17 major urban areas east of the Mississippi River. The multiport cost spreadsheet computes the least total transportation cost port for each hinterland city and the greater incremental costs for the other ports that are not "least total cost" in worksheet "Least Cost SH 42ft" for without project conditions. Ensuing worksheets ("Least Cost SH 43ft" through "Least Cost SH 48ft") pertain to with-project conditions.

Table 38 identifies the incremental total transportation costs for Savannah Harbor for each of the hinterland cities for the three benefiting services (FE ECUS MED, FE ECUS EU, and FE SUEZ ECUS) for without-project conditions as outputs of the worksheet "Least Cost SH 42 ft." Savannah Harbor is the least total transportation cost for Memphis, St. Louis, Jackson, Birmingham, Atlanta, and Nashville compared to the ports of Norfolk, Wilmington, Charleston, and Jacksonville. For other hinterland areas, Savannah Harbor has higher total transportation costs than the other ports, ranging from $31.84 (FE SUEZ ECUS – Knoxville) to $136.61 (FE ECUS EU – Detroit) per TEU.

Table 38. Savannah Harbor Least Total Incremental Cost, Import Containers, 42-Foot Project ($/TEU)

	FE ECUS MED	FE ECUS EU	FE SUEZ ECUS
New Orleans	$86.74	$88.04	$81.72
Mobile	$66.55	$67.86	$61.54
Memphis	$0.00	$0.00	$0.00
St. Louis	$0.00	$0.00	$0.00
Jackson	$0.00	$0.00	$0.00
Birmingham	$0.00	$0.00	$0.00
Atlanta	$0.00	$0.00	$0.00
Charlotte	$43.52	$46.04	$42.37
Nashville	$0.00	$0.00	$0.00
Knoxville	$39.74	$44.61	$31.84
Louisville	$40.29	$45.15	$32.39
Cincinnati	$39.74	$44.61	$31.84
Columbus	$84.71	$90.24	$84.31
Indianapolis	$40.29	$45.15	$32.39
Chicago	$50.35	$55.88	$49.94
Detroit	$131.08	$136.61	$130.67
Cleveland	$125.62	$131.15	$125.22

Source: G.E.C., Inc.

With-project conditions at Savannah Harbor will reduce vessel average total cargo costs for cargo (TEUs) for each of the benefiting services by virtue of more cargo carried on the vessel voyage legs that precede and follow Savannah Harbor. However, most other transportation costs will remain unchanged on a TEU basis.[23] Therefore, reductions in average total vessel voyage costs per TEU for with-project conditions need to be sufficiently large to overcome higher total transportation costs for the port hinterlands for which Savannah does not have a "least total cost" in without-project conditions. As can be seen from Table 38, Savannah Harbor has higher costs in the range of $30 to $50 per TEU for several hinterland cities, including Charlotte, Knoxville, Louisville, Cincinnati, Indianapolis, and Chicago.[24]

The multiport spreadsheet computes the decreased average total vessel voyage cargo costs per TEU in the same manner as the NED Model spreadsheet. The worksheets "Savannah 42ft" through "Savannah 48ft" compute the average total voyage at sea costs per TEU for inbound and outbound vessel calls at Savannah Harbor for each of the benefiting services for without project conditions (42 feet) and with-project conditions (43 feet through 48 feet). The worksheet outputs are contained in Table 39. For without-project conditions (42-foot project), the average total inbound at sea (voyage leg) costs are $33.09 per TEU for FE ECUS MED service, $47.43 per TEU for FE ECUS EU service, and $10.81 per TEU for FE SUEZ ECUS service.[25]

The average total voyage leg costs decrease for successive increases in project depth by virtue of more cargo carried on the vessel from deeper sailing drafts consistent with the paradigm for NED deepening benefits. Table 39 indicates that for the FE ECUS MED service, inbound average total voyage costs per TEU decline from $33.09 to $29.77 (43 feet), $27.05 (44 feet), $24.79 (45 feet), $22.88 (46 feet), $21.24 (47 feet) and $19.82 (48 feet). The other benefiting services (FE ECUS EU and FE SUEZ ECUS) exhibit similar decreases in average total voyage costs per TEU in response to successive increases in project depth (43 feet to 48 feet).

Table 39 shows the change in average total voyage costs unconstrained by vessel maximum sailing draft and project depth.[26] For example, the maximum size Panamax container vessels assigned to the two FE Panama Canal ECUS EU or ECUS MED pendulum services have a maximum sailing draft of 44.9 feet. These vessels cannot take advantage of deeper sailings drafts exceeding 38 feet at Savannah Harbor in without-project conditions other than by tide riding.[27] The sailing draft distributions for these services indicate that the maximum benefiting project depth is 44 feet for the MED pendulum service and 44 feet outbound and 46 feet inbound

[23] The NED benefits from deepening assumes that more cargo is carried on voyage legs preceding and following Savannah Harbor as part of overall more efficient use of the vessel. This cargo is not necessarily related to Savannah Harbor from an origin/destination and least total transportation cost perspective.

[24] The hinterland cities were purposely chosen to include some that would lie outside of an expected least total cost hinterland for Savannah Harbor to more clearly identify the existing and prospective least total cost hinterlands for without and with-project conditions.

[25] A description of the Savannah Harbor sea (voyage) related costs for benefiting services is contained in the multiport cost spreadsheet worksheet "Savannah Sea."

[26] Refer to Section III., Methodology, in *Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Vessel Fleet Forecasts*, Part 7: Savannah Fleet With Project (Final Report August 2005), pages 7-3 through 7-7.

[27] The observed sailing draft distributions for these vessels and services indicate that tide riding does occur.

for the EU pendulum service. For the FE SUEZ ECUS service with Post-Panamax vessels, the maximum benefiting project depth is 46 feet inbound and 47 feet outbound.[28]

Table 39. Vessel Cost Savings by Project Depth for Benefiting Services ($/TEU)

	FE ECUS MED	FE ECUS EU	FE SUEZ ECUS
42 in	$0.00	$0.00	$0.00
42 out	$0.00	$0.00	$0.00
43 in	$3.32	$4.65	$0.75
43 out	$1.42	$0.94	$1.08
44 in	**$6.04**	$8.48	$1.40
44 out	**$2.61**	**$1.74**	$1.97
45 in	$8.30	$11.67	$1.97
45 out	$3.63	$2.41	$2.70
46 in	$10.21	**$14.39**	**$2.48**
46 out	$4.50	$2.99	$3.35
47 in	$11.85	$16.71	$2.93
47 out	$5.25	$3.50	**$3.86**
48 in	$13.27	$18.74	$3.34
48 out	$5.92	$3.94	$4.32

Notes: Bold values indicate maximum benefiting project depths for particular services and vessels.

Source: G.E.C., Inc.

The average total vessel costs ($/TEU) for the benefiting services and maximum benefiting project depths have been highlighted in bold in Table 23. Lower average total vessel costs per TEU for successively greater project depths should not be used for the multiport cost analysis (because of vessel maximum sailing draft/project depth constraints).

Table 40 shows the vessel cost savings ($/TEU) for the with-project conditions (43 feet through 48 feet) compared to the without-project condition. For example, for the FE ECUS MED service inbound, the 43-foot project would save $3.32 per TEU. Successive depths and corresponding savings would be $6.04 per TEU for 44 feet, $8.30 per TEU for 45 feet, $10.21 per TEU for 46 feet, $11.85 per TEU for 47 feet and $13.27 per TEU for 48 feet. Similar to Table 23, Table 24 uses bold to highlight the values for the maximum vessel sailing draft/project depth for each service and direction.

The multiport analysis will focus on imports because this is the predominant trade for Savannah and other competing U.S. ports. For imports, the maximum reduction in average total vessel voyage costs (refer to Table 39) is $6.04 per TEU for the MED pendulum service, $14.39 for the EU pendulum service, and $2.48 for the SUEZ pendulum service. When these savings in voyage costs are compared to the incremental hinterland least total transportation costs in Table 38 for

[28] Refer to tables 7-1 through 7-6 for the sailing draft distributions of the benefiting services as contained in Part 7 of the Vessel Fleet Forecasts (Savannah Fleet With Project).

Savannah Harbor (ranging upwards of $30 per TEU), it is evident that hinterland cargo will not specifically shift to Savannah Harbor under with-project conditions based on "least total transportation cost" analyses. The largest vessel cost savings in Table 39 ($14.39 per TEU) is about one-third of the higher incremental total transportation costs of this service for Savannah to hinterland cities for which it does not have least total transportation cost such as Charlotte, Knoxville, Louisville, Cincinnati, Indianapolis, and Chicago.

Table 40. Vessel Costs by Project Depth for Benefiting Services ($/TEU)

	FE ECUS MED	FE ECUS EU	FE SUEZ ECUS
42 in	$33.09	$47.43	$10.81
42 out	$16.08	$10.69	$10.76
43 in	$29.77	$42.78	$10.06
43 out	$14.66	$9.75	$9.68
44 in	**$27.05**	$38.95	$9.41
44 out	**$13.47**	**$8.95**	$8.79
45 in	$24.79	$35.76	$8.84
45 out	$12.45	$8.28	$8.06
46 in	$22.88	**$33.04**	**$8.33**
46 out	$11.58	$7.70	$7.41
47 in	$21.24	$30.72	$7.88
47 out	$10.83	$7.19	**$6.90**
48 in	$19.82	$28.69	$7.47
48 out	$10.16	$6.75	$6.44

Notes: Bold values indicate maximum benefiting project depths for particular services and vessels.

Source: G.E.C., Inc.

XII. COMPUTE NED BENEFITS (Task 9)

For the three benefiting services and current pattern of port calls before and after Savannah Harbor, there are no NED benefits associated with changes in least total transportation costs for containers for a 17-city hinterland and container ports at Hampton Roads, Wilmington, Charleston, and Jacksonville in response to with-project conditions at Savannah Harbor. With-project conditions at Savannah Harbor will not attract containerized cargo from these other ports based on estimated changes in least total transportation costs, other things being equal.

XIII. SUMMARY

The information contained in this final report is part of the overall study of the calculation of NED benefits for Savannah Harbor from a multiport perspective. To determine the lowest total transportation delivered cost for particular ports and hinterland cities, each step involved in the transportation of containerized cargo has been expressed as a total cost for sea (voyage), port, and land components. The voyage costs are developed for Panamax and Post-Panamax vessels for the three major services identified as the beneficiaries from deepening of Savannah Harbor (FE SUEZ ECUS PEN, FE ECUS MED PEN, and FE ECUS EU PEN).

The multiport cost analysis combines the total cost from sea, port, and land components to develop total transportation delivered cost for containers at five ports and 17 hinterland cities.

The multiport spreadsheet developed for this analysis relies on user inputs for different costs (sea, port, and land). The spreadsheet does not perform any optimization analysis. Some of the cost inputs for the sea, port, and land components were estimated to develop the multiport total transportation delivered cost methodology and analytical framework. The methodology and analytical framework used in this final report indicate the "least total cost" for the different components (sea, port, and land), with the sum of these components expressed as total transportation cost. The multiport spreadsheet sorts the ports by "least total cost" for each trade and hinterland city for the transportation cost components (sea, port, and land) and the total costs and computes the incremental costs for each component to identify the least total cost port.

The multiport analysis uses the same analytical framework for the at sea costs as the NED benefits (deepening) applied to competing ports (and channel depths) for a least total cost comparison. The same benefiting vessel services and characteristics are used in the multiport analysis as the NED (deepening) analysis. For these services, there is no indication that deepening Savannah Harbor would sufficiently reduce at sea costs for Savanna Harbor so as to result in lower total transportation costs for more cities in the competitive hinterland. Currently, Savannah Harbor is "least total transportation cost" for six cities in the hinterland. These would not change under with-project conditions. Consequently, under a "least total cost analysis" with-project conditions at Savannah Harbor should not be expected to shift any containerized cargo away from competing ports for the major benefiting services and their current deployments.[29]

[29] It is possible that new services or vessel deployments might have multiport cargo shifts, but these have not been identified as part of the NED benefiting services to be included in this multiport analysis.

Appendix A

MATERIALS FOR SECTION VIII

Appendix A

MATERIALS FOR SECTION VIII

Table 1.1. Direct Rail Services for Norfolk Southern from Savannah, Norfolk, Charleston, and Jacksonville

Rail Company	Port	Terminal City	State
Norfolk Southern	Savannah	Atlanta	GA
		Charlotte	NC
		Memphis	TN
		Chicago	IL
		Huntsville	AL
		New Orleans	LA
		Cincinnati	OH
		Louisville	KY
Norfolk Southern	Norfolk	Atlanta	GA
		Chicago	IL
		Cincinnati	OH
		Cleveland	OH
		Columbus	OH
		Detroit	MI
		Louisville	KY
		Memphis	TN
		St. Louis	MO
Norfolk Southern	Charleston	Cincinnati	OH
		Chicago	IL
		Louisville	KY
		Huntsville	AL
		Memphis	TN
		Atlanta	GA
		New Orleans	LA
Norfolk Southern	Jacksonville	Atlanta	GA
		Chicago	IL
		Cincinnati	OH
		Detroit	MI
		Louisville	KY
		Memphis	TN
		St. Louis	MO

Source: Norfolk Southern Intermodal Schedules.

Table 1.2. Direct Rail Services for CSX from Savannah, Portsmouth, Charleston, and Jacksonville

Rail Company	Port	Terminal City	State
CSX	Savannah	Chicago	IL
		Birmingham	AL
		Memphis	TN
		New Orleans	LA
	Portsmouth	Chicago	IL
	Charleston	Chicago	IL
		Memphis	TN
		New Orleans	LA
	Jacksonville	Chicago	IL
		Birmingham	AL
		Memphis	TN
		New Orleans	LA

Source: CSX Intermodal Schedules.

Table 1.3 Distances in Miles from Port Cities to Hinterland Cities

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Savannah	683	0	637	0	0	394	249	252
Charleston	778	0	778	0	0	0	315	0
Norfolk	0	0	916	913	0	0	566	0
Jacksonville	546	0	733	900	0	493	345	0
Wilmington	0	0	0	0	0	0	0	0

Table 1.3 (cont'd). Distances in Miles from Port Cities to Hinterland Cities

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland	Huntsville
Savannah	0	0	659	664	0	0	953	0	0	442
Charleston	0	0	607	613	0	0	901	0	0	509
Norfolk	0	0	654	699	594	0	885	709	558	0
Jacksonville	0	0	768	796	0	0	1,100	1,057	0	0
Wilmington	0	0	0	0	0	0	0	0	0	0

Note: Zero represents no direct rail service to that hinterland.

Source: G.E.C., Inc.

Table 1.4. Direct Rail Services for Norfolk Southern from Savannah Norfolk, Charleston, and Jacksonville

Rail Company	Port	Terminal City	State	($) Cost per Container
Norfolk Southern	Savannah	Atlanta	GA	186.75
		Charlotte	NC	189
		Memphis	TN	443.5
		Chicago	IL	601.5
		Huntsville	AL	331.5
		New Orleans	LA	466.5
		Cincinnati	OH	457
		Louisville	KY	454.5
Norfolk Southern	Norfolk	Atlanta	GA	441.5
		Chicago	IL	567.5
		Cincinnati	OH	474.5
		Cleveland	OH	404
		Columbus	OH	422
		Detroit	MI	479.5
		Louisville	KY	452
		Memphis	TN	583
		St. Louis	MO	581.5
Norfolk Southern	Charleston	Cincinnati	OH	431.5
		Chicago	IL	575.5
		Louisville	KY	428.5
		Huntsville	AL	509
		Memphis	TN	514
		Atlanta	GA	236.25
		New Orleans	LA	514
Norfolk Southern	Jacksonville	Atlanta	GA	258.75
		Chicago	IL	800
		Cincinnati	OH	523
		Detroit	MI	779
		Louisville	KY	509
		Memphis	TN	491.5
		St. Louis	MO	575

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 1.5. Direct Rail Services for CSX from Savannah, Portsmouth, Charleston, and Jacksonville

Rail Company	Port	Terminal City	State	($) Cost per Container
CSX	Savannah	Chicago	IL	601.5
		Birmingham	AL	295.5
		Memphis	TN	443.5
		New Orleans	LA	466.5
	Portsmouth	Chicago	IL	893
	Charleston	Chicago	IL	575.5
		Memphis	TN	514
		New Orleans	LA	514
	Jacksonville	Chicago	IL	800
		Birmingham	AL	246.5
		Memphis	TN	491.5
		New Orleans	LA	398

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Appendix B

MATERIALS FOR SECTION IX

Appendix B

MATERIALS FOR SECTION IX

Table 2.1. Tons per TEU Input

Service	Tons per TEU
FE ECUS MED PEN service Inbound	10
FE ECUS MED PEN service Outbound	10
FE ECUS EU PEN service Inbound	10
FE ECUS EU PEN service Outbound	10
FE SUEZ ECUS PEN service Inbound	10
FE SUEZ ECUS PEN service Outbound	10

Source: G.E.C., Inc.

Table 2.2. Wilmington Input Values for Benefiting Services

Service	FE ECUS MED PEN	FE ECUS EU PEN	FE SUEZ ECUS PEN
Voyage Distance for Service Inbound	1,115	1,612	462
Voyage Distance for Service Outbound	462	262	262
Cargo Density Factor (CDF) Inbound	100	100	100
Cargo Density Factor (CDF) Outbound	100	100	100
Vessel Cargo in Metric Tonnes Inbound	24,464	24,968	51,696
Vessel Cargo in Metric Tonnes Outbound	27,464	27,404	36,696
Vessel Type	Panamax	Panamax	Post Panamax

Notes: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 2.3. Charleston Input Values for Benefiting Services

Service	FE ECUS MED PEN	FE ECUS EU PEN	FE SUEZ ECUS PEN
Voyage Distance for Service Inbound	1,064	1,563	533
Voyage Distance for Service Outbound	533	353	353
Cargo Density Factor (CDF) Inbound	100	100	100
Cargo Density Factor (CDF) Outbound	100	100	100
Vessel Cargo in Metric Tonnes Inbound	31,160	31,664	61,740
Vessel Cargo in Metric Tonnes Outbound	34,160	34,100	46,740
Vessel Type	Panamax	Panamax	Post Panamax

Notes: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 2.4. Jacksonville Input Values for Benefiting Services

Service	FE ECUS MED PEN	FE ECUS EU PEN	FE SUEZ ECUS PEN
Voyage Distance for Service Inbound	1,016	1,515	674
Voyage Distance for Service Outbound	674	474	474
Cargo Density Factor (CDF) Inbound	100	100	100
Cargo Density Factor (CDF) Outbound	100	100	100
Vessel Cargo in Metric Tonnes Inbound	22,232	22,736	48,348
Vessel Cargo in Metric Tonnes Outbound	25,232	25,172	33,348
Vessel Type	Panamax	Panamax	PostPanamax

Notes: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 2.5. Portsmouth Input Values for Benefiting Services

Service	FE ECUS MED PEN	FE ECUS EU PEN	FE SUEZ ECUS PEN
Voyage Distance for Service Inbound	1,279	1,778	200
Voyage Distance for Service Outbound	200	200	200
Cargo Density Factor (CDF) Inbound	100	100	100
Cargo Density Factor (CDF) Outbound	100	100	100
Vessel Cargo in Metric Tonnes Inbound	24,464	24,968	51,696
Vessel Cargo in Metric Tonnes Outbound	27,464	27,404	36,696
Vessel Type	Panamax	Panamax	PostPanamax

Notes: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 2.6. Newport News Input Values for Benefiting Services

Service	FE ECUS MED PEN	FE ECUS EU PEN	FE SUEZ ECUS PEN
Voyage Distance for Service Inbound	1,279	1,778	200
Voyage Distance for Service Outbound	200	200	200
Cargo Density Factor (CDF) Inbound	100	100	100
Cargo Density Factor (CDF) Outbound	100	100	100
Vessel Cargo in Metric Tonnes Inbound	31,160	31,664	61,740
Vessel Cargo in Metric Tonnes Outbound	34,160	34,100	46,740
Vessel Type	Panamax	Panamax	PostPanamax

Notes: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 2.7. Norfolk International Input Values for Benefiting Services

Service	FE ECUS MED PEN	FE ECUS EU PEN	FE SUEZ ECUS PEN
Voyage Distance for Service Inbound	1,279	1,778	200
Voyage Distance for Service Outbound	200	200	200
Cargo Density Factor (CDF) Inbound	100	100	100
Cargo Density Factor (CDF) Outbound	100	100	100
Vessel Cargo in Metric Tonnes Inbound	33,392	33,896	78,480
Vessel Cargo in Metric Tonnes Outbound	33,392	36,332	63,480
Vessel Type	Panamax	Panamax	PostPanamax

Notes: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 2.8. Charleston Sea Cost for Benefiting Services

Inbound	FE ECUS MED PEN	FE ECUS EU PEN	FE SUEZ ECUS PEN
Voyage Hours	46.26087	67.95652	21.66667
Voyage Days	1.927536	2.831522	0.902778
Total Voyage Cost ($)	$66,249	$97,319	$43,649
Sea Cost ($/TEU)	$21.26	$30.74	$7.07
Outbound			
Voyage Hours	23.17391	15.34783	14.34959
Voyage Days	0.96558	0.639493	0.5979
Total Voyage Cost ($)	$33,187	$21,979	$28,908
Sea Cost ($/TEU)	$9.72	$6.45	$6.18

Notes: It is assumed that the vessel's TEU port volume is 1,500 TEUs.
Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 2.9. Jacksonville Sea Cost for Benefiting Services

Inbound	FE ECUS MED PEN	FE ECUS EU PEN	FE SUEZ ECUS PEN
Voyage Hours	44.17391	65.86957	27.39837
Voyage Days	1.84058	2.744565	1.141599
Total Voyage Cost ($)	$63,261	$94,331	$55,196
Sea Cost ($/TEU)	$28.45	$41.49	$11.42
Outbound			
Voyage Hours	29.30435	20.6087	19.26829
Voyage Days	1.221014	0.858696	0.802846
Total Voyage Cost ($)	$41,966	$29,513	$38,818
Sea Cost ($/TEU)	$16.63	$11.72	$11.64

Notes: It is assumed that the vessel's TEU port volume is 1,500 TEUs.
Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 2.10. Portsmouth Sea Cost for Benefiting Services

Inbound	FE ECUS MED PEN	FE ECUS EU PEN	FE SUEZ ECUS PEN
Voyage Hours	55.6087	77.30435	8.130081
Voyage Days	2.317029	3.221014	0.338753
Total Voyage Cost ($)	$79,636	$110,706	$16,379
Sea Cost ($/TEU)	$32.55	$44.34	$3.17
Outbound			
Voyage Hours	8.695652	8.695652	8.130081
Voyage Days	0.362319	0.362319	0.338753
Total Voyage Cost ($)	$12,453	$12,453	$16,379
Sea Cost ($/TEU)	$4.53	$4.54	$4.46

Notes: It is assumed that the vessel's TEU port volume is 1,500 TEUs.
Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 2.11. Newport News Sea Cost for Benefiting Services, FE ECUS MED PEN

Inbound	FE ECUS MED PEN	FE ECUS EU PEN	FE SUEZ ECUS PEN
Voyage Hours	55.6087	77.30435	8.130081
Voyage Days	2.317029	3.221014	0.338753
Total Voyage Cost ($)	$79,636	$110,706	$16,379
Sea Cost ($/TEU)	$25.56	$34.96	$2.65
Outbound			
Voyage Hours	8.695652	8.695652	8.130081
Voyage Days	0.362319	0.362319	0.338753
Total Voyage Cost ($)	$12,453	$12,453	$16,379
Sea Cost ($/TEU)	$3.65	$3.65	$3.50

Notes: It is assumed that the vessel's TEU port volume is 1,500 TEUs.
Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 2.12. Norfolk International Sea Cost for Benefiting Services, FE ECUS MED PEN

Inbound	FE ECUS MED PEN	FE ECUS EU PEN	FE SUEZ ECUS PEN
Voyage Hours	55.6087	77.30435	8.130081
Voyage Days	2.317029	3.221014	0.338753
Total Voyage Cost ($)	$79,636	$110,706	$16,379
Sea Cost ($/TEU)	$23.85	$32.66	$2.09
Outbound			
Voyage Hours	8.695652	8.695652	8.130081
Voyage Days	0.362319	0.362319	0.338753
Total Voyage Cost ($)	$12,453	$12,453	$16,379
Sea Cost ($/TEU)	$3.73	$3.43	$2.58

Notes: It is assumed that the vessel's TEU capacity is 1,500 TEUs.
Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 2.13. Port Costs for Five Mid-Atlantic and South Atlantic Ports, FE ECUS EU PEN

Port	Wharfage $/TEU	Dockage $/TEU	Container Charges $/TEU	Pilotage $/TEU	Tuggage $/TEU	Total Port Costs $/TEU
Norfolk – Portsmouth	35.60	5.51	150.00	2.33	1.33	194.77
Norfolk – Newport News	35.60	5.51	150.00	2.37	1.33	194.82
Norfolk – International	35.60	5.51	150.00	2.44	1.33	194.89
Wilmington	30.97	6.00	150.00	2.33	1.33	190.64
Charleston	40.23	4.91	150.00	2.33	1.33	198.81
Savannah 42 feet	38.58	6.69	150.00	2.30	1.33	198.90
Jacksonville	33.07	4.94	150.00	2.19	1.33	191.53

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 2.14. Port Costs for Five Mid-Atlantic and South Atlantic Ports, FE SUEZ ECUS PEN

	Wharfage $/TEU	Dockage $/TEU	Container Charges $/TEU	Pilotage $/TEU	Tuggage $/TEU	Total Port Costs $/TEU
Norfolk –Portsmouth	35.60	6.05	150.00	3.13	1.33	196.11
Norfolk – Newport News	35.60	6.05	150.00	3.17	1.33	196.15
Norfolk - International	35.60	6.05	150.00	3.24	1.33	196.22
Wilmington	30.97	6.59	150.00	3.13	1.33	196.22
Charleston	40.23	5.39	150.00	3.11	1.33	200.07
Savannah 42 feet	38.58	7.34	150.00	3.10	1.33	200.36
Jacksonville	33.07	5.42	150.00	2.93	1.33	192.76

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 2.15. Truck Costs for Wilmington Associated with Hinterland Cities

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Pickup Time in Hours	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Delivery Time in Hours	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Driving Time in Hours	15.78	13.24	15.33	17.31	14.27	10.02	7.36	3.56
Pickup/Delivery Cost	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00
Driving Cost	$946.91	$794.18	$919.64	$1,038.55	$856.36	$601.09	$441.82	$213.82
Total Truck Land Cost	$1,026.91	$874.18	$999.64	$1,118.55	$936.36	$681.09	$521.82	$293.82
Truck Land Cost/TEU	$513.45	$437.09	$499.82	$559.27	$468.18	$340.55	$260.91	$146.91

Table 2.15 (cont'd). Truck Costs for Wilmington Associated with Hinterland Cities

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Pickup Time in Hours	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Delivery Time in Hours	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Driving Time in Hours	12.15	8.93	12.60	11.96	11.96	14.62	17.95	15.67	12.73
Pickup/Delivery Cost	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00
Driving Cost	$728.73	$535.64	$756.00	$717.82	$717.82	$877.09	$1,076.73	$940.36	$763.64
Total Truck Land Cost	$808.73	$615.64	$836.00	$797.82	$797.82	$957.09	$1,156.73	$1,020.36	$843.64
Truck Land Cost/TEU	$404.36	$307.82	$418.00	$398.91	$398.91	$478.55	$578.36	$510.18	$421.82

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 2.16. Truck Costs for Charleston Associated with Hinterland Cities

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Pickup Time in Hours	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Delivery Time in Hours	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Driving Time in Hours	14.15	11.60	14.15	15.40	12.64	8.38	5.73	3.64
Pickup/Delivery Cost	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00
Driving Cost	$848.73	$696.00	$848.73	$924.00	$758.18	$502.91	$343.64	$218.18
Total Truck Land Cost	$928.73	$776.00	$928.73	$1,004.00	$838.18	$582.91	$423.64	$298.18
Truck Land Cost/TEU	$464.36	$388.00	$464.36	$502.00	$419.09	$291.45	$211.82	$149.09

Table 2.16 (cont'd). Truck Costs for Charleston Associated with Hinterland Cities

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Pickup Time in Hours	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Delivery Time in Hours	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Driving Time in Hours	9.84	6.62	11.04	11.15	12.24	13.05	16.38	15.91	12.96
Pickup/Delivery Cost	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00
Driving Cost	$590.18	$397.09	$662.18	$668.73	$734.18	$783.27	$982.91	$954.55	$777.82
Total Truck Land Cost	$670.18	$477.09	$742.18	$748.73	$814.18	$863.27	$1,062.91	$1,034.55	$857.82
Truck Land Cost/TEU	$335.09	$238.55	$371.09	$374.36	$407.09	$431.64	$531.45	$517.27	$428.91

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 2.17. Truck Costs for Jacksonville Associated with Hinterland Cities

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Pickup Time in Hours	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Delivery Time in Hours	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Driving Time in Hours	9.93	7.35	13.33	16.36	13.22	8.96	6.27	6.98
Pickup/Delivery Cost	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00
Driving Cost	$595.64	$440.73	$799.64	$981.82	$793.09	$537.82	$376.36	$418.91
Total Truck Land Cost	$675.64	$520.73	$879.64	$1,061.82	$873.09	$617.82	$456.36	$498.91
Truck Land Cost/TEU	$337.82	$260.36	$439.82	$530.91	$436.55	$308.91	$228.18	$249.45

Table 2.17 (cont'd). Truck Costs for Jacksonville Associated with Hinterland Cities

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Pickup Time in Hours	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Delivery Time in Hours	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Driving Time in Hours	10.80	9.96	13.96	14.47	15.58	15.98	20.00	19.22	16.31
Pickup/Delivery Cost	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00	$80.00
Driving Cost	$648.00	$597.82	$837.82	$868.36	$934.91	$958.91	$1,200.00	$1,153.09	$978.55
Total Truck Land Cost	$728.00	$677.82	$917.82	$948.36	$1,014.91	$1,038.91	$1,280.00	$1,233.09	$1,058.55
Truck Land Cost/TEU	$364.00	$338.91	$458.91	$474.18	$507.45	$519.45	$640.00	$616.55	$529.27

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Appendix C

MATERIALS FOR SECTION X

Appendix C

MATERIALS FOR SECTION X

Table 3.1. Vessel Table Inputs

	PP2	Post Panamax	Panamax	SubPanamax	Handysize	Feedermax	Feeder
Service Speed in Knots	0	246	23	209	194	184	164
Daily Vessel Cost	0	48,350	34,370	24,710	18,260	14,740	10,460
Immersion Rate in metric tonnes per inch (TPI)	0	279	186	135.7	101.2	82	52.7
TEC	0	6,000	4,000	2,500	1,600	1,200	600

Source: G.E.C., Inc.

Table 3.2 Tonnes Per TEU Input

Service	Tonnes per TEU
FE ECUS MED PEN – Inbound	10
FE ECUS MED PEN – Outbound	10
FE ECUS EU PEN – Inbound	10
FE ECUS EU PEN – Outbound	10
FE SUEZ ECUS PEN – Inbound	10
FE SUEZ ECUS PEN - Outbound	10

Source: G.E.C., Inc.

Table 3.3. Savannah Sea Cost and Benefiting Services

	FE ECUS MED PEN	FE ECUS EU PEN	FE SUEZ ECUS PEN
Voyage Distance for Service Inbound	1,063	1,562	594
Voyage Distance for Service Outbound	594	394	394
Cargo Density Factor (CDF) Inbound	100	100	100
Cargo Density Factor (CDF) Outbound	100	100	100
Vessel Without-Project Cargo in Metric Tonnes Inbound	20,000	20,504	45,000
Vessel Without-Project Cargo in Metric Tonnes Outbound	23,000	22,940	30,000
43 Feet Vessel Cargo in Metric Tonnes Inbound	22,232	22,736	48,348
43 Feet Vessel Cargo in Metric Tonnes Outbound	25,232	25,172	33,348
44 Feet Vessel Cargo in Metric Tonnes Inbound	24,464	24,968	51,696
44 Feet Vessel Cargo in Metric Tonnes Outbound	27,464	27,404	36,696
45 Feet Vessel Cargo in Metric Tonnes Inbound	26,696	27,200	55,044
45 Feet Vessel Cargo in Metric Tonnes Outbound	29,696	29,636	40,044
46 Feet Vessel Cargo in Metric Tonnes Inbound	28,928	29,432	58,392
46 Feet Vessel Cargo in Metric Tonnes Outbound	31,928	31,868	43,392
47 Feet Vessel Cargo in Metric Tonnes Inbound	31,160	31,664	61,740
47 Feet Vessel Cargo in Metric Tonnes Outbound	34,160	34,100	46,740
48 Feet Vessel Cargo in Metric Tonnes Inbound	33,392	33,896	65,088
48 Feet Vessel Cargo in Metric Tonnes Outbound	36,392	36,332	50,088
Vessel Type	Panamax	Panamax	PostPanamax

Source: G.E.C., Inc.

Table 3.4. Savannah Sea Cost Based on Current Depth of 42 Feet, Inbound/Outbound

Inbound	FE ECUS MED PEN	FE ECUS EU PEN	FE SUEZ ECUS PEN
Voyage Hours	46.21739	67.91304	24.14634
Voyage Days	1.925725	2.82971	1.006098
Total Voyage Cost ($)	$66,187	$97,257	$48,645
Sea Cost ($/TEU)	$33.09	$47.43	$10.81
Outbound			
Voyage Hours	25.82609	17.13043	16.01626
Voyage Days	1.076087	0.713768	0.667344
Total Voyage Cost ($)	$36,985	$24,532	$32,266
Sea Cost ($/TEU)	$16.08	$10.69	$10.76

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.5. Savannah Sea Cost Based on Future Depth of 43 Feet, Inbound/Outbound
FE ECUS MED PEN

Inbound	FE ECUS MED PEN	FE ECUS EU PEN	FE SUEZ ECUS PEN
Voyage Hours	46.21739	67.91304	24.14634
Voyage Days	1.925725	2.82971	1.006098
Total Voyage Cost ($)	$66,187	$97,257	$48,645
Sea Cost ($/TEU)	$29.77	$42.78	$10.06
Outbound			
Voyage Hours	25.82609	17.13043	16.01626
Voyage Days	1.076087	0.713768	0.667344
Total Voyage Cost ($)	$36,985	$24,532	$32,266
Sea Cost ($/TEU)	$14.66	$9.75	$9.68

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.6. Savannah Sea Cost Based on Future Depth of 44 Feet, Inbound/Outbound
FE ECUS MED PEN

Inbound	FE ECUS MED PEN	FE ECUS EU PEN	FE SUEZ ECUS PEN
Voyage Hours	46.21739	67.91304	24.14634
Voyage Days	1.925725	2.82971	1.006098
Total Voyage Cost ($)	$66,187	$97,257	$48,645
Sea Cost ($/TEU)	$27.05	$38.95	$9.41
Outbound			
Voyage Hours	25.82609	17.13043	16.01626
Voyage Days	1.076087	0.713768	0.667344
Total Voyage Cost ($)	$36,985	$24,532	$32,266
Sea Cost ($/TEU)	$13.47	$8.95	$8.79

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.7. Savannah Sea Cost Based on Future Depth of 46 Feet, Inbound/Outbound FE ECUS MED PEN

Inbound	FE ECUS MED PEN	FE ECUS EU PEN	FE SUEZ ECUS PEN
Voyage Hours	46.21739	67.91304	24.14634
Voyage Days	1.925725	2.82971	1.006098
Total Voyage Cost ($)	$66,187	$97,257	$48,645
Sea Cost ($/TEU)	$22.88	$33.04	$8.33
Outbound			
Voyage Hours	25.82609	17.13043	16.01626
Voyage Days	1.076087	0.713768	0.667344
Total Voyage Cost ($)	$36,985	$24,532	$32,266
Sea Cost ($/TEU)	$11.58	$7.70	$7.44

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.8. Savannah Sea Cost Based on Future Depth of 47 Feet, Inbound/Outbound FE ECUS MED PEN

Inbound	FE ECUS MED PEN	FE ECUS EU PEN	FE SUEZ ECUS PEN
Voyage Hours	46.21739	67.91304	24.14634
Voyage Days	1.925725	2.82971	1.006098
Total Voyage Cost ($)	$66,187	$97,257	$48,645
Sea Cost ($/TEU)	$21.24	$30.72	$7.88
Outbound			
Voyage Hours	25.82609	17.13043	16.01626
Voyage Days	1.076087	0.713768	0.667344
Total Voyage Cost ($)	$36,985	$24,532	$32,266
Sea Cost ($/TEU)	$10.83	$7.19	$6.90

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.9. Savannah Sea Cost Based on Future Depth of 48 Feet, Inbound/Outbound FE ECUS MED PEN

Inbound	FE ECUS MED PEN	FE ECUS EU PEN	FE SUEZ ECUS PEN
Voyage Hours	46.21739	67.91304	24.14634
Voyage Days	1.925725	2.82971	1.006098
Total Voyage Cost ($)	$66,187	$97,257	$48,645
Sea Cost ($/TEU)	$19.82	$28.69	$7.47
Outbound			
Voyage Hours	25.82609	17.13043	16.01626
Voyage Days	1.076087	0.713768	0.667344
Total Voyage Cost ($)	$36,985	$24,532	$32,266
Sea Cost ($/TEU)	$10.16	$6.75	$6.44

Note: Some cost inputs have been estimated.
Source: G.E.C., Inc.

Table 3.10. Portsmouth Total Cost for Hinterland, 45 Feet, Inbound FE ECUS MED PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$32.55	$32.55	$32.55	$32.55	$32.55	$32.55	$32.55	$32.55
Port Cost Total	$194.77	$194.77	$194.77	$194.77	$194.77	$194.77	$194.77	$194.77
Land Cost Total	$604.00	$527.64	$539.64	$538.00	$556.55	$428.91	$348.73	$218.36
Total Cost	$831.33	$754.96	$766.96	$765.33	$783.87	$656.24	$576.05	$445.69

Table 3.10 (cont'd). Portsmouth Total Cost for Hinterland, 45 Feet, Inbound FE ECUS MED PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$32.55	$32.55	$32.55	$32.55	$32.55	$32.55	$32.55	$32.55	$32.55
Port Cost Total	$194.77	$194.77	$194.77	$194.77	$194.77	$194.77	$194.77	$194.77	$194.77
Land Cost Total	$424.55	$323.09	$396.73	$421.27	$364.00	$457.27	$522.73	$426.73	$344.36
Total Cost	$651.87	$550.42	$624.05	$648.60	$591.33	$684.60	$750.05	$654.05	$571.69

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.11. Newport News Total Cost for Hinterland, 45 Feet, Inbound FE ECUS MED PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$25.56	$25.56	$25.56	$25.56	$25.56	$25.56	$25.56	$25.56
Port Cost Total	$194.82	$194.82	$194.82	$194.82	$194.82	$194.82	$194.82	$194.82
Land Cost Total	$604.00	$527.64	$539.64	$538.00	$556.55	$428.91	$348.73	$218.36
Total Cost	$824.37	$748.01	$760.01	$758.37	$776.92	$649.28	$569.10	$438.74

Table 3.11 (cont'd). Newport News Total Cost for Hinterland, 45 Feet, Inbound FE ECUS MED PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$25.56	$25.56	$25.56	$25.56	$25.56	$25.56	$25.56	$25.56	$25.56
Port Cost Total	$194.82	$194.82	$194.82	$194.82	$194.82	$194.82	$194.82	$194.82	$194.82
Land Cost Total	$424.55	$323.09	$396.73	$421.27	$364.00	$457.27	$522.73	$426.73	$344.36
Total Cost	$644.92	$543.46	$617.10	$641.65	$584.37	$677.65	$743.10	$647.10	$564.74

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.12. Norfolk International Total Cost for Hinterland, 45 Feet, Inbound FE ECUS MED PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$23.85	$23.85	$23.85	$23.85	$23.85	$23.85	$23.85	$23.85
Port Cost Total	$194.89	$194.89	$194.89	$194.89	$194.89	$194.89	$194.89	$194.89
Land Cost Total	$604.00	$527.64	$539.64	$538.00	$556.55	$428.91	$348.73	$218.36
Total Cost	$822.74	$746.37	$758.37	$756.74	$775.28	$647.64	$567.46	$437.10

Table 3.12 (cont'd). Norfolk International Total Cost for Hinterland, 45 Feet, Inbound FE ECUS MED PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$23.85	$23.85	$23.85	$23.85	$23.85	$23.85	$23.85	$23.85	$23.85
Port Cost Total	$194.89	$194.89	$194.89	$194.89	$194.89	$194.89	$194.89	$194.89	$194.89
Land Cost Total	$424.55	$323.09	$396.73	$421.27	$364.00	$457.27	$522.73	$426.73	$344.36
Total Cost	$643.28	$541.83	$615.46	$640.01	$582.74	$676.01	$741.46	$645.46	$563.10

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.13. Wilmington Total Cost for Hinterland, 45 Feet, Inbound FE ECUS MED PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$28.38	$28.38	$28.38	$28.38	$28.38	$28.38	$28.38	$28.38
Port Cost Total	$190.64	$190.64	$190.64	$190.64	$190.64	$190.64	$190.64	$190.64
Land Cost Total	$513.45	$437.09	$499.82	$559.27	$468.18	$340.55	$260.91	$146.91
Total Cost	$732.47	$656.11	$718.84	$778.29	$687.20	$559.56	$479.93	$365.93

Table 3.13 (cont'd). Wilmington Total Cost for Hinterland, 45 Feet, Inbound FE ECUS MED PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$28.38	$28.38	$28.38	$28.38	$28.38	$28.38	$28.38	$28.38	$28.38
Port Cost Total	$190.64	$190.64	$190.64	$190.64	$190.64	$190.64	$190.64	$190.64	$190.64
Land Cost Total	$404.36	$307.82	$418.00	$398.91	$398.91	$478.55	$578.36	$510.18	$421.82
Total Cost	$623.38	$526.84	$637.02	$617.93	$617.93	$697.56	$797.38	$729.20	$640.84

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.14. Charleston Total Cost for Hinterland, 45 Feet, Inbound
FE ECUS MED PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$21.26	$21.26	$21.26	$21.26	$21.26	$21.26	$21.26	$21.26
Port Cost Total	$198.81	$198.81	$198.81	$198.81	$198.81	$198.81	$198.81	$198.81
Land Cost Total	$464.36	$388.00	$464.36	$502.00	$419.09	$291.45	$211.82	$149.09
Total Cost	$684.43	$608.07	$684.43	$722.07	$639.16	$511.52	$431.89	$369.16

Table 3.14 (cont'd). Charleston Total Cost for Hinterland, 45 Feet, Inbound
FE ECUS MED PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$21.26	$21.26	$21.26	$21.26	$21.26	$21.26	$21.26	$21.26	$21.26
Port Cost Total	$198.81	$198.81	$198.81	$198.81	$198.81	$198.81	$198.81	$198.81	$198.81
Land Cost Total	$335.09	$238.55	$371.09	$374.36	$407.09	$431.64	$531.45	$517.27	$428.91
Total Cost	$555.16	$458.62	$591.16	$594.43	$627.16	$651.71	$751.52	$737.34	$648.98

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.15. Jacksonville Total Cost for Hinterland, 45 Feet, Inbound
FE ECUS MED PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$28.45	$28.45	$28.45	$28.45	$28.45	$28.45	$28.45	$28.45
Port Cost Total	$191.53	$191.53	$191.53	$191.53	$191.53	$191.53	$191.53	$191.53
Land Cost Total	$337.82	$260.36	$439.82	$530.91	$436.55	$308.91	$228.18	$249.45
Total Cost	$557.81	$480.35	$659.81	$750.90	$656.53	$528.90	$448.17	$469.44

Table 3.15 (cont'd). Jacksonville Total Cost for Hinterland, 45 Feet, Inbound
FE ECUS MED PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$28.45	$28.45	$28.45	$28.45	$28.45	$28.45	$28.45	$28.45	$28.45
Port Cost Total	$191.53	$191.53	$191.53	$191.53	$191.53	$191.53	$191.53	$191.53	$191.53
Land Cost Total	$364.00	$338.91	$458.91	$474.18	$507.45	$519.45	$640.00	$616.55	$529.27
Total Cost	$583.99	$558.90	$678.90	$694.17	$727.44	$739.44	$859.99	$836.53	$749.26

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.16. Portsmouth Total Cost for Hinterland, 45 Feet, Outbound
FE ECUS MED PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$4.53	$4.53	$4.53	$4.53	$4.53	$4.53	$4.53	$4.53
Port Cost Total	$194.77	$194.77	$194.77	$194.77	$194.77	$194.77	$194.77	$194.77
Land Cost Total	$604.00	$527.64	$539.64	$538.00	$556.55	$428.91	$348.73	$218.36
Total Cost	$803.31	$726.94	$738.94	$737.31	$755.85	$628.22	$548.04	$417.67

Table 3.16 (cont'd). Portsmouth Total Cost for Hinterland, 45 Feet, Outbound
FE ECUS MED PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$4.53	$4.53	$4.53	$4.53	$4.53	$4.53	$4.53	$4.53	$4.53
Port Cost Total	$194.77	$194.77	$194.77	$194.77	$194.77	$194.77	$194.77	$194.77	$194.77
Land Cost Total	$424.55	$323.09	$396.73	$421.27	$364.00	$457.27	$522.73	$426.73	$344.36
Total Cost	$623.85	$522.40	$596.04	$620.58	$563.31	$656.58	$722.04	$626.04	$543.67

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.17. Newport News Total Cost for Hinterland, 45 Feet, Outbound
FE ECUS MED PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$3.65	$3.65	$3.65	$3.65	$3.65	$3.65	$3.65	$3.65
Port Cost Total	$194.82	$194.82	$194.82	$194.82	$194.82	$194.82	$194.82	$194.82
Land Cost Total	$604.00	$527.64	$539.64	$538.00	$556.55	$428.91	$348.73	$218.36
Total Cost	$802.46	$726.10	$738.10	$736.46	$755.01	$627.37	$547.19	$416.83

Table 3.17 (cont'd). Newport News Total Cost for Hinterland, 45 Feet, Outbound
FE ECUS MED PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$3.65	$3.65	$3.65	$3.65	$3.65	$3.65	$3.65	$3.65	$3.65
Port Cost Total	$194.82	$194.82	$194.82	$194.82	$194.82	$194.82	$194.82	$194.82	$194.82
Land Cost Total	$424.55	$323.09	$396.73	$421.27	$364.00	$457.27	$522.73	$426.73	$344.36
Total Cost	$623.01	$521.55	$595.19	$619.73	$562.46	$655.73	$721.19	$625.19	$542.83

Note: Some cost inputs have been estimated.
Source: G.E.C., Inc.

Table 3.18. Norfolk International Total Cost for Hinterland, 45 Feet, Outbound
FE ECUS MED PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$3.73	$3.73	$3.73	$3.73	$3.73	$3.73	$3.73	$3.73
Port Cost Total	$194.89	$194.89	$194.89	$194.89	$194.89	$194.89	$194.89	$194.89
Land Cost Total	$604.00	$527.64	$539.64	$538.00	$556.55	$428.91	$348.73	$218.36
Total Cost	$802.62	$726.25	$738.25	$736.62	$755.16	$627.52	$547.34	$416.98

Table 3.18 (cont'd). Norfolk International Total Cost for Hinterland, 45 Feet, Outbound
FE ECUS MED PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$3.73	$3.73	$3.73	$3.73	$3.73	$3.73	$3.73	$3.73	$3.73
Port Cost Total	$194.89	$194.89	$194.89	$194.89	$194.89	$194.89	$194.89	$194.89	$194.89
Land Cost Total	$424.55	$323.09	$396.73	$421.27	$364.00	$457.27	$522.73	$426.73	$344.36
Total Cost	$623.16	$521.71	$595.34	$619.89	$562.62	$655.89	$721.34	$625.34	$542.98

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.19. Wilmington Total Cost for Hinterland, 45 Feet, Outbound
FE ECUS MED PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$10.47	$10.47	$10.47	$10.47	$10.47	$10.47	$10.47	$10.47
Port Cost Total	$190.64	$190.64	$190.64	$190.64	$190.64	$190.64	$190.64	$190.64
Land Cost Total	$513.45	$437.09	$499.82	$559.27	$468.18	$340.55	$260.91	$146.91
Total Cost	$714.57	$638.20	$700.93	$760.39	$669.29	$541.66	$462.02	$348.02

Table 3.19 (cont'd). Wilmington Total Cost for Hinterland, 45 Feet, Outbound
FE ECUS MED PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$10.47	$10.47	$10.47	$10.47	$10.47	$10.47	$10.47	$10.47	$10.47
Port Cost Total	$190.64	$190.64	$190.64	$190.64	$190.64	$190.64	$190.64	$190.64	$190.64
Land Cost Total	$404.36	$307.82	$418.00	$398.91	$398.91	$478.55	$578.36	$510.18	$421.82
Total Cost	$605.48	$508.93	$619.11	$600.02	$600.02	$679.66	$779.48	$711.29	$622.93

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.20. Charleston Total Cost for Hinterland, 45 Feet, Outbound
FE ECUS MED PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$9.72	$9.72	$9.72	$9.72	$9.72	$9.72	$9.72	$9.72
Port Cost Total	$198.81	$198.81	$198.81	$198.81	$198.81	$198.81	$198.81	$198.81
Land Cost Total	$464.36	$388.00	$464.36	$502.00	$419.09	$291.45	$211.82	$149.09
Total Cost	$672.89	$596.52	$672.89	$710.52	$627.62	$499.98	$420.34	$357.62

Table 3.20 (cont'd). Charleston Total Cost for Hinterland, 45 Feet, Outbound
FE ECUS MED PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$9.72	$9.72	$9.72	$9.72	$9.72	$9.72	$9.72	$9.72	$9.72
Port Cost Total	$198.81	$198.81	$198.81	$198.81	$198.81	$198.81	$198.81	$198.81	$198.81
Land Cost Total	$335.09	$238.55	$371.09	$374.36	$407.09	$431.64	$531.45	$517.27	$428.91
Total Cost	$543.62	$447.07	$579.62	$582.89	$615.62	$640.16	$739.98	$725.80	$637.43

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.21. Savannah Total Cost for Hinterland, 45 Feet, Outbound
FE ECUS MED PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$12.45	$12.45	$12.45	$12.45	$12.45	$12.45	$12.45	$12.45
Port Cost Total	$198.94	$198.94	$198.94	$198.94	$198.94	$198.94	$198.94	$198.94
Land Cost Total	$412.55	$314.91	$387.45	$478.00	$383.09	$254.91	$175.82	$177.45
Total Cost	$623.94	$526.31	$598.85	$689.40	$594.49	$466.31	$387.22	$388.85

Table 3.21 (cont'd). Savannah Total Cost for Hinterland, 45 Feet, Outbound
FE ECUS MED PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$12.45	$12.45	$12.45	$12.45	$12.45	$12.45	$12.45	$12.45	$12.45
Port Cost Total	$198.94	$198.94	$198.94	$198.94	$198.94	$198.94	$198.94	$198.94	$198.94
Land Cost Total	$311.09	$266.36	$399.45	$402.18	$435.45	$460.00	$559.82	$544.55	$456.73
Total Cost	$522.49	$477.76	$610.85	$613.58	$646.85	$671.40	$771.22	$755.94	$668.13

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.22. Jacksonville Total Cost for Hinterland, 45 Feet, Outbound
FE ECUS MED PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$16.63	$16.63	$16.63	$16.63	$16.63	$16.63	$16.63	$16.63
Port Cost Total	$191.53	$191.53	$191.53	$191.53	$191.53	$191.53	$191.53	$191.53
Land Cost Total	$337.82	$260.36	$439.82	$530.91	$436.55	$308.91	$228.18	$249.45
Total Cost	$545.98	$468.53	$647.98	$739.07	$644.71	$517.07	$436.35	$457.62

Table 3.22 (cont'd). Jacksonville Total Cost for Hinterland, 45 Feet, Outbound
FE ECUS MED PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$16.63	$16.63	$16.63	$16.63	$16.63	$16.63	$16.63	$16.63	$16.63
Port Cost Total	$191.53	$191.53	$191.53	$191.53	$191.53	$191.53	$191.53	$191.53	$191.53
Land Cost Total	$364.00	$338.91	$458.91	$474.18	$507.45	$519.45	$640.00	$616.55	$529.27
Total Cost	$572.16	$547.07	$667.07	$682.35	$715.62	$727.62	$848.16	$824.71	$737.44

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.23. Portsmouth Total Cost for Hinterland, 45 Feet, Inbound
FE ECUS EU PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$44.34	$44.34	$44.34	$44.34	$44.34	$44.34	$44.34	$44.34
Port Cost Total	$194.77	$194.77	$194.77	$194.77	$194.77	$194.77	$194.77	$194.77
Land Cost Total	$604.00	$527.64	$539.64	$538.00	$556.55	$428.91	$348.73	$218.36
Total Cost	$843.11	$766.75	$778.75	$777.11	$795.66	$668.02	$587.84	$457.48

Table 3.23 (cont'd). Portsmouth Total Cost for Hinterland, 45 Feet, Inbound
FE ECUS EU PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$44.34	$44.34	$44.34	$44.34	$44.34	$44.34	$44.34	$44.34	$44.34
Port Cost Total	$194.77	$194.77	$194.77	$194.77	$194.77	$194.77	$194.77	$194.77	$194.77
Land Cost Total	$424.55	$323.09	$396.73	$421.27	$364.00	$457.27	$522.73	$426.73	$344.36
Total Cost	$663.66	$562.20	$635.84	$660.39	$603.11	$696.39	$761.84	$665.84	$583.48

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.24. Newport News Total Cost for Hinterland, 45 Feet, Inbound
FE ECUS EU PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$34.96	$34.96	$34.96	$34.96	$34.96	$34.96	$34.96	$34.96
Port Cost Total	$194.82	$194.82	$194.82	$194.82	$194.82	$194.82	$194.82	$194.82
Land Cost Total	$604.00	$527.64	$539.64	$538.00	$556.55	$428.91	$348.73	$218.36
Total Cost	$833.78	$757.42	$769.42	$767.78	$786.32	$658.69	$578.51	$448.14

Table 3.24 (cont'd). Newport News Total Cost for Hinterland, 45 Feet, Inbound
FE ECUS EU PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$34.96	$34.96	$34.96	$34.96	$34.96	$34.96	$34.96	$34.96	$34.96
Port Cost Total	$194.82	$194.82	$194.82	$194.82	$194.82	$194.82	$194.82	$194.82	$194.82
Land Cost Total	$424.55	$323.09	$396.73	$421.27	$364.00	$457.27	$522.73	$426.73	$344.36
Total Cost	$654.32	$552.87	$626.51	$651.05	$593.78	$687.05	$752.51	$656.51	$574.14

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.25. Norfolk International Total Cost for Hinterland, 45 Feet, Inbound
FE ECUS EU PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$32.66	$32.66	$32.66	$32.66	$32.66	$32.66	$32.66	$32.66
Port Cost Total	$194.89	$194.89	$194.89	$194.89	$194.89	$194.89	$194.89	$194.89
Land Cost Total	$604.00	$527.64	$539.64	$538.00	$556.55	$428.91	$348.73	$218.36
Total Cost	$831.55	$755.18	$767.18	$765.55	$784.09	$656.46	$576.27	$445.91

Table 3.25 (cont'd). Norfolk International Total Cost for Hinterland, 45 Feet, Inbound
FE ECUS EU PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$32.66	$32.66	$32.66	$32.66	$32.66	$32.66	$32.66	$32.66	$32.66
Port Cost Total	$194.89	$194.89	$194.89	$194.89	$194.89	$194.89	$194.89	$194.89	$194.89
Land Cost Total	$424.55	$323.09	$396.73	$421.27	$364.00	$457.27	$522.73	$426.73	$344.36
Total Cost	$652.09	$550.64	$624.27	$648.82	$591.55	$684.82	$750.27	$654.27	$571.91

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.26. Wilmington Total Cost for Hinterland, 45 Feet, Inbound
FE ECUS EU PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$40.20	$40.20	$40.20	$40.20	$40.20	$40.20	$40.20	$40.20
Port Cost Total	$190.64	$190.64	$190.64	$190.64	$190.64	$190.64	$190.64	$190.64
Land Cost Total	$513.45	$437.09	$499.82	$559.27	$468.18	$340.55	$260.91	$146.91
Total Cost	$744.29	$667.93	$730.66	$790.11	$699.02	$571.38	$491.75	$377.75

Table 3.26 (cont'd). Wilmington Total Cost for Hinterland, 45 Feet, Inbound
FE ECUS EU PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$40.20	$40.20	$40.20	$40.20	$40.20	$40.20	$40.20	$40.20	$40.20
Port Cost Total	$190.64	$190.64	$190.64	$190.64	$190.64	$190.64	$190.64	$190.64	$190.64
Land Cost Total	$404.36	$307.82	$418.00	$398.91	$398.91	$478.55	$578.36	$510.18	$421.82
Total Cost	$635.20	$538.66	$648.84	$629.75	$629.75	$709.38	$809.20	$741.02	$652.66

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.27. Charleston Total Cost for Hinterland, 45 Feet, Inbound
FE ECUS EU PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$30.74	$30.74	$30.74	$30.74	$30.74	$30.74	$30.74	$30.74
Port Cost Total	$198.81	$198.81	$198.81	$198.81	$198.81	$198.81	$198.81	$198.81
Land Cost Total	$464.36	$388.00	$464.36	$502.00	$419.09	$291.45	$211.82	$149.09
Total Cost	$693.91	$617.54	$693.91	$731.54	$648.64	$521.00	$441.36	$378.64

Table 3.27 (cont'd). Charleston Total Cost for Hinterland, 45 Feet, Inbound
FE ECUS EU PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$30.74	$30.74	$30.74	$30.74	$30.74	$30.74	$30.74	$30.74	$30.74
Port Cost Total	$198.81	$198.81	$198.81	$198.81	$198.81	$198.81	$198.81	$198.81	$198.81
Land Cost Total	$335.09	$238.55	$371.09	$374.36	$407.09	$431.64	$531.45	$517.27	$428.91
Total Cost	$564.64	$468.09	$600.64	$603.91	$636.64	$661.18	$761.00	$746.82	$658.45

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.28. Savannah Total Cost for Hinterland, 45 Feet, Inbound
FE ECUS EU PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$35.76	$35.76	$35.76	$35.76	$35.76	$35.76	$35.76	$35.76
Port Cost Total	$198.94	$198.94	$198.94	$198.94	$198.94	$198.94	$198.94	$198.94
Land Cost Total	$412.55	$314.91	$387.45	$478.00	$383.09	$254.91	$175.82	$177.45
Total Cost	$647.25	$549.61	$622.15	$712.70	$617.79	$489.61	$410.52	$412.15

Table 3.28 (cont'd). Savannah Total Cost for Hinterland, 45 Feet, Inbound
FE ECUS EU PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$35.76	$35.76	$35.76	$35.76	$35.76	$35.76	$35.76	$35.76	$35.76
Port Cost Total	$198.94	$198.94	$198.94	$198.94	$198.94	$198.94	$198.94	$198.94	$198.94
Land Cost Total	$311.09	$266.36	$399.45	$402.18	$435.45	$460.00	$559.82	$544.55	$456.73
Total Cost	$545.79	$501.06	$634.15	$636.88	$670.15	$694.70	$794.52	$779.25	$691.43

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.29. Jacksonville Total Cost for Hinterland, 45 Feet, Inbound
FE ECUS EU PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$41.49	$41.49	$41.49	$41.49	$41.49	$41.49	$41.49	$41.49
Port Cost Total	$191.53	$191.53	$191.53	$191.53	$191.53	$191.53	$191.53	$191.53
Land Cost Total	$337.82	$260.36	$439.82	$530.91	$436.55	$308.91	$228.18	$249.45
Total Cost	$570.84	$493.39	$672.84	$763.93	$669.57	$541.93	$461.20	$482.48

Table 3.29 (cont'd). Jacksonville Total Cost for Hinterland, 45 Feet, Inbound
FE ECUS EU PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$41.49	$41.49	$41.49	$41.49	$41.49	$41.49	$41.49	$41.49	$41.49
Port Cost Total	$191.53	$191.53	$191.53	$191.53	$191.53	$191.53	$191.53	$191.53	$191.53
Land Cost Total	$364.00	$338.91	$458.91	$474.18	$507.45	$519.45	$640.00	$616.55	$529.27
Total Cost	$597.02	$571.93	$691.93	$707.20	$740.48	$752.48	$873.02	$849.57	$762.29

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.30. Portsmouth Total Cost for Hinterland, 45 Feet, Outbound
FE ECUS EU PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$4.54	$4.54	$4.54	$4.54	$4.54	$4.54	$4.54	$4.54
Port Cost Total	$194.77	$194.77	$194.77	$194.77	$194.77	$194.77	$194.77	$194.77
Land Cost Total	$604.00	$527.64	$539.64	$538.00	$556.55	$428.91	$348.73	$218.36
Total Cost	$803.32	$726.95	$738.95	$737.32	$755.86	$628.23	$548.05	$417.68

Table 3.30 (cont'd). Portsmouth Total Cost for Hinterland, 45 Feet, Outbound
FE ECUS EU PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$4.54	$4.54	$4.54	$4.54	$4.54	$4.54	$4.54	$4.54	$4.54
Port Cost Total	$194.77	$194.77	$194.77	$194.77	$194.77	$194.77	$194.77	$194.77	$194.77
Land Cost Total	$424.55	$323.09	$396.73	$421.27	$364.00	$457.27	$522.73	$426.73	$344.36
Total Cost	$623.86	$522.41	$596.05	$620.59	$563.32	$656.59	$722.05	$626.05	$543.68

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.31. Newport News Total Cost for Hinterland, 45 Feet, Outbound
FE ECUS EU PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$3.65	$3.65	$3.65	$3.65	$3.65	$3.65	$3.65	$3.65
Port Cost Total	$194.82	$194.82	$194.82	$194.82	$194.82	$194.82	$194.82	$194.82
Land Cost Total	$604.00	$527.64	$539.64	$538.00	$556.55	$428.91	$348.73	$218.36
Total Cost	$802.47	$726.10	$738.10	$736.47	$755.01	$627.38	$547.20	$416.83

Table 3.31 (cont'd). Newport News Total Cost for Hinterland, 45 Feet, Outbound
FE ECUS EU PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$3.65	$3.65	$3.65	$3.65	$3.65	$3.65	$3.65	$3.65	$3.65
Port Cost Total	$194.82	$194.82	$194.82	$194.82	$194.82	$194.82	$194.82	$194.82	$194.82
Land Cost Total	$424.55	$323.09	$396.73	$421.27	$364.00	$457.27	$522.73	$426.73	$344.36
Total Cost	$623.01	$521.56	$595.20	$619.74	$562.47	$655.74	$721.20	$625.20	$542.83

Note: Some cost inputs have been estimated.
Source: G.E.C., Inc.

Table 3.32. Norfolk International Total Cost for Hinterland, 45 Feet, Outbound
FE ECUS EU PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$3.43	$3.43	$3.43	$3.43	$3.43	$3.43	$3.43	$3.43
Port Cost Total	$194.89	$194.89	$194.89	$194.89	$194.89	$194.89	$194.89	$194.89
Land Cost Total	$604.00	$527.64	$539.64	$538.00	$556.55	$428.91	$348.73	$218.36
Total Cost	$802.31	$725.95	$737.95	$736.31	$754.86	$627.22	$547.04	$416.68

Table 3.32 (cont'd). Norfolk International Total Cost for Hinterland, 45 Feet, Outbound
FE ECUS EU PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$3.43	$3.43	$3.43	$3.43	$3.43	$3.43	$3.43	$3.43	$3.43
Port Cost Total	$194.89	$194.89	$194.89	$194.89	$194.89	$194.89	$194.89	$194.89	$194.89
Land Cost Total	$424.55	$323.09	$396.73	$421.27	$364.00	$457.27	$522.73	$426.73	$344.36
Total Cost	$622.86	$521.40	$595.04	$619.59	$562.31	$655.59	$721.04	$625.04	$542.68

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.33. Wilmington Total Cost for Hinterland, 45 Feet, Outbound
FE ECUS EU PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$5.95	$5.95	$5.95	$5.95	$5.95	$5.95	$5.95	$5.95
Port Cost Total	$190.64	$190.64	$190.64	$190.64	$190.64	$190.64	$190.64	$190.64
Land Cost Total	$513.45	$437.09	$499.82	$559.27	$468.18	$340.55	$260.91	$146.91
Total Cost	$710.05	$633.68	$696.41	$755.86	$664.77	$537.14	$457.50	$343.50

Table 3.33 (cont'd). Wilmington Total Cost for Hinterland, 45 Feet, Outbound
FE ECUS EU PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$5.95	$5.95	$5.95	$5.95	$5.95	$5.95	$5.95	$5.95	$5.95
Port Cost Total	$190.64	$190.64	$190.64	$190.64	$190.64	$190.64	$190.64	$190.64	$190.64
Land Cost Total	$404.36	$307.82	$418.00	$398.91	$398.91	$478.55	$578.36	$510.18	$421.82
Total Cost	$600.96	$504.41	$614.59	$595.50	$595.50	$675.14	$774.96	$706.77	$618.41

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.34. Charleston Total Cost for Hinterland, 45 Feet, Outbound
FE ECUS EU PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$6.45	$6.45	$6.45	$6.45	$6.45	$6.45	$6.45	$6.45
Port Cost Total	$198.81	$198.81	$198.81	$198.81	$198.81	$198.81	$198.81	$198.81
Land Cost Total	$464.36	$388.00	$464.36	$502.00	$419.09	$291.45	$211.82	$149.09
Total Cost	$669.62	$593.25	$669.62	$707.25	$624.35	$496.71	$417.07	$354.35

Table 3.34 (cont'd). Charleston Total Cost for Hinterland, 45 Feet, Outbound
FE ECUS EU PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$6.45	$6.45	$6.45	$6.45	$6.45	$6.45	$6.45	$6.45	$6.45
Port Cost Total	$198.81	$198.81	$198.81	$198.81	$198.81	$198.81	$198.81	$198.81	$198.81
Land Cost Total	$335.09	$238.55	$371.09	$374.36	$407.09	$431.64	$531.45	$517.27	$428.91
Total Cost	$540.35	$443.80	$576.35	$579.62	$612.35	$636.89	$736.71	$722.53	$634.16

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.35. Savannah Total Cost for Hinterland, 45 Feet, Outbound
FE ECUS EU PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$8.28	$8.28	$8.28	$8.28	$8.28	$8.28	$8.28	$8.28
Port Cost Total	$198.94	$198.94	$198.94	$198.94	$198.94	$198.94	$198.94	$198.94
Land Cost Total	$412.55	$314.91	$387.45	$478.00	$383.09	$254.91	$175.82	$177.45
Total Cost	$619.77	$522.13	$594.68	$685.22	$590.31	$462.13	$383.04	$384.68

Table 3.35 (cont'd). Savannah Total Cost for Hinterland, 45 Feet, Outbound
FE ECUS EU PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$8.28	$8.28	$8.28	$8.28	$8.28	$8.28	$8.28	$8.28	$8.28
Port Cost Total	$198.94	$198.94	$198.94	$198.94	$198.94	$198.94	$198.94	$198.94	$198.94
Land Cost Total	$311.09	$266.36	$399.45	$402.18	$435.45	$460.00	$559.82	$544.55	$456.73
Total Cost	$518.31	$473.59	$606.68	$609.40	$642.68	$667.22	$767.04	$751.77	$663.95

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.36. Jacksonville Total Cost for Hinterland, 45 Feet, Outbound
FE ECUS EU PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$11.72	$11.72	$11.72	$11.72	$11.72	$11.72	$11.72	$11.72
Port Cost Total	$191.53	$191.53	$191.53	$191.53	$191.53	$191.53	$191.53	$191.53
Land Cost Total	$337.82	$260.36	$439.82	$530.91	$436.55	$308.91	$228.18	$249.45
Total Cost	$541.08	$463.62	$643.08	$734.17	$639.80	$512.17	$431.44	$452.71

Table 3.36 (cont'd). Jacksonville Total Cost for Hinterland, 45 Feet, Outbound
FE ECUS EU PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$11.72	$11.72	$11.72	$11.72	$11.72	$11.72	$11.72	$11.72	$11.72
Port Cost Total	$191.53	$191.53	$191.53	$191.53	$191.53	$191.53	$191.53	$191.53	$191.53
Land Cost Total	$364.00	$338.91	$458.91	$474.18	$507.45	$519.45	$640.00	$616.55	$529.27
Total Cost	$567.26	$542.17	$662.17	$677.44	$710.71	$722.71	$843.26	$819.80	$732.53

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.37. Portsmouth Total Cost for Hinterland, 45 Feet, Inbound
FE SUEZ ECUS PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$3.17	$3.17	$3.17	$3.17	$3.17	$3.17	$3.17	$3.17
Port Cost Total	$196.11	$196.11	$196.11	$196.11	$196.11	$196.11	$196.11	$196.11
Land Cost Total	$604.00	$527.64	$539.64	$538.00	$556.55	$428.91	$348.73	$218.36
Total Cost	$803.28	$726.92	$738.92	$737.28	$755.83	$628.19	$548.01	$417.64

Table 3.37 (cont'd). Portsmouth Total Cost for Hinterland, 45 Feet, Inbound
FE SUEZ ECUS PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$3.17	$3.17	$3.17	$3.17	$3.17	$3.17	$3.17	$3.17	$3.17
Port Cost Total	$196.11	$196.11	$196.11	$196.11	$196.11	$196.11	$196.11	$196.11	$196.11
Land Cost Total	$424.55	$323.09	$396.73	$421.27	$364.00	$457.27	$522.73	$426.73	$344.36
Total Cost	$623.83	$522.37	$596.01	$620.55	$563.28	$656.55	$722.01	$626.01	$543.64

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.38. Newport News Total Cost for Hinterland, 45 Feet, Inbound
FE SUEZ ECUS PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$2.65	$2.65	$2.65	$2.65	$2.65	$2.65	$2.65	$2.65
Port Cost Total	$196.15	$196.15	$196.15	$196.15	$196.15	$196.15	$196.15	$196.15
Land Cost Total	$604.00	$527.64	$539.64	$538.00	$556.55	$428.91	$348.73	$218.36
Total Cost	$802.81	$726.44	$738.44	$736.81	$755.35	$627.72	$547.54	$417.17

Table 3.38 (cont'd). Newport News Total Cost for Hinterland, 45 Feet, Inbound
FE SUEZ ECUS PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$2.65	$2.65	$2.65	$2.65	$2.65	$2.65	$2.65	$2.65	$2.65
Port Cost Total	$196.15	$196.15	$196.15	$196.15	$196.15	$196.15	$196.15	$196.15	$196.15
Land Cost Total	$424.55	$323.09	$396.73	$421.27	$364.00	$457.27	$522.73	$426.73	$344.36
Total Cost	$623.35	$521.90	$595.54	$620.08	$562.81	$656.08	$721.54	$625.54	$543.17

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.39. Norfolk International Total Cost for Hinterland, 45 Feet, Inbound
FE SUEZ ECUS PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$2.09	$2.09	$2.09	$2.09	$2.09	$2.09	$2.09	$2.09
Port Cost Total	$196.22	$196.22	$196.22	$196.22	$196.22	$196.22	$196.22	$196.22
Land Cost Total	$604.00	$527.64	$539.64	$538.00	$556.55	$428.91	$348.73	$218.36
Total Cost	$802.31	$725.95	$737.95	$736.31	$754.86	$627.22	$547.04	$416.68

Table 3.39 (cont'd). Norfolk International Total Cost for Hinterland, 45 Feet, Inbound
FE SUEZ ECUS PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$2.09	$2.09	$2.09	$2.09	$2.09	$2.09	$2.09	$2.09	$2.09
Port Cost Total	$196.22	$196.22	$196.22	$196.22	$196.22	$196.22	$196.22	$196.22	$196.22
Land Cost Total	$424.55	$323.09	$396.73	$421.27	$364.00	$457.27	$522.73	$426.73	$344.36
Total Cost	$622.86	$521.40	$595.04	$619.58	$562.31	$655.58	$721.04	$625.04	$542.68

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.40. Wilmington Total Cost for Hinterland, 45 Feet, Inbound
FE SUEZ ECUS PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$7.32	$7.32	$7.32	$7.32	$7.32	$7.32	$7.32	$7.32
Port Cost Total	$192.03	$192.03	$192.03	$192.03	$192.03	$192.03	$192.03	$192.03
Land Cost Total	$513.45	$437.09	$499.82	$559.27	$468.18	$340.55	$260.91	$146.91
Total Cost	$712.80	$636.44	$699.16	$758.62	$667.53	$539.89	$460.25	$346.25

Table 3.40 (cont'd). Wilmington Total Cost for Hinterland, 45 Feet, Inbound
FE SUEZ ECUS PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$7.32	$7.32	$7.32	$7.32	$7.32	$7.32	$7.32	$7.32	$7.32
Port Cost Total	$192.03	$192.03	$192.03	$192.03	$192.03	$192.03	$192.03	$192.03	$192.03
Land Cost Total	$404.36	$307.82	$418.00	$398.91	$398.91	$478.55	$578.36	$510.18	$421.82
Total Cost	$603.71	$507.16	$617.34	$598.25	$598.25	$677.89	$777.71	$709.53	$621.16

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.41. Charleston Total Cost for Hinterland, 45 Feet, Inbound
FE SUEZ ECUS PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$7.07	$7.07	$7.07	$7.07	$7.07	$7.07	$7.07	$7.07
Port Cost Total	$200.07	$200.07	$200.07	$200.07	$200.07	$200.07	$200.07	$200.07
Land Cost Total	$464.36	$388.00	$464.36	$502.00	$419.09	$291.45	$211.82	$149.09
Total Cost	$671.51	$595.14	$671.51	$709.14	$626.24	$498.60	$418.96	$356.24

Table 3.41 (cont'd). Charleston Total Cost for Hinterland, 45 Feet, Inbound
FE SUEZ ECUS PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$7.07	$7.07	$7.07	$7.07	$7.07	$7.07	$7.07	$7.07	$7.07
Port Cost Total	$200.07	$200.07	$200.07	$200.07	$200.07	$200.07	$200.07	$200.07	$200.07
Land Cost Total	$335.09	$238.55	$371.09	$374.36	$407.09	$431.64	$531.45	$517.27	$428.91
Total Cost	$542.24	$445.69	$578.24	$581.51	$614.24	$638.78	$738.60	$724.42	$636.05

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.42. Savannah Total Cost for Hinterland, 45 Feet, Inbound
FE SUEZ ECUS PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$8.84	$8.84	$8.84	$8.84	$8.84	$8.84	$8.84	$8.84
Port Cost Total	$200.40	$200.40	$200.40	$200.40	$200.40	$200.40	$200.40	$200.40
Land Cost Total	$412.55	$314.91	$387.45	$478.00	$383.09	$254.91	$175.82	$177.45
Total Cost	$621.78	$524.14	$596.69	$687.24	$592.33	$464.14	$385.05	$386.69

Table 3.42 (cont'd). Savannah Total Cost for Hinterland, 45 Feet, Inbound
FE SUEZ ECUS PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$8.84	$8.84	$8.84	$8.84	$8.84	$8.84	$8.84	$8.84	$8.84
Port Cost Total	$200.40	$200.40	$200.40	$200.40	$200.40	$200.40	$200.40	$200.40	$200.40
Land Cost Total	$311.09	$266.36	$399.45	$402.18	$435.45	$460.00	$559.82	$544.55	$456.73
Total Cost	$520.33	$475.60	$608.69	$611.42	$644.69	$669.24	$769.05	$753.78	$665.96

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.43. Jacksonville Total Cost for Hinterland, 45 Feet, Inbound
FE SUEZ ECUS PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$11.42	$11.42	$11.42	$11.42	$11.42	$11.42	$11.42	$11.42
Port Cost Total	$192.76	$192.76	$192.76	$192.76	$192.76	$192.76	$192.76	$192.76
Land Cost Total	$337.82	$260.36	$439.82	$530.91	$436.55	$308.91	$228.18	$249.45
Total Cost	$541.99	$464.54	$643.99	$735.08	$640.72	$513.08	$432.36	$453.63

Table 3.43 (cont'd). Jacksonville Total Cost for Hinterland, 45 Feet, Inbound
FE SUEZ ECUS PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$11.42	$11.42	$11.42	$11.42	$11.42	$11.42	$11.42	$11.42	$11.42
Port Cost Total	$192.76	$192.76	$192.76	$192.76	$192.76	$192.76	$192.76	$192.76	$192.76
Land Cost Total	$364.00	$338.91	$458.91	$474.18	$507.45	$519.45	$640.00	$616.55	$529.27
Total Cost	$568.17	$543.08	$663.08	$678.36	$711.63	$723.63	$844.17	$820.72	$733.45

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.44. Portsmouth Total Cost for Hinterland, 45 Feet, Outbound
FE SUEZ ECUS PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$4.46	$4.46	$4.46	$4.46	$4.46	$4.46	$4.46	$4.46
Port Cost Total	$196.11	$196.11	$196.11	$196.11	$196.11	$196.11	$196.11	$196.11
Land Cost Total	$604.00	$527.64	$539.64	$538.00	$556.55	$428.91	$348.73	$218.36
Total Cost	$804.58	$728.21	$740.21	$738.58	$757.12	$629.49	$549.30	$418.94

Table 3.44 (cont'd). Portsmouth Total Cost for Hinterland, 45 Feet, Outbound
FE SUEZ ECUS PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$4.46	$4.46	$4.46	$4.46	$4.46	$4.46	$4.46	$4.46	$4.46
Port Cost Total	$196.11	$196.11	$196.11	$196.11	$196.11	$196.11	$196.11	$196.11	$196.11
Land Cost Total	$424.55	$323.09	$396.73	$421.27	$364.00	$457.27	$522.73	$426.73	$344.36
Total Cost	$625.12	$523.67	$597.30	$621.85	$564.58	$657.85	$723.30	$627.30	$544.94

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.45. Newport News Total Cost for Hinterland, 45 Feet, Outbound
FE SUEZ ECUS PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$3.50	$3.50	$3.50	$3.50	$3.50	$3.50	$3.50	$3.50
Port Cost Total	$196.15	$196.15	$196.15	$196.15	$196.15	$196.15	$196.15	$196.15
Land Cost Total	$604.00	$527.64	$539.64	$538.00	$556.55	$428.91	$348.73	$218.36
Total Cost	$803.66	$727.30	$739.30	$737.66	$756.20	$628.57	$548.39	$418.02

Table 3.45 (cont'd). Newport News Total Cost for Hinterland, 45 Feet, Outbound
FE SUEZ ECUS PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$3.50	$3.50	$3.50	$3.50	$3.50	$3.50	$3.50	$3.50	$3.50
Port Cost Total	$196.15	$196.15	$196.15	$196.15	$196.15	$196.15	$196.15	$196.15	$196.15
Land Cost Total	$424.55	$323.09	$396.73	$421.27	$364.00	$457.27	$522.73	$426.73	$344.36
Total Cost	$624.20	$522.75	$596.39	$620.93	$563.66	$656.93	$722.39	$626.39	$544.02

Note: Some cost inputs have been estimated.
Source: G.E.C., Inc.

Table 3.46. Norfolk International Total Cost for Hinterland, 45 Feet, Outbound
FE SUEZ ECUS PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$2.58	$2.58	$2.58	$2.58	$2.58	$2.58	$2.58	$2.58
Port Cost Total	$196.22	$196.22	$196.22	$196.22	$196.22	$196.22	$196.22	$196.22
Land Cost Total	$604.00	$527.64	$539.64	$538.00	$556.55	$428.91	$348.73	$218.36
Total Cost	$802.81	$726.44	$738.44	$736.81	$755.35	$627.71	$547.53	$417.17

Table 3.46 (cont'd). Norfolk International Total Cost for Hinterland, 45 Feet, Outbound
FE SUEZ ECUS PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$2.58	$2.58	$2.58	$2.58	$2.58	$2.58	$2.58	$2.58	$2.58
Port Cost Total	$196.22	$196.22	$196.22	$196.22	$196.22	$196.22	$196.22	$196.22	$196.22
Land Cost Total	$424.55	$323.09	$396.73	$421.27	$364.00	$457.27	$522.73	$426.73	$344.36
Total Cost	$623.35	$521.90	$595.53	$620.08	$562.81	$656.08	$721.53	$625.53	$543.17

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.47. Wilmington Total Cost for Hinterland, 45 Feet, Outbound
FE SUEZ ECUS PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$5.85	$5.85	$5.85	$5.85	$5.85	$5.85	$5.85	$5.85
Port Cost Total	$192.03	$192.03	$192.03	$192.03	$192.03	$192.03	$192.03	$192.03
Land Cost Total	$513.45	$437.09	$499.82	$559.27	$468.18	$340.55	$260.91	$146.91
Total Cost	$711.33	$634.96	$697.69	$757.15	$666.05	$538.42	$458.78	$344.78

Table 3.47 (cont'd). Wilmington Total Cost for Hinterland, 45 Feet, Outbound
FE SUEZ ECUS PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$5.85	$5.85	$5.85	$5.85	$5.85	$5.85	$5.85	$5.85	$5.85
Port Cost Total	$192.03	$192.03	$192.03	$192.03	$192.03	$192.03	$192.03	$192.03	$192.03
Land Cost Total	$404.36	$307.82	$418.00	$398.91	$398.91	$478.55	$578.36	$510.18	$421.82
Total Cost	$602.24	$505.69	$615.87	$596.78	$596.78	$676.42	$776.24	$708.05	$619.69

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.48. Charleston Total Cost for Hinterland, 45 Feet, Outbound
FE SUEZ ECUS PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$6.18	$6.18	$6.18	$6.18	$6.18	$6.18	$6.18	$6.18
Port Cost Total	$200.07	$200.07	$200.07	$200.07	$200.07	$200.07	$200.07	$200.07
Land Cost Total	$464.36	$388.00	$464.36	$502.00	$419.09	$291.45	$211.82	$149.09
Total Cost	$670.62	$594.26	$670.62	$708.26	$625.35	$497.71	$418.08	$355.35

Table 3.48 (cont'd). Charleston Total Cost for Hinterland, 45 Feet, Outbound
FE SUEZ ECUS PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$6.18	$6.18	$6.18	$6.18	$6.18	$6.18	$6.18	$6.18	$6.18
Port Cost Total	$200.07	$200.07	$200.07	$200.07	$200.07	$200.07	$200.07	$200.07	$200.07
Land Cost Total	$335.09	$238.55	$371.09	$374.36	$407.09	$431.64	$531.45	$517.27	$428.91
Total Cost	$541.35	$444.80	$577.35	$580.62	$613.35	$637.90	$737.71	$723.53	$635.17

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.49. Savannah Total Cost for Hinterland, 45 Feet, Outbound
FE SUEZ ECUS PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$8.06	$8.06	$8.06	$8.06	$8.06	$8.06	$8.06	$8.06
Port Cost Total	$200.40	$200.40	$200.40	$200.40	$200.40	$200.40	$200.40	$200.40
Land Cost Total	$412.55	$314.91	$387.45	$478.00	$383.09	$254.91	$175.82	$177.45
Total Cost	$621.00	$523.36	$595.91	$686.46	$591.55	$463.36	$384.27	$385.91

Table 3.49 (cont'd). Savannah Total Cost for Hinterland, 45 Feet, Outbound
FE SUEZ ECUS PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$8.06	$8.06	$8.06	$8.06	$8.06	$8.06	$8.06	$8.06	$8.06
Port Cost Total	$200.40	$200.40	$200.40	$200.40	$200.40	$200.40	$200.40	$200.40	$200.40
Land Cost Total	$311.09	$266.36	$399.45	$402.18	$435.45	$460.00	$559.82	$544.55	$456.73
Total Cost	$519.55	$474.82	$607.91	$610.64	$643.91	$668.46	$768.27	$753.00	$665.18

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Table 3.50. Jacksonville Total Cost for Hinterland, 45 Feet, Outbound
FE SUEZ ECUS PEN

Port Cities	New Orleans	Mobile	Memphis	St. Louis	Jackson	Birmingham	Atlanta	Charlotte
Sea Cost Total	$11.64	$11.64	$11.64	$11.64	$11.64	$11.64	$11.64	$11.64
Port Cost Total	$192.76	$192.76	$192.76	$192.76	$192.76	$192.76	$192.76	$192.76
Land Cost Total	$337.82	$260.36	$439.82	$530.91	$436.55	$308.91	$228.18	$249.45
Total Cost	$542.22	$464.76	$644.22	$735.31	$640.94	$513.31	$432.58	$453.85

Table 3.50 (cont'd). Jacksonville Total Cost for Hinterland, 45 Feet, Outbound
FE SUEZ ECUS PEN

Port Cities	Nashville	Knoxville	Louisville	Cincinnati	Columbus	Indianapolis	Chicago	Detroit	Cleveland
Sea Cost Total	$11.64	$11.64	$11.64	$11.64	$11.64	$11.64	$11.64	$11.64	$11.64
Port Cost Total	$192.76	$192.76	$192.76	$192.76	$192.76	$192.76	$192.76	$192.76	$192.76
Land Cost Total	$364.00	$338.91	$458.91	$474.18	$507.45	$519.45	$640.00	$616.55	$529.27
Total Cost	$568.40	$543.31	$663.31	$678.58	$711.85	$723.85	$844.40	$820.94	$733.67

Note: Some cost inputs have been estimated.

Source: G.E.C., Inc.

Appendix D

GROWTH TRENDS IN SELECTED FOREIGN PORTS

Appendix D

GROWTH TRENDS IN SELECTED FOREIGN PORTS

Table 4.1 shows the growth in TEUs for selected foreign ports along the benefiting services. The unlighted cells represent actual numbers acquired through internet searches of individual port websites. Yellow highlighted cells represent estimated growth based on the percentage change of unlighted rows over the previous two years, in order for the final years of the analysis to be complete. Blue highlighted cells represent years not given in the data source, but nonetheless estimated based on later years' percentage growth on a year-by-year basis. Once the yearly percentage change was calculated, the average variation was found and multiplied by each incremental yearly TEU figure. For example, in the year 2002-2003 the port of Jeddah increased by 23 percent and 27 percent in the following year 2004. As a result, the average increase was taken and found to be 25 percent indicating a two percent variation from the average for years 2003 and 2004. In order to complete the backwards trend to year 1997, each subsequent year was multiplied by the percentage decrease of two percent (2001 was calculated 1,366,902 x 0.79 = 1,079,853 and 2000 was calculated 1,079,853 x 0.81 = 874,681). See Excel spreadsheet Trends in Foreign Ports 3 27 06 for formula validations. Red highlighted cells represent data given in metric tonnes multiplied by 1.1023 to convert into short tons then divided by 10 to convert into TEUs. As one can see this information is estimated but consistent in the trends of foreign port expansion and growth.

Table 4.1 Growth in Total TEUs for Selected Foreign Ports: Benefiting Services

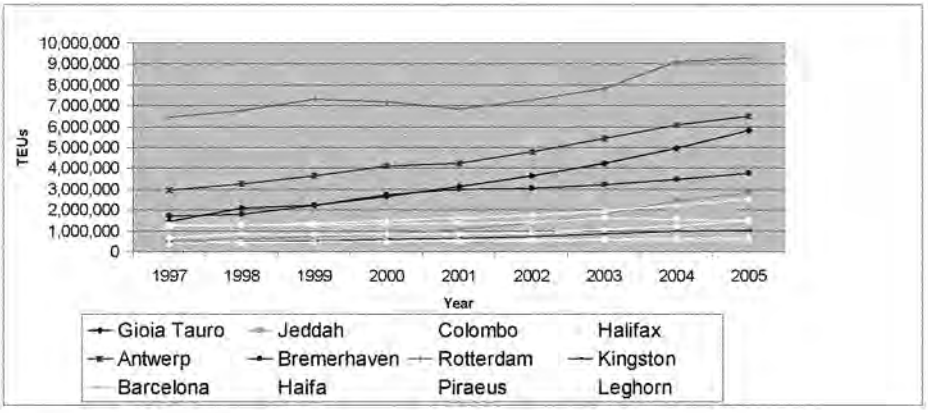
		TEUs									
		Year									
Service	Port	1997	1998	1999	2000	2001	2002	2003	2004	2005	AACGR
AEX	Gioia Tauro	1,448,531	2,093,650	2,202,951	2,652,701	3,303,660	3,631,282	4,248,600	4,970,862	5,815,909	18.98%
	Jeddah	536,866	617,087	725,985	874,681	1,079,853	1,366,902	1,777,165	2,425,930	2,835,461	23.12%
	Colombo	1,226,069	1,290,599	1,372,978	1,476,320	1,604,696	1,763,402	1,959,336	2,214,050	2,501,877	9.32%
PAX	Halifax	459,176	425,435	462,766	548,404	541,640	524,336	541,650	525,553	551,402	2.31%
	Antwerp	2,969,189	3,265,750	3,614,246	4,082,334	4,218,176	4,777,151	5,445,437	6,063,746	6,488,029	10.26%
	Bremerhaven	1,705,089	1,811,014	2,201,210	2,751,793	2,972,882	3,031,587	3,189,853	3,469,253	3,743,969	10.33%
	Rotterdam	6,456,392	6,772,421	7,305,289	7,186,114	6,857,629	7,256,000	7,814,425	9,085,267	9,286,756	4.65%
ZCS	Kingston	449,590	483,431	525,468	577,437	641,597	720,896	837,597	984,093	1,016,751	10.74%
	Barcelona	1,057,353	1,115,433	1,212,427	1,352,337	1,480,375	1,525,822	1,691,347	2,022,103	2,070,726	9.02%
	Haifa	669,000	834,000	800,000	871,000	839,000	906,000	1,069,000	1,260,351	1,485,954	10.49%
	Piraeus	1,262,946	1,269,292	1,282,114	1,308,279	1,348,741	1,404,939	1,605,135	1,541,563	1,479,900	2.00%
	Leghorn	427,428	449,924	478,643	519,169	531,814	546,882	592,778	638,586	683,287	6.04%

Note: AACGR – Average Annual Compound Growth Rate, calculated as ((2005/1997)^(1/8)-1)
AEX = FE SUEZ ECUS; PAX =FE ECUS EU; ZCS = FE ECUS MED

Source: Port websites.

Figure 4.1 shows the trends in TEUs for selected foreign ports during the years 1997-2005 along the three world services AEX, PAX, and ZCS. Port of Rotterdam is consistently above the other ports in terms of TEU volume, followed by Antwerp. However, Gioia Tauro is increasing at a

faster rate over the last nine years than Rotterdam or Antwerp[41]. Of the ports selected, Halifax has the lowest production numbers in terms of TEU volume.



Source: Port websites.

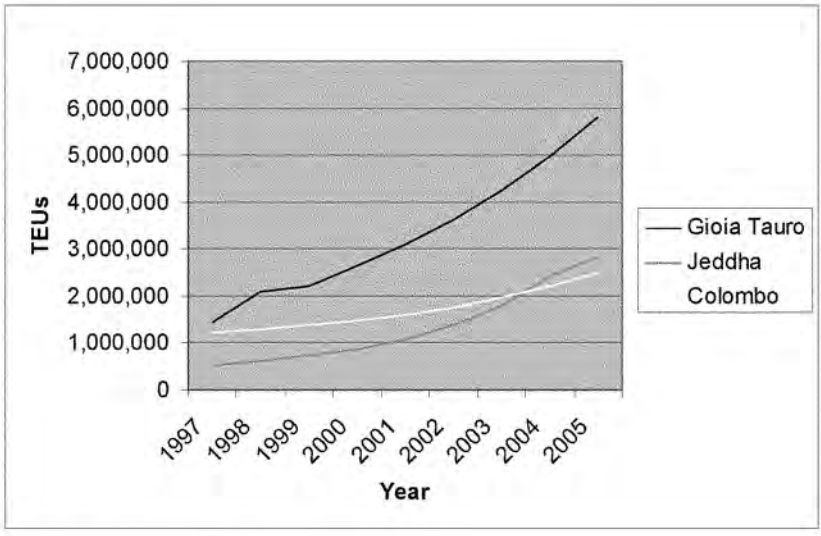
Figure 4.1. Trends in TEUs for Selected Foreign Ports, 1997-2005

Figures 4.2 and 4.3 shows selected ports along the AEX and PAX services, respectively. The AEX service is FE SUEZ ECUS for eastern sections of the international trade pendulum. Since 1997, the port of Gioia Tauro has grown at an average annual compounding growth rate of nearly 19 percent, while Jeddah has grown even faster at a rate of around 23 percent (Appendix Table 4.1).

The PAX service is FE ECUS EU for the European sections of the international trade pendulum. Since 1997, the ports of Antwerp and Bremerhaven have consistently had very similar growth in their average annual compounding growth rates, slightly over 10 percent (Appendix Table 4.1).

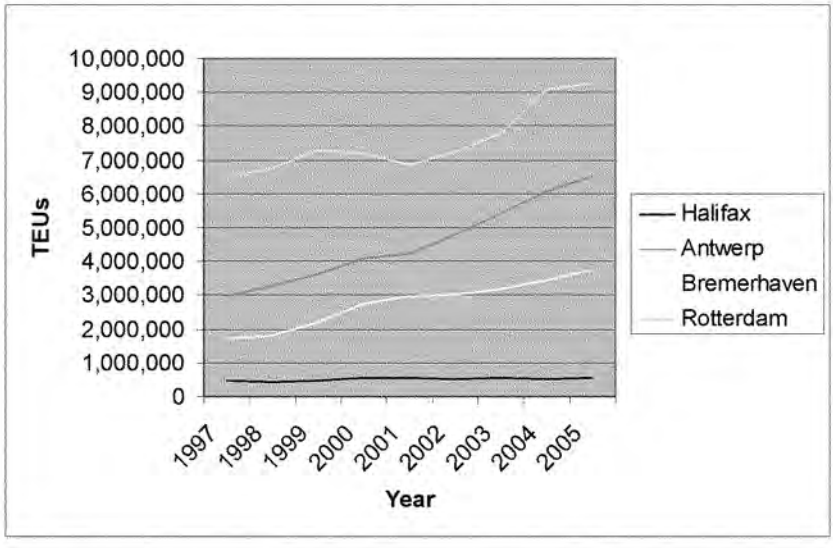
Figure 4.4 shows selected ports along the ZCS service. This service is for the FE ECUS MED for Eastern and Mediterranean sections of the international trade pendulum. Since 1997, the port of Kingston has had a higher AACGR than any of the other ports on this service, nearly 11 percent (Appendix Table 4.1).

[41] After year 2000, Gioia Tauro's TEU volume was estimated.



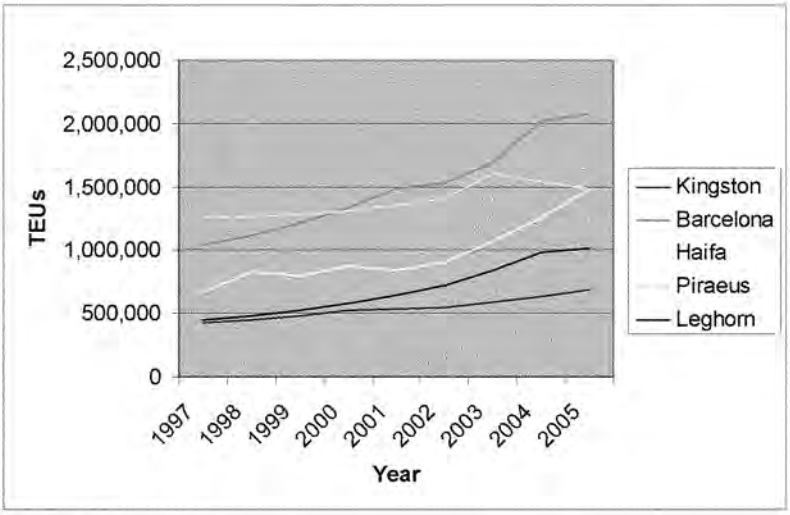
Source: Port websites.

Figure 4.2. Trends in TEUs for Selected Foreign Ports on AEX Service, 1997-2005



Source: Port websites.

Figure 4.3. Trends in TEUs for Selected Foreign Ports on PAX Service, 1997-2005



Source: Port websites.

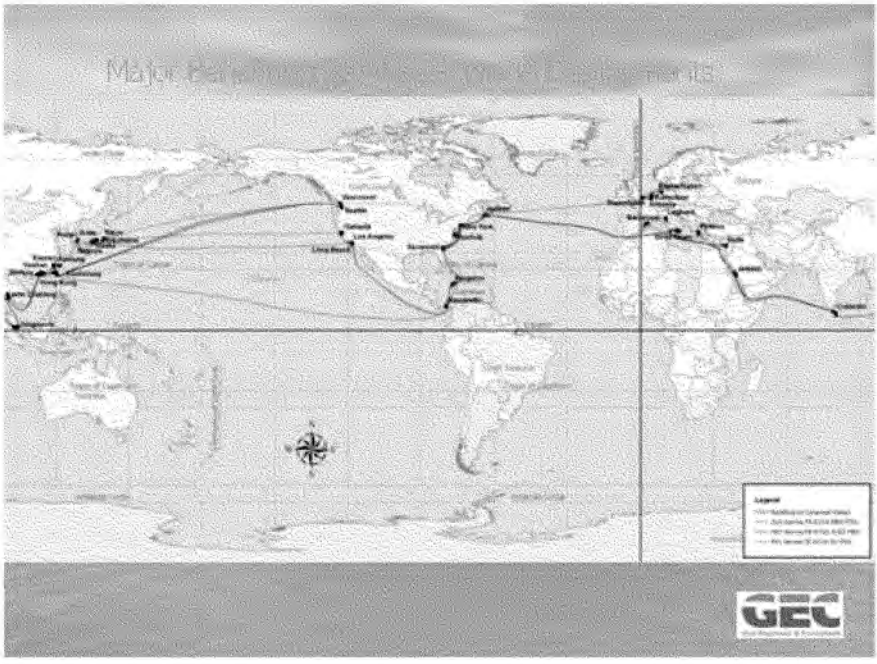
Figure 4.4. Trends in TEUs for Selected Foreign Ports on ZCS Service, 1997-2005

Table 4.2 shows the channel depth, terminal depth, or both of selected foreign ports on AEX, PAX, and ZCS services. Port of Rotterdam has the deepest terminal depths of all the ports. Port of Piraeus has a depth up to 52.48 feet as well.

Table 4.2. Examples of Port Depths for Benefiting Services

Port	Channel Depth		Terminal Depth	
AEX	**Meters**	**Feet**	**Meters**	**Feet**
Gioia Tauro	12.5 - 18	41 - 59		
Jeddah	16	52.48		
Colombo	16	52.48		
PAX				
Halifax			up to 15.2	50
Antwerp		42	Max draft is 15.5 m or 50.84 ft	
Bremerhaven			15	49
Rotterdam			16	52.48
ZCS				
Kingston	14	46		
Barcelona			up to 16.5	54
Haifa			up to 14	46
Piraeus			12 to 16	39 - 52.48
Leghorn				up to 38

Source: Port websites.



Source: G.E.C., Inc.

Figure 4.5. Shows the Major Benefiting Services (AEX, PAX, and ZCS)

Appendix E

COMMENTS AND RESPONSES

Appendix E

COMMENTS AND RESPONSES

There were no official comments towards the first Multiport Interim report task 1-4 submitted July 2005 and third Multiport Interim report task 8-9 submitted March 30, 2006. The comments below are focused on the second Multiport Interim report tasks 1-7, which where indicated by emails in mid June 2006 to be the only comments for Multiport Analysis.

MEMORANDUM

TO: Ken Claseman, U.S. Army Corps of Engineers, Mobile District
Kevin Knight, U.S. Army Corps of Engineers, San Francisco District

FROM: Kevin Horn, G.E.C., Inc.

DATE: March 22, 2006

SUBJECT: Responses to Peer Review of the Savannah Harbor Expansion Project – Economic Analysis: Benefits Calculation Methodology and Model, Multiport Analysis and Regional Analysis, Phase III, comments (February 22, 2006) on October 24, 2005 Interim Report.

Introduction:

Comment 1. It might be useful to provide additional information on deepening projects at competing harbors. What depths will they ultimately be along with estimated completion dates? What were the results of the Charleston Deepening Study/Norfolk Deepening, etc. Is there any information in those studies that may contradict the assumptions used for Savannah Harbor?

I recall seeing memos accusing the Corps of working in a vacuum, i.e., each District examining their projects on their own merits, without incorporating projects of competing districts.

Response 1. This is a good suggestion. We sometimes take the port competitive environment for granted, i.e., "Everyone knows that Charleston has 45 foot channel depth, etc.", when this should not be assumed. We will write a small addendum that indicates a brief description of the competing ports that are contained in the multiport analysis, consisting of Norfolk (Hampton Roads), Wilmington, Charleston, and Jacksonville.

Comment 2. Table 1
For the Norfolk (42-50) PAX route, Norfolk is cited twice (should be New York?)

Response 2. Table 1 should be corrected to reflect "New York" for the PAX service shifted to Norfolk instead of Savannah. The distance, 200 nautical miles, is correct but the entry of "Norfolk" will be replaced with "New York".

Comment 3. Port Costs

Container charges and tuggage are the same across the five South Atlantic ports. Are these costs universal?

Response 3. At the time that the multiport analysis was undertaken it was envisioned that a separate Regional Port Analysis (RPA) task would be conducted during the course of the Multiport task. The RPA was envisioned as dealing with the other ports from a capacity perspective. It was intended that port cargo handling related costs (other than tariff items) and tuggage would be likely identified in contact with the other ports. This has not proved to be possible.

The average total port costs per TEU for cargo throughput at Savannah have been used as a proxy for all the ports. In practice the major East Coast port throughput costs are normally quite similar, such as Charleston and Savannah (other than New York/New Jersey), notwithstanding some differences in particular port cost elements and related cargo handling productivity issues. Port tariffs, although insightful, are often not of particular value with regard to what the actual negotiated port costs are for the lines. Moreover, there are usually substantial cargo volume incentives that provide for layers of "port cost" related to cargo throughput by different lines. In practice steamship lines play port costs off against each other, particularly when there are multiple calls and overlapping hinterlands as in the case of marine containers.

Consequently, the average total port cargo handling costs have been used for cargo handling across the multiport range (Norfolk to Jacksonville). Sensitivity analysis should be conducted to allow "port costs" to be lower or higher at Savannah to determine the competitive impact.

Tuggage costs are another negotiated non-tariff item that steamship lines handle with local firms at each port. It is not unusual to see one major tug operator providing services. While tuggage costs will differ among the ports, particularly depending on the time involved (distance from between berth and where tugs are applied for transit) not enough information exists in the public domain to determine the tug practices at the different ports. Moreover, changes in tug costs will have relatively little impact on cargo throughput costs which are primarily driven by land side transportation costs.

Comment 4. Truck Costs

Table 7—Average Distance in Miles Traveled from Each Southeastern Port shows Savannah Harbor as being the most centrally located, because its average distance to these 17 hinterland cities is 619 miles. Charleston's average is 630 miles, yet its standard deviation is smaller, so it's practically identical.

How representative are the trucking costs, especially given the recent spike in fuel prices? Also, can the truck costs be refined for hinterland cities having congestion problems? (We've experienced this on the West Coast, particularly Los Angeles, where 1 hour at port is probably too low.)

Response 4. Truck movements of marine containers dominate the East Coast ports, unlike the West Coast ports, because of the shorter distances typically involved. The east coast ports are typically served by a network of east-west Interstates that cross similar north-south Interstates. Consequently, port hinterland distances are often quite similar except at the outside of the range, for example between Jacksonville and New Orleans or New York and Detroit, etc.

The truck cost user defined inputs (refer to the worksheet "Land Costs") are specified for $40 per hour idle and $60 per hour underway. The underway costs, primarily fuel, would be $20 per hour which at 55 miles per hour would be $0.36 per mile. With average underway fuel consumption of about 5.5 miles per gallon the fuel factor price would be about $2.00 per gallon ($0.36 * 5.5 = $2.00) which is close to the market price. Truck costs could be specified higher, perhaps $65.00 per hour underway, but the comparative changes among the ports would not be pronounced given less than ten percent change in truck costs.

More important than the truck costs are determinants of truck productivity with respect to loading and unloading time as well as opportunities for backhauls. The "Truck Costs" worksheet nominally assigns the same user input for pickup and delivery time, one hour. But this is a variable that the user can change to reflect particular situations. Unless particular ports are congested (for example New York/New Jersey marine container terminals) the port times for pick up or delivery would be the major variables rather than hinterland cities for particular ports. Truck turn times for Savannah are reportedly less than one hour and should be similar for the port range included in the multiport analysis.

Comment 5. Railroad/Truck Destinations

For the extreme hinterland cities like Memphis, St. Louis, and New Orleans, how much traffic would be barged via the Mississippi River (and avoid the South Atlantic ports altogether)?

Response 5. Container On Barge (COB) using the Lower Mississippi River and the Port of New Orleans has not been successful for a variety of reasons, particularly transit times and the relatively weak market position of the Gulf ports for non-local marine container traffic in general and New Orleans in particular. There has been a resurrection of COB service primarily from Baton Rouge to New Orleans that reflects overweight export containers (paper products, etc.). This COB service has purportedly been extended to Memphis for similar cargoes. For the most part this service via New Orleans would be designed to handle special circumstances such as over weight boxes (for highway movements), empty containers, and very low value non-time sensitive merchandise, particularly exports of raw materials like scrap and waste products.

Unlike West Coast ports which rely heavily on rail intermodal for very long distance (Midwest) marine container movements, most east coast ports utilize truck for marine container movements. The multiport model has been set to a default for "truck". There is some rail (about 15 percent of the TEU volume at Savannah may be moved by rail) at the various ports, Jacksonville, Charleston, and Norfolk (Wilmington has no dedicated rail intermodal train service other than rail intermodal with conventional mixed general freight train service) but truck predominates. Rail movements as previously indicated for the east coast reflect containers that are not

particularly susceptible to truck movement such as overweight containers (for highway movement), 20 foot boxes, empty boxes and non-time sensitive merchandise.

Comment 6. Tables 9 and 10, suggest labeling them Norfolk Southern and CSX, respectively. Also, might want to distinguish between no rail linkage (hence the zero) and the lowest cost.

Response 6. We will do this.

Comment 7. Summary, 2nd Paragraph states "The spreadsheet does perform any optimization analysis…(should be "not perform").

Response 7. This will be corrected as noted above.

GENERAL RE-EVALUATION REPORT
APPENDIX A: ECONOMICS

SAVANNAH HARBOR EXPANSION PROJECT

Chatham County, Georgia and Jasper County, South Carolina

January 2012

ATTACHMENT 5

GEC Savannah Harbor Expansion Project
Deep Draft Channel Improvements
Economics Analysis: Commodity
Projections Parts 1-4

US Army Corps
of Engineers
Savannah District
South Atlantic Division

Final Report

SAVANNAH HARBOR EXPANSION PROJECT DEEP-DRAFT CHANNEL IMPROVEMENTS ECONOMIC ANALYSIS: COMMODITY PROJECTIONS

Part 1: World Waterborne Trade Forecast
Part 2: U.S. Waterborne Trade Forecast

US Army Corps of Engineers
Savannah District
Savannah, Georgia

Final

SAVANNAH HARBOR EXPANSION PROJECT
DEEP-DRAFT CHANNEL IMPROVEMENTS
ECONOMIC ANALYSIS: COMMODITY PROJECTIONS

Part 1: World Waterborne Trade Forecast
Part 2: U.S. Waterborne Trade Forecast

Contract No. DACW60-03-D-0001
Delivery Order No. 0004
GEC Project No. 22315504

Prepared by

9357 Interline Avenue
Baton Rouge, Louisiana 70809
Phone – 225/612-3000

357 E. Alameda
Santa Fe, New Mexico 87501

U.S. ARMY CORPS OF ENGINEERS
SAVANNAH DISTRICT
SAVANNAH, GEORGIA

August 2004

TABLE OF CONTENTS

Section **Page**

Part 1: WORLD WATERBORNE TRADE FORECAST

I INTRODUCTION 1-1
II OBJECTIVES 1-2
III OVERVIEW 1-3
IV METHODOLOGY 1-6

Introduction 1-6
Stage of Development Approach 1-7
Model Size and Complexity 1-8
Market Demand Forecasting 1-8
Predicting Trade Flows 1-10
Statistical and Econometric Approach 1-10
General Equation Application 1-13
Translation to Maritime Trade 1-14
Long-Term Perspective 1-16
Long-Term Trade Model 1-20
Translation to Trade Volume and Mode 1-22
Maritime Trade Forecasting 1-23

V WORLD TRADE FORECAST 1-29
VI SUMMARY AND CONCLUSIONS 1-40

Part 2: U.S. WATERBORNE TRADE FORECAST

I INTRODUCTION 2-1
II OBJECTIVES 2-2
III OVERVIEW 2-3
IV METHODOLOGY 2-6

Forecasting Regional U.S. Trade 2-6
Translation to Maritime Trade 2-8
Summary 2-9

V U.S. AND WORLD TRADE FORECAST 2-11
VI U.S. TRADE FORECAST 2-18
VII SUMMARY AND CONCLUSIONS 2-30

Appendix A: WORLD COMMODITY FORECAST, 1995-2050
Appendix B: U.S. COMMODITY FORECAST, 1995-2050

LIST OF TABLES

Number **Page**

Part 1: WORLD WATERBORNE TRADE FORECAST

1-1 Factors Driving Market Demand Used in QuERI-International Trade Models 1-11

1-2 Commodity Groupings 1-15

1-3 Regional Market Demand Shares 1-20

1-4 Trade Flows by Order of Size 1-21

1-5 China's Primary Exports 1-23

1-6 World Commodity Forecast for all Commodities, Sorted by Origin, by Major Region, 1995-2050, Selected Years (Metric Tonnes) 1-30

1-7 World Commodity Forecast for all Commodities, Sorted by Destination, by Major Region, 1995-2050, Selected Years (Metric Tonnes) 1-31

1-8 Containerized World Commodity Forecast for all Commodities, Sorted by Origin, by Major Region, 1995-2050, Selected Years (Metric Tonnes) 1-32

1-9 Containerized World Commodity Forecast for all Commodities, Sorted by Destination, by Major Region, 1995-2050, Selected Years (Metric Tonnes) 1-33

1-10 Containerized World Commodity Forecast for all Commodities, Sorted by Origin, by Major Region, 1995-2050, Selected Years (TEUs) 1-34

1-11 Containerized World Commodity Forecast for all Commodities, Sorted by Destination, by Major Region, 1995-2050, Selected Years (TEUs) 1-35

1-12 Growth Rate of World Commodity Forecast, by Major Commodity, 1995-2050 1-37

1-13 Growth Rate in Metric Tonnes of World Containerized Commodity Forecast, by Major Commodity, 1995-2050 1-37

1-14 Growth Rate in TEUs of World Containerized Commodity Forecast, by Major Commodity, 1995-2050 1-38

LIST OF TABLES

Number **Page**

Part 2: U.S. WATERBORNE TRADE FORECAST

2-1 Counties Within Each Aggregated Region 2-7

2-2 U.S. Imports of Miscellaneous Transport Equipment From Taiwan 2-8

2-3 Relationship of U.S. Regions to U.S. Maritime Regions 2-9

2-4 World and U.S. Waterborne Trade Trends, Metric Tonnes, Containerized Tonnes and TEUs, 1995-2050 2-12

2-5a U.S. and World Trade Shares of TEUs by Major Commodity Groups, 1995-2000 2-13

2-5b U.S. and World Trade Shares of TEUs by Major Commodity Groups, 2000-2005 2-14

2-5c U.S. and World Trade Shares of TEUs by Major Commodity Groups, 2005-2020 2-15

2-5d U.S. and World Trade Shares of TEUs by Major Commodity Groups, 2020-2050 2-16

2-6 U.S. and World TEUs Growth Summary Trends, 1995-2050 2-17

2-7 U.S. Commodity Forecast for all Commodities, Sorted by Origin, by Major Region, 1995-2050, Selected Years (Metric Tonnes) 2-19

2-8 U.S. Commodity Forecast for all Commodities, Sorted by Destination, By Major Region, 1995-2050, Selected Years (Metric Tonnes) 2-20

2-9 Containerized U.S. Commodity Forecast for all Commodities, Sorted by Origin, By Major Region, 1995-2050, Selected Years (Metric Tonnes) 2-21

2-10 Containerized U.S. Commodity Forecast for all Commodities, Sorted by Destination, by Major Region, 1995-2050, Selected Year (Metric Tonnes) 2-22

2-11 Containerized U.S. Commodity Forecast for all Commodities, Sorted by Origin, by Major Region, 1995-2050, Selected Years (TEUs) 2-23

2-12 Containerized U.S. Commodity Forecast for all Commodities, Sorted by Destination, by Major Region, 1995-2050, Selected Years (TEUs) 2-24

LIST OF TABLES (cont'd)

Number		Page
2-13	Growth Rate of Outbound U.S. Commodity Forecast, by Major Commodity, 1995-2050	2-26
2-14	Growth Rate of Inbound U.S. Commodity Forecast, by Major Commodity, 1995-2050	2-26
2-15	Growth Rate in Metric Tonnes of Outbound U.S. Containerized Commodity Forecast, by Major Commodity, 1995-2050	2-27
2-16	Growth Rate in Metric Tonnes of Inbound U.S. Containerized Commodity Forecast, by Major Commodity, 1995-2050	2-27
2-17	Growth Rate in TEUs of Outbound U.S. Containerized Commodity Forecast, by Major Commodity, 1995-2050	2-29
2-18	Growth Rate in TEUs of Inbound U.S. Containerized Commodity Forecast, by Major Commodity, 1995-2050	2-29

LIST OF FIGURES

Number **Page**

Part 1: WORLD WATERBORNE TRADE FORECAST

1-1 Structure of Core Model 1-12

1-2 Derivation of Market Demand Drivers for Detailed Commodities Used in International Trade Model 1-12

1-3 International Trade Model Approach 1-13

1-4 Long-Term Structural Model 1-17

1-5 Gross Domestic Product Growth Rates 1-18

1-6 Annual Growth Rates for Total Ocean Exports in Metric Tonnes 1-25

1-6a Total Ocean Exports in Millions of Metric Tonnes 1-25

1-7 Annual Growth Rates for Total Ocean Imports in Metric Tonnes 1-26

1-7a Total Ocean Imports in Millions of Metric Tonnes 1-26

1-8 Annual Growth Rates for Total Ocean Exports in TEUs 1-27

1-8a Total Ocean Exports in Million TEUs 1-27

1-9 Annual Growth Rates for Total Ocean Imports in TEUs 1-28

1-9a Total Ocean Imports in Million TEUs 1-28

Part 2: U.S. WATERBORNE TRADE FORECAST

2-1 U.S. and World Trade in Containerized Products, 1995-2050 2-3

2-2 U.S. and China Share of World Containerized Trade 2-4

2-2a U.S. and China Share of World Containerized Trade in Total TEUs 2-5

Part I: WORLD WATERBORNE TRADE FORECAST

I. INTRODUCTION

Commodity projections constitute one of the major inputs to harbor improvement studies, typically having a direct effect on National Economic Development (NED) benefits based on the growth and timing of future benefiting cargo volumes. The nature of commodity forecasts is long term, spanning upwards of 50 years. Although most NED benefits will accrue within the first two decades of the inception of a project, from the standpoint of discount rates and net present value this is still a substantial period of time for forecasting. Traditionally, most forecasts range in duration from three to five years upwards to a decade. The long-term forecasts necessitated by the large span of useful life of a deep-draft harbor improvement and the uncertainty of world trade require that commodity projections be carefully documented with respect to assumptions, data inputs, and interpretation of outputs.

II. OBJECTIVES

Savannah Harbor was last deepened subsequent to the Corps of Engineers 1992 Feasibility Study. In 1998, the Georgia Ports Authority (GPA) published a Feasibility Study, and deepening to no more than 48 feet was authorized by Congress, subject to the requirements in the October 1999 Chief's Report. The 1998 Feasibility Study had a commodity forecast for the period 2000 to 2050 with a base year of 1996.[1] The 1996 commodity projections are outdated and no longer appropriate for use. For example, the 1996 forecast shows Savannah Harbor container trade exceeding one million loaded TEUs by 2010.[2] In fact, this volume had already been achieved by 2003.

The Project Guidance Memorandum (dated 31 October 2002) from the HQUSACE specifies that the trade forecast needs to be revised. In order to revise the trade forecast for Savannah Harbor, a world trade forecast is needed that will enable U.S. trade to be identified as a separate component. Subsequent disaggregation will then be applied to develop a Savannah Harbor commodity forecast in later tasks. The objective of part 1 is to develop a world trade waterborne forecast.

[1] Savannah Harbor Expansion, March 30, 1998 *Economic Appendix*, Historical and Projected Commodities, page 7.
[2] Ibid. page 15, Exhibit 3-11.

III. OVERVIEW

The world economy has two primary engines of growth:

- The United States economy, which was the mainstay of economic expansion throughout the period 1995 – 2003;
- The surging Chinese economy, helped by increased export volumes and a growing base of middle-class consumers in the urban areas.

Tax cuts have helped the U.S. economy make a partial recovery from the recession of 2001 and the growth recession of 2002. However, employment growth has lagged, and unemployment remains a problem. More than three million jobs have been lost since the collapse of the NASDAQ and the technology bubble in late 2000. Most of the losses have been in manufacturing jobs, with trade substituting for domestic production. A new development, the shift of back-office and technology jobs to places like India, Eastern Europe, and China, has also added to the problems faced by the economy. At the same time, corporate profits have never been higher, and the stock market has recovered.

The lack of new job opportunities may be ending as the economy continues to expand, with more than 300,000 jobs created in March. The U.S. economy continues to demand more from the world than the world demands from the U.S. The size of the trade deficit is likely to continue to grow despite the weakness of the U.S. dollar against mainly the euro and the Japanese currency. The strong growth out of China, although helpful to U.S. exports in general, will not solve the problem of the growing trade deficit with that country. The difference between U.S. imports from China and U.S. exports is over 6 to 1 in 1995 U.S. dollars.

Moreover, the products exported by U.S. manufacturers are not in great demand in China. Chinese imports are mainly intermediate inputs used in assembly of exports (most of which go to the U.S. alone) and raw materials, including iron ore, oil, and luxury consumer goods. One risk to the world economy, as well as the U.S., is that this increasingly large deficit in the U.S. current account may be unsustainable. Given the dependency of China on U.S. exports, and Asia on China, the potential for a sudden collapse of confidence cannot be discounted, at least in the short-term.

China's market has grown strongly over the past several years. Real economic growth has averaged over 7 percent for the past several years, with 2003 growth estimated to be 9 percent. However, China needs at least 7 percent growth to allow the gradual integration of workers freed up by progress in agriculture and attracted to higher-paid employment in the urban areas. To meet this need, China has encouraged foreign investment in both domestic production and export.

Average wages for unskilled factory workers in China are estimated to be in the range of between fifty cents and one dollar per hour. The size of the market and the low wages have proven attractive for foreign firms. Partnerships with increasingly sophisticated manufacturers

have led to the migration of employment from higher-cost centers in Western Europe and North America to low- cost manufacturing sites in China. When used in the export of finished products, export-free zones that allow the free entry of intermediates make China more like a factory location than a true market. Where companies have set up facilities to meet the Chinese domestic market demand, they have faced many problems, including special rules for foreign owners, unfair partnerships, forced transfers of technology, and other impediments to free trade.

The most significant problem, however, may be that the Chinese market is highly competitive. Because credit to Chinese companies is readily available, competition for business is fierce, with many companies selling below cost and financing the difference through low-cost loans from government-run banks. As a result, foreign firms, without access to this same source of credit and interested in making a profit, have concentrated on the upper end of the market. For example, GM's Buick automobile sells at about $30,000 compared to the lowest-cost Chinese automobile, which sells for $ 6,000.

The Chinese domestic market may also be less dynamic than currently believed, given the low wages and the likelihood that wages will remain low as surplus rural labor is added to the employment. This limits the potential for the Chinese market to become a major importer of finished consumer products, at least at present. China, like Japan before it, is likely to be a major importer of raw materials, oil, luxury products (differentiated), capital equipment, technology products, and specialized industrial materials.

Asia, including Japan, has become dependent on continued Chinese import demand as a main engine of economic growth. Japanese success has been mainly through exports to China of such things as iron and steel, electronics, and automobile parts. Japan's improved export performance has occurred despite a stronger yen/dollar rate (close to 105). The domestic sector has benefited from this boom as business and consumer confidence has risen.

European growth and development can be divided between countries that have adopted the euro and those that have not. The United Kingdom, outside the monetary union, has done well and continues to grow strongly. However, most of the major countries on the Continent have been constrained by a stronger currency (the euro appreciated almost 40 percent from its low against the U.S. dollar) and constraints on fiscal and monetary policy.

In Latin America, conditions are better than in the period 1999–2001 when Argentina and Brazil were both in recession. Conditions in Argentina should be better beginning in 2003 and continuing through 2004, and Brazil is expected to recover fully and begin to grow at around 3 – 4 percent after 2003. Mexico has started to recover. Tied very closely to the U.S. market, Mexico has benefited from the NAFTA-related investment boom. The rise of China as a major manufacturing location and the lower wages paid to Chinese workers has, however, led to an exodus of American companies from Mexico. Although much of the production leaving Mexico has shifted to China, higher shipping costs into and out of China and other bottlenecks will probably begin to cause a reverse migration; and Mexico is making a concerted effort to improve its skill level to attract higher-value investments. The economic forecast for Mexico is for trade to recover as the U.S. economy recovers and for economic growth that has been close to 1 percent for the last two years to increase to over 3 percent.

The Middle East and Africa should benefit from the surge in prices of raw materials, including oil, copper, bauxite, phosphorous, and gold. How much of the benefit of this boom will pass into the domestic economies of these nations remains to be seen; but the higher revenues will probably stimulate additional imports.

IV. METHODOLOGY

INTRODUCTION

Measuring global trade flows is complex, and the results must reflect the volatility that characterizes trade patterns in general. Although the final result, when aggregated across all products and routes, may appear to be close to a simple time trend, the underlying detail reflects the shifting development paths taken by nations.

In 1985, the DRI/McGraw-Hill World Sea Trade Service was launched. It included a model based on a pooled-cross-sectional-time-series methodology. The data used was a collection of data developed by the OECD and missing the majority of the intra-regional flows between developing countries. Later additions of data added intra-Asian trade to the model. The econometric specification was steadily changed to include more information on consumption and production by industry group, but the model was primitive and difficult to work with. It included estimates of German exports to the U.S. and U.S. imports from Germany that were sometimes different because of the use of German export data and U.S. import data.

The DRI World Trade model relied on data drawn from the DRI world macroeconomic databases and was thus limited to a smaller subset of world trade and output. It was used to drive the World Sea Trade model and, thus, ultimately to the project carried out by DRI for the Port of Savannah.

In 1996, the methodology used for forecasting world trade and the underlying databases was rebuilt. Data was collected from Statistics Canada that had only one direction of any bilateral flow. It was based on Statistics Canada's interpretation of UN trade data and in theory encompassed the entire world. Macroeconomic data was drawn from the World Bank databases and also included all available GDP data. A new industrial and consumption data set was constructed from UN and UNIDO data and a new cross-sectional model was developed.

This new model was used to develop a version of the World Sea Trade Service. A version of the global maritime trade forecast was prepared for Booze-Allen and was used in their work for Savannah. The model was more advanced than the one used to create the original World Sea Trade Service forecast, but it had a very rudimentary extension of trade beyond the base period (2010). How Booze Allen then used this to forecast specific flow into and out of the Port of Savannah was beyond what was delivered to them. Only total U.S. inbound and outbound trade by ocean freight was provided as part of that contract.

The ICF model was transferred to the Columbus Group in 1997 and was used in various projects for the U.S. Army Corps of Engineers, the Panama Canal, and some international port work as well. The model and databases were they sold to the WEFA Group by the Columbus Group. When WEFA merged with DRI, becoming Global Insight, they used as their base this ICF version of the world. The basic underlying data was from Statistics Canada.

The QuERI model is a derivative model based on a new framework and new data developed at Merge Global. The new data was collected from original sources, including a full set of UN trade data, Eurostat data, and US DOC data, as well as country specific data from eight more countries. The industrial data was based on later versions of UNIDO and UN SNA data than that used at ICF.

The new trade is a more advanced version of all of the earlier models. The demand pull-price relationship was improved significantly. Demand is fully based on indirect demand coming from personal consumption, business investment, government, and intra-industry demand. Three different models are developed for each product, one for advanced countries, one for emerging markets, and one for developing economies. A new long-term model framework has been developed that allows for slowing growth in some products and steady growth in others.

The new model also allows for individual port ranges within the U.S. trade flows. Thus, it is port specific and allows for a dynamic shift in port shares over time.

Comparing forecasts across all of these models is difficult. Trade forecasts depend on baseline macroeconomic forecasts. These views change over time as economic conditions change. For example, in the original Savannah baseline developed by DRI, the importance of China was clearly underestimated. By the time the ICF baseline was developed, China had taken on greater importance.

STAGE OF DEVELOPMENT APPROACH

The models that are used in the present analysis are all based on a stage of economic development approach. Countries move through cycles. Some of these are short-term and related to disturbances and mistakes in policy; others are long-term. A poor nation, for example, may begin as a raw materials producer and then develop a small manufacturing sector. Still relatively poor, it can attract investment that may be used to develop local industry and export related manufacturing that uses the raw materials. Moving up, a larger industrial-service sector is created that produces more self-sustaining growth, which is fueled by higher wages and more people employed in the money economy. This, in turn, leads to a stronger economy, more industrial development, and imports. This process of successive levels of development and wealth creation may be continuous. If it follows this route, the poor nation will move along the road already traveled by its wealthier neighbors.[3]

This development pattern leads to a distribution of nations that can be characterized as poor, middle income, and wealthy. To develop a picture of industrial development and the trade of poor, middle income, and wealthy states, models are used that relate development along this continuum. A non-linear model allows the shape of the future to be observed by extrapolating past trends for the entire group of countries included in the model. This is done by using a log-linear model based on a cross-country sample of countries over a defined time period (1990 - 2003).

[3] The international trade life cycle approach was also used in the Savannah Harbor Expansion 1998 study. Refer to Section B, Commodity Forecast Methodologies, pages 4 and 5.

A pooled cross-sectional-time-series model is used for this analysis. An advantage of this model is that it allows for use of less than complete data and, more importantly, can handle the extreme volatility of trade. Unlike a time series that must depend upon a single country's experience, the pooled model depends on a larger sample of country experiences. The result is that the developed coefficients are usually robust and stable.

The pooled-cross-sectional model is also highly efficient. It enables a massive amount of information to be processed, and the resulting model can then be used to forecast future growth. Fitting individual time series models is significantly more time consuming and would likely yield results biased by past patterns of trade or industry development. Stated simply, a time series based model assumes that conditions do not change, whereas a pooled-cross-sectional-time-series model allows countries to move up the ladder and change the mix of products they sell and buy following along the path described statistically and based on the factors derived from the full sample of countries (rich and poor alike).

MODEL SIZE AND COMPLEXITY

The model used in this analysis is capable of managing a system that has potentially well over 250,000 individual forecasts. The pooling of data across time and across countries insures that statistical issues related to volatility can be dealt with. The model is supported by a structured methodology, which insures that when statistical relationships are judged to be too weak, an alternate, less statistically rigorous method of forecasting is applied. These judgments are made by the computer in real time.

Although this may appear mechanical, it is important to remember that transportation is a byproduct of economic growth, and trade is a residual flow related to what can be produced in any country at that point in time compared to what is available from outside the country. There is no "expert opinion" capable of this type of integration.

The qualities of an effective model may thus be summarized as follows:

1. The model must be inclusive of all products and all routes, with no single flow dominating. To develop a realistic forecast, everything that could possibly move internationally has to be modeled.

2. Exports must be related directly to imports. The matrix of in and out should cover nearly 100 percent of total world commercial activity.

3. Forecasts should be statistically based. No researcher can be knowledgeable about all the factors that might influence trade flows.

MARKET DEMAND FORECASTING

International trade is the critical factor in determining the viability of port improvement projects. Global models and databases designed to project trends in growth, industrial development, and

international trade flows are used by different vendors for a wide range of products, from chemicals to computers. Forecasts based on these models have guided government policies.

Prior to the estimation of trade forecasts, a baseline projection of global private consumption, government consumption, business investment, and demand for intermediate inputs is developed. Many models rely mainly on macroeconomic aggregates. However, the models used in this analysis combine macroeconomic factors and forecasts (developed from short-term forecasts managed by Oxford Economic Forecasting using March 2004 as a baseline) with medium- and long-term forecasts (developed using QuERI models).

Industrial and employment models for specific sectors (64 individual industrial and service categories) are linked through adjusted input-output matrices. Personal consumption, government consumption, and business investment are also integrated. Prior-period trade forecasts by commodity are also included. This insures that the system is fully connected and reflects the general trends within a country over time and across a group of countries as they develop.

Like trade models, these forecasts are based on a pooled-cross-sectional-time-series methodology. The methodology insures that changing patterns of industrial development can be identified. It is based on an assumption of ignorance about the future development plans of industry. Growth is a function of past growth and the natural evolution of a nation from mainly a primary producer to an industrial state as defined by data collected from countries ranging from rich to poor.

The model used in this analysis covers 100 percent of world trade. It is route-specific and relates bilateral flows between 85 countries and regions for 80 commodity groups, accounting for 100 percent of all traded products. International exchange is measured in terms of the following metrics:

- Nominal U.S. dollars
- Real 1995 U.S. dollars
- Metric Tonnes
- Air Metric Tonnes
- Ocean Metric Tonnes
- Ocean Containerized Metric Tonnes
- Ocean Containers measured in Twenty-Foot Equivalent Units (TEUs)

The starting point for the global forecast is trade measured in nominal U.S. dollars. The data are collected from a number of different sources:

- United States Department of Commerce (through 2003)
- Eurostat (15 European countries through mid-year 2003)
- United Nations Trade Data (covering 200 countries through 2001/2002)
- National sources (Switzerland, Taiwan, Japan, etc.).

Steps in the process of modeling trade include:

- Developing a consistent bilateral database for historic trade using a hierarchy of datasets (U.S. bilateral trade, Eurostat, Other National Sources, United Nations data) in order to develop a full 85 x 85 bilateral trade data set.

- Deflating nominal U.S. dollar trade into constant 1995 U.S. dollar trade, which allows the data to be used for measuring real volume growth independent of price and exchange rate movements.

- Relating real volume flows to economic activity variables drawn from a detailed model of the global economy. This model relates trade to the following major economic drivers:
    - Market demand for the commodity in the importing country
    - Import prices (commodity price trends and exchange rate movements)
    - Domestic production capacity and growth trends
    - Exporter share of worldwide production.

PREDICTING TRADE FLOWS

Models of international trade depend on sets of economic assumptions. The models used in this analysis rely on a large-scale integrated system of databases and models to relate trade to market demand. Market demand is the overall demand for domestically produced and foreign-produced products for a single traded commodity. Market demand is dependent on the industrial and service mix in the importing economy (measured by intermediate demand) and on final demand (measured through personal consumption, government consumption, and business investment).

The starting point for forecasting in this analysis is the Oxford Economic Forecast global macroeconomic model. This short-term model, updated monthly, provides a high-level view of the economic environment that is driving trade. It is used in the present analysis in conjunction with more industry-specific and consumption-demand-specific models developed by QuERi to refine the underlying model for market demand. The Oxford baseline is a reasonable starting point describing the short-term to medium-term economic environment; however, it extends only to 2013.

International trade flows are related to individual product groups derived from these basic source data. The trade model aggregates, at a detailed commodity group level, market demand derived from personal consumption, government consumption, business investment, and intermediate demand. Table 1-1 shows the general approach for the key variables. Using input-output model distributions, a more detailed estimate of demand is derived and used in the model. Figures 1-1 through 1-3 provide an overview of the general approach.

STATISTICAL AND ECONOMETRIC APPROACH

Each commodity route model is based on a pooled-cross-sectional-time-series model framework. Models are based on importer demand from specific export sources (countries and export regions). Pooled-cross-sectional-time-series models are better able to pick up long-term trends because they reflect both short-term patterns (as measured by cyclical movements for individual

Table 1-1: Factors Driving Market Demand Used in QuERI-International Trade Models

Macroeconomic Concept	QuERI-International Detailed Subgroup	I/O Conversion Methodology	Trade Model Input Variable for Commodity (80)
Personal Consumption	Food	Distribution	Final Demand
Personal Consumption	Non-alcoholic Beverage	Distribution	Final Demand
Personal Consumption	Alcoholic Beverages	Distribution	Final Demand
Personal Consumption	Tobacco	Distribution	Final Demand
Personal Consumption	Clothing and Footwear	Distribution	Final Demand
Personal Consumption	Fuel and Power	Distribution	Final Demand
Personal Consumption	Housing Expenses	Distribution	Final Demand
Personal Consumption	Furniture and Household Equipment	Distribution	Final Demand
Personal Consumption	Medical Care and Health Expenses	Distribution	Final Demand
Personal Consumption	Personal Transport Equipment	Distribution	Final Demand
Personal Consumption	Other Transport and Communications	Distribution	Final Demand
Personal Consumption	Education	Distribution	Final Demand
Personal Consumption	Entertainment and Culture	Distribution	Final Demand
Personal Consumption	Personal Care	Distribution	Final Demand
Personal Consumption	Restaurants, Cafes, and Hotels	Distribution	Final Demand
Personal Consumption	Other Services	Distribution	Final Demand
Government Consumption	General Public Services	Distribution	Final Demand
Government Consumption	Defense	Distribution	Final Demand
Government Consumption	Public Order & Safety	Distribution	Final Demand
Government Consumption	Education	Distribution	Final Demand
Government Consumption	Health	Distribution	Final Demand
Government Consumption	Social Security & Welfare	Distribution	Final Demand
Government Consumption	Housing and Community Amenities	Distribution	Final Demand
Government Consumption	Recreational, Cultural, and Religious	Distribution	Final Demand
Government Consumption	Economic Services	Distribution	Final Demand
Government Consumption	Other Functions	Distribution	Final Demand
Fixed Business Investment	64 ISIC Industry/Service Groups	Distribution	Final Demand
Industrial/Service Production	64 ISIC Industry/Service Groups	I/O A-matrix	Intermediate Demand

Source: QuERI-International.

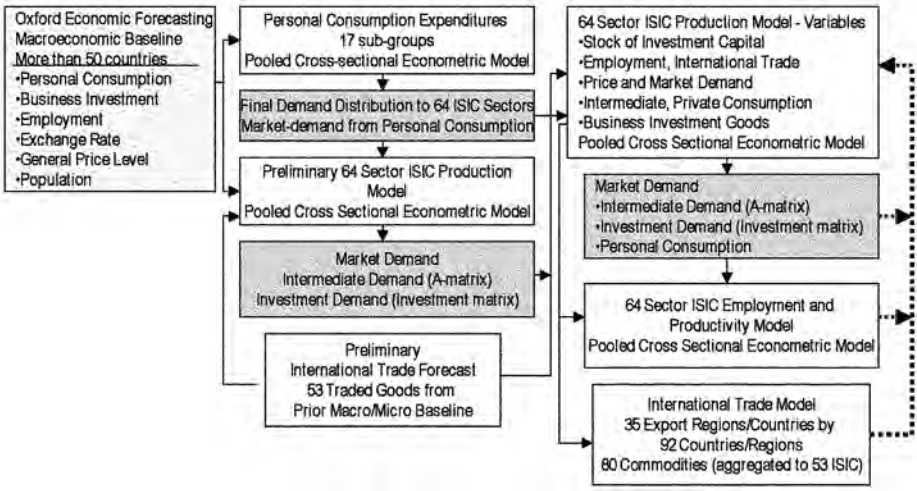


Figure 1-1. Structure of Core Model

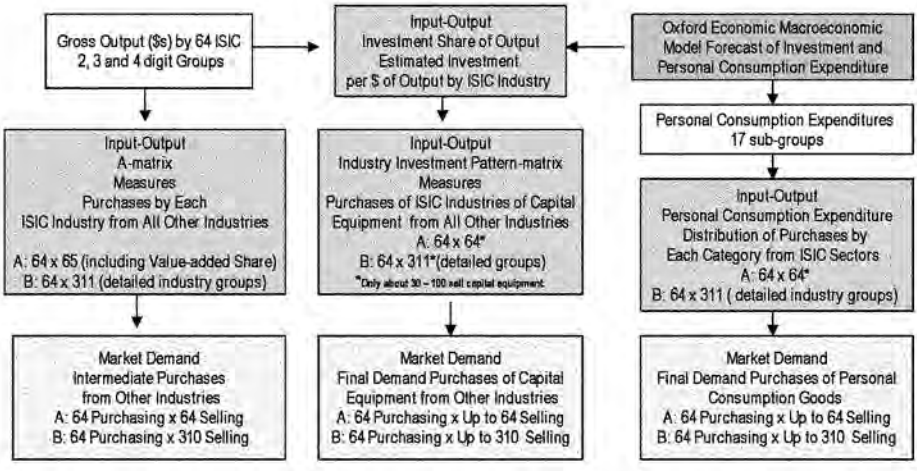


Figure 1-2. Derivation of Market Demand Drivers for Detailed Commodities Used in International Trade Model

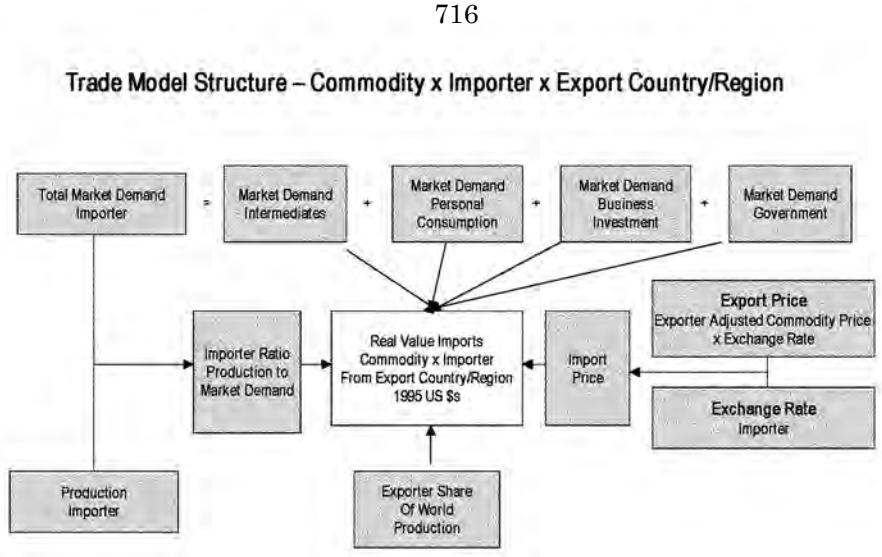


Figure 1-3. International Trade Model Approach

countries over the historic time period) and longer-term shifts resulting from improving incomes and industrial bases as measured through the cross-sectional elements in the data set. A pooled-cross-sectional model groups data across countries and over time in a single estimation process. Individual differences are preserved by allowing for separate constant terms, as well as for country/group-specific coefficients in equations.

Given the often-wide gap between rich and poor nations, pools are split into three groups:

- Advanced Nations;
- Emerging Markets;
- Poorer Developing Countries and Regions.

GENERAL EQUATION APPLICATION

The trade model is based on a statistical relationship between imports and market demand and price variables, taking the general form:

$$Mijk = \mathrm{A} + \partial ijkFDik + \phi ijkINTDik + \alpha ijkPijk + \eta ijk\frac{RPik}{MDik} + \varphi ijk\frac{RPjk}{RPwk} + \varepsilon ijk, where$$

$$Pijk = \frac{IRXi \times Pjk}{IRXj}.$$

Where:

M = imports for commodity k into country i and from exporter j; FD = final demand from private consumption, business investment, and government consumption for commodity k; INT = intermediate demand for commodity k; P = import price for commodity k and export region j; RP = production of closest product group (to trade group), MD = market demand for closest production group to commodity k; i = import country designation; j = exporter country designation; k = commodity group; IRX is index of exchange rate (1995 = 1.0 based on Local Currency Units per U.S.); and Pk is the U.S. dollar commodity price.

Where an econometric relationship is not feasible, a trended trade share, MS, is developed relating the exporter's share of each import market to the import demand from the world, which is always based on an econometric relationship.

$$Mijk = MSijk \times Mik,wd$$

$$MSijk = Trend(\frac{Mijk}{Mik,wd}).$$

TRANSLATION TO MARITIME TRADE

The maritime trade baseline is derived from a series of assumptions. For U.S. routes, maritime trade weight is directly available from Department of Commerce data. For non-U.S. routes, assumptions about land diversion are applied to data in metric tonnes. Real-value forecasts are applied to extend historic weight into the forecast period. Table 1-2 contains a listing of the commodity groupings.

The measurement of TEUs is complicated by a number of different factors that can influence the total number of TEUs on a given route. Weight-based trade must be converted to volumetric trade. Changes in mix within product groups can cause complications, and no published factors are available. Thus, information was drawn from a number of different sources to develop the maritime trade baseline. Much of this information has been collected as part of earlier versions of the ocean trade forecast (DRI, ICF, MGI).

The key factors needed to calculate TEUs by product and by route are:

- The shares of trade measured in metric tonnes that can be containerized (i.e., products carried in 20-foot or 40-foot containers
- The mix of 20-foot and 40-foot containers on each trade route
- Ratios of filled containers to weight, which are by product

Complicating the calculation is that there is no "official" measure of any of these factors. The baseline forecast was developed using inputs from liner companies, PIERS, Drewry's reports, and factors developed by QuERI over many years. The reported total TEUs thus contain a mix of elements. The general approach to calculation of TEUs is as follows:

Table 1-2. Commodity Groupings

CODE	DESCRIPTION	AGGREGATE	MAJOR AGGREGATE
C1A	Grain	PRIMARY FOOD/BEVERAGE	AGRICULTURE
C1B	Oil Seeds	PRIMARY FOOD/BEVERAGE	AGRICULTURE
C1C	Veg. and Fruits - req Refrigeration	REFRIGERATED PRODUCTS	AGRICULTURE
C1D	Veg. and Fruits - non-Refrigerated	PRIMARY FOOD/BEVERAGE	AGRICULTURE
C1E	Cork and Wood	OTHER AGRICULTURE	AGRICULTURE
C1F	Natural Rubber	OTHER AGRICULTURE	AGRICULTURE
C1G	Cotton	OTHER AGRICULTURE	AGRICULTURE
C1H	Other Raw Textile Materials	OTHER AGRICULTURE	AGRICULTURE
C1I	Other Agriculture	OTHER AGRICULTURE	AGRICULTURE
C1J	Coffee	PRIMARY FOOD/BEVERAGE	AGRICULTURE
C1K	Cut Flowers and Foliage, etc.	OTHER AGRICULTURE	AGRICULTURE
C2A	Stone, Clay and Other Crude Minerals	BULK ORES	EXTRACTIVE
C2B	Crude Fertilizers	BULK ORES	EXTRACTIVE
C2C	Ores	BULK ORES	EXTRACTIVE
C2D	Coal and Coke	COAL	EXTRACTIVE
C2E	Crude Petroleum	CRUDE PETROLEUM	EXTRACTIVE
C2F	Natural Gas	NATURAL GAS	EXTRACTIVE
C2G	Scrap	BULK ORES	EXTRACTIVE
C311A	Refrigerated: Meat/Dairy/Fish	REFRIGERATED PRODUCTS	FOOD
C311B	Other Meat/Dairy/Fish/Fruit/Veg.	NONREFRIGERATED	FOOD
C311C	Sugar	NONREFRIGERATED	FOOD
C311D	Animal Feed	OTHER FOOD	FOOD
C311E	Animal and Vegetable Oils	OILS & FATS	FOOD
C311F	Other Food	PROCESSED	FOOD
C313	Beverages	BEVERAGES	FOOD
C314	Tobacco	TOBACCO	FOOD
C321	Textiles	TEXTILES, APPAREL,	MATERIALS
C322	Wearing Apparel	TEXTILES, APPAREL,	CONSUMER
C323	Leather and Products	TEXTILES, APPAREL,	MATERIALS
C324	Footwear	TEXTILES, APPAREL,	MATERIALS
C331	Wood Products	WOOD & PAPER	MATERIALS
C332	Furniture and Fixtures	CONSUMER	CONSUMER
C341A	Waste Paper	WOOD & PAPER	MATERIALS
C341B	Pulp	WOOD & PAPER	MATERIALS
C341C	Paper and Paperboard and Products	WOOD & PAPER	MATERIALS
C342	Printing and Publishing	CONSUMER	CONSUMER
C3511	Organic Chemicals	INDUS CHEM.	CHEMICALS
C3511	Inorganic Chemicals	INDUS CHEM.	CHEMICALS
C3512	Fertilizers and Pesticides	INDUS CHEM.	CHEMICALS
C3513	Synthetic Resins	INDUS CHEM.	CHEMICALS
C3521	Paints, Varnishes and Lacquers	CONSUMER CHEMICALS	CHEMICALS
C3522	Drugs and Medicines	HIGH TECH	HIGHTECH
C3523	Soap and Cleaning Preparations	CONSUMER CHEMICALS	CONSUMER
C3529	Chemical Products, nec	INDUS CHEM.	CHEMICALS
C353	Petroleum Refineries	FUELS	FUELS
C354	Petroleum and Coal Products	FUELS	FUELS
C355	Rubber Products	INTERM. MATERIALS	INTER.MFG.
C356	Plastic Products, nec.	INTERM. MATERIALS	INTER.MFG.
C361	Pottery, China etc.	INTERM. MATERIALS	INTER.MFG.
C362	Glass and Products	INTERM. MATERIALS	INTER.MFG.
C369	Non-Metallic Products, nec	INTERM. MATERIALS	INTER.MFG.
C371	Iron and Steel	PRIMARY METALS	INTER.MFG.
C372	Non-Ferrous Metals	PRIMARY METALS	INTER.MFG.
C381	Metal Products	PRIMARY METALS	INTER.MFG.
C3821	Engines and Turbines	CAPITAL	CAPITALEQUIP.
C3822	Agricultural Machinery	CAPITAL	CAPITALEQUIP.
C3823	Metal and Wood Working Machinery	CAPITAL	CAPITALEQUIP.
C3824	Special Industrial Machinery	CAPITAL	CAPITALEQUIP.
C3825	Office and Computing Machinery	HIGH TECH	HIGHTECH
C3829	Machinery and Equipment, nec.	CAPITAL	CAPITALEQUIP.
C3831	Electrical Industrial Machinery	CAPITAL	CAPITALEQUIP.
C3832	Radio and TV	HIGH TECH	HIGHTECH
C3832	Semi-conductors, Electronic Tubes,etc	HIGH TECH	HIGHTECH
C3832	Other Communications Equipment	HIGH TECH	HIGHTECH
C3833	Electrical Appliances and Houseware	CONSUMER	CONSUMER
C3839	Electrical Apparatus, nec.	CAPITAL	CAPITALEQUIP.
C3841	Shipbuilding and Repairing	TRANSPORT	CAPITALEQUIP.
C3842	Railroad Equipment	TRANSPORT	CAPITALEQUIP.
C3843	Motor Vehicles and Parts	MOTOR VEHICLES	CAPITALEQUIP.
C3843	Motor Vehicles	MOTOR VEHICLES	CAPITALEQUIP.
C3843	Parts of Motor Vehicles	MOTOR VEHICLES	CAPITALEQUIP.
C3844	Motorcycles and Bicycles	MOTOR VEHICLES	CAPITALEQUIP.
C3845	Aircraft	TRANSPORT	CAPITALEQUIP.
C3849	Transport Equipment, nec.	TRANSPORT	CAPITALEQUIP.
C3851	Professional Equipment	HIGH TECH	HIGHTECH
C3852	Photographic and Optical Goods	CONSUMER	CONSUMER
C3853	Watches and Clocks	CONSUMER	CONSUMER
C390	Other Manufacturing, nes	CONSUMER	CONSUMER
C390A	Toys, Games and Sporting Goods	CONSUMER	CONSUMER
C390B	Jewelry	CONSUMER	CONSUMER
C390C	Misc. Manufacturing Goods	CONSUMER	CONSUMER

Source: QuERI-International.

- TEUs = Metric Tonnes x Containerized Tonnes Share/Weighted Average Metric Tonnes per TEU
- Weighted Average Metric Tonnes per TEU = % 20 * MT/TEU + % 40 *(MT/FEU), where:

  MT = Metric Tonnes
  TEU = 20-foot equivalent unit
  FEU = 40-foot equivalent unit.

Total containerized trade measured in TEUs has been compared to data reported by the public media or available from sources such as Drewry's, Containerization International, and the U.S. Maritime Administration.

LONG-TERM PERSPECTIVE

Short-term economic trends are largely influenced by current events such as war, terrorism, sudden disruptions of supplies of essential materials, and policy restrictions. Europe's problems are partly the result of its social policies, ranging from restrictive labor laws to self-imposed limits on deficit spending resulting from the European Union's stability pact. The failure of the new Central Bank to reduce lending rates is also a factor. Elsewhere in the world, waste, fraud, abuse, war, disease, pollution, and a host of other problems can cause a nation to decline or fail to develop.

Technological change is implicit in the underlying shifts observed in the patterns of global production and consumption. Productivity, as measured by output per worker, is a key factor in the long-term production model. No explicit assumptions are made about productivity growth, with changes coming entirely from shifts observed in investment per dollar of output and the resulting capital/labor ratios used to forecast changing production.

Technology has always been a difficult problem for economic models. Most production models assume that technological change is the "unexplained" variable that explains the difference between a static output per unit of capital and the observed output per unit of capital.

Products that are more technologically sophisticated have been of greater importance to world trade than those that are less complex. Given that these high technology products are growing faster, this is an implicit measure of technology in the long-term forecast. Thus, although there are no explicit assumptions about technology in the model in terms of a demand pull and supply push point of view, technology is included in the basic long-term trade forecast. It impacts the industrial patterns observed, and it affects the mix of products that will be traded into the future.

Longer-term economic prospects assume that these disturbances will be eventually overcome. Statistical models tend to return the world to a trend. Traditionally, long-term economic growth is dependent on two factors:

- Population growth;
- Productivity/Technological Progress.

Although population trends can be easily measured, at least through the forecast interval (2050), productivity and technological progress is not so easily forecast. The present analysis takes a different approach to the issue of the very long-term by using a series of models based on a pooled-cross-sectional-time-series approach. The advantage of this approach is that it considers the relative stage of economic development achieved. The cross-sectional model by definition tends to be better suited for projecting long-term patterns of growth.

The models are based on an analysis of economic growth trends across a group of 72 countries, ranging from the very poor countries of the Indian Subcontinent and Africa to the richest nations in the world such as the United States, Western Europe, and Japan. A staged approach is used to develop the long-term market demand factors required by the QuERI trade models.

To extend beyond the Oxford baseline (2013), a structural model (Figure 1-4) has been developed for GDP growth and the share of that growth for each component: personal consumption, business investment, government consumption, imports, and exports. These are the main components of GDP as measured by the demand side. Also included is employment to population. Each of the component shares is driven by the change in population size and per capita income, as well as a general time trend. The entire model is solved simultaneously. The starting point mirrors the Oxford baseline.

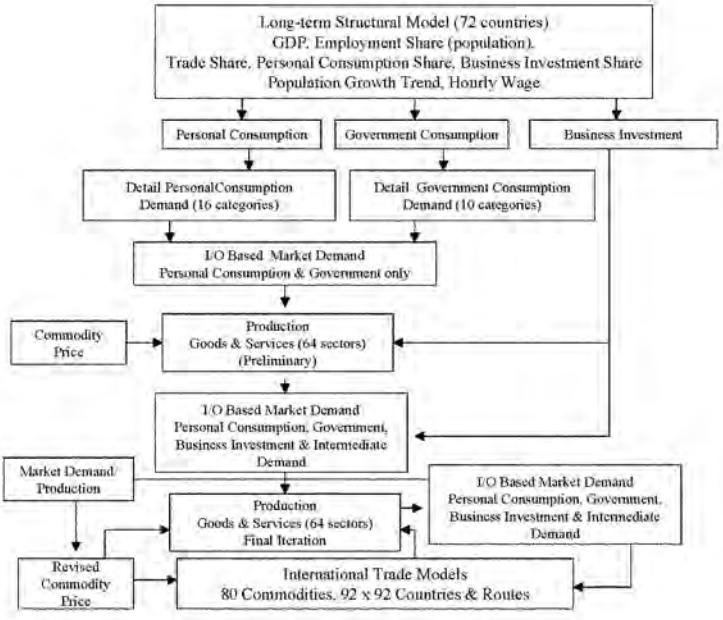


Figure 1-4. Long-Term Structural Model

Forecasts for personal consumption expenditure, business investment, and government consumption derived either directly from Oxford Economic Forecasts or extended using the QuERI long-term structural model are then used in conjunction with existing structural models for the more detailed subcategories. The steps used in the short-term model are followed through so that a pattern of industrial production, market demand, consumption, investment, and government consumption are measured for each of the International Statistical Classification Code (ISIC) traded products (about 50).

This market demand is then used in the long-term trade models, resulting in a dynamic, long-term, structurally based forecast for trade by detailed product and covering more than 7,000 trade routes.

The staged approach allows for variations in rates of economic growth among nations. Short-term patterns are developed using the Oxford March 2004 baseline and longer-term growth rates are developed using the long-term model framework. As Figure 1-5 indicates, the model reaches asymptotic growth rates close to the general increase in population growth and long-term productivity. Countries that are working off a large rural population and developing an expanding middle class tend to have higher long-term growth potential than smaller, less populous countries. Countries that are already advanced will slow down or maintain, through technological progress and policy approaches, stable long-term growth. The difference, for example, between Germany and the U.S. is explained by the population growth rate disparity as much as by the productivity differences.

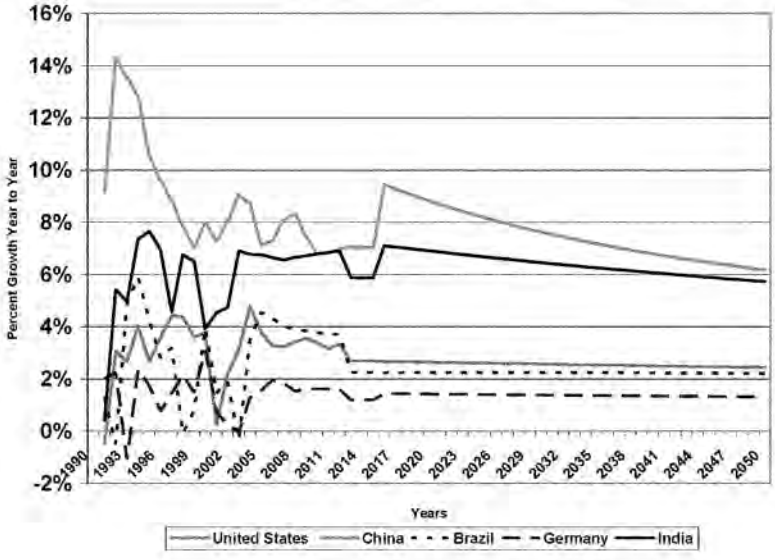


Figure 1-5. Gross Domestic Product Growth Rates

As can be seen from Figure 1-5, the short-term pattern reflects the business cycle and external shocks (including the 2001 terrorist/post-boom recession), and the long-term growth tends to move towards an asymptotic trend. The growth trend, however, is a gradual decline towards stable long-term growth. In advanced nations, this comes close to the long-term population growth plus productivity; but there are periods when economic policies push growth well above the trend and/or well below the trend. Over time, the strong growth in China and India will slow as well. How soon and when that occurs will depend as much on these nations' ability to manage their environment and deal with shortages of resources (food, clean water and air, and raw materials). The simplified long-term model used in this analysis ignores these issues and assumes that supply will always be sufficient (supply is perfectly elastic).

GDP growth trends are top-line estimates. The trade model depends on a structured approach to long-term production and consumption trends. Long-term patterns of development reflect structural changes, as well as trade and industrial development patterns. The starting point for the analysis is a measurement of personal consumption demand and government demand, from which an initial estimate of production is developed. This production, along with personal consumption and government consumption, is translated into two types of market demand:

- Final demand by commodity (one of 80 commodity types) developed from input-output final demand matrices (final demand is the aggregate of personal consumption, government consumption, and business investment);
- Intermediate demand by commodity (one of 80 commodities), based on the input-output models related to industrial and service production (64 sectors).

This initial estimate of market demand is then used along with structural factors (derived from the long-term structural model) to develop a new production forecast, which is used in the input-output framework to develop the final demand and intermediate demand estimates used in the long-term trade model.

The long-term production model uses a non-linear framework based on a pooled-cross-sectional-time series and reflects past patterns and changes in trade shares. When the long-term forecast is analyzed in terms of share of total production, it can be seen that there is a decidedly different mix of products between regions. While population growth slows (growing at about 1 percent for most of the period), demand as measured by per capita consumption increases throughout most of the world.

Market demand is the key driver for the long-term trade model and is derived from a combination of production and consumption trends. Production models reflect the ability of a region to produce a type of product. Market demand measures the requirements to drive the production model and to meet the private consumption needs of workers. Table 1-3 shows market demand shares for the three major world regions over time.[4]

[4] Market demand drives the trade model. In fine-tuning the long-term model, it has been found that the production model tends to show stronger growth than market demand. This suggests that structurally the capitalist model may tend to always overfulfill requirements. This may explain the persistence of excess capacity.

Table 1-3. Regional Market Demand Shares

Year	Region	Food	Capital	Consumer	Technology	Primary	Intermediate	Services	Size of Market	C.A.G.R.	GDP Growth	C.A.G.R.
1990	N.America	5.2%	3.2%	10.9%	2.8%	2.5%	7.0%	68.4%	$ 13,698.58		$7,322	
	Europe	6.0%	3.9%	11.8%	2.5%	2.5%	8.1%	63.2%	$ 19,008.63		$9,344	
	Asia	6.8%	4.8%	12.2%	3.5%	2.0%	9.5%	61.2%	$ 14,088.26		$6,987	
2000	N.America	4.4%	3.3%	11.5%	3.6%	2.1%	6.5%	68.6%	$ 19,390.96	3.5%	$9,970	3.1%
	Europe	5.4%	3.6%	11.8%	2.8%	2.3%	7.3%	66.8%	$ 22,414.71	1.7%	$11,298	1.9%
	Asia	6.6%	4.5%	11.6%	3.7%	2.1%	8.3%	63.3%	$ 19,510.59	2.5%	$9,518	3.1%
2010	N.America	3.8%	3.1%	11.6%	4.2%	1.8%	6.1%	69.3%	$ 26,395.10	3.1%	$13,472	3.1%
	Europe	5.0%	3.5%	12.3%	3.3%	2.0%	7.5%	66.5%	$ 28,011.40	2.3%	$13,944	2.1%
	Asia	5.9%	5.0%	11.5%	4.3%	2.0%	8.6%	62.6%	$ 26,639.07	3.4%	$13,071	3.2%
2030	N.America	2.7%	3.1%	11.2%	5.9%	1.3%	6.3%	69.3%	$ 48,314.15	3.1%	$27,951	2.7%
	Europe	3.9%	3.6%	12.8%	4.3%	1.6%	7.8%	66.0%	$ 44,123.20	2.3%	$20,507	1.9%
	Asia	3.7%	6.4%	12.0%	7.3%	1.5%	11.4%	57.6%	$ 66,436.26	4.7%	$27,948	3.9%
2050	N.America	1.9%	3.1%	10.4%	7.6%	1.1%	6.5%	69.4%	$ 87,339.71	3.0%	$38,445	2.6%
	Europe	3.0%	3.5%	12.9%	5.2%	1.3%	8.0%	65.9%	$ 69,925.07	2.3%	$30,257	2.0%
	Asia	1.7%	7.5%	12.1%	11.2%	1.1%	15.4%	51.0%	$ 230,289.15	6.4%	$70,927	4.8%

Notes: C.A.G.R. = Compound Annual Growth Rate.

Source: QuERI-International.

Although the consumption share of processed foods for Asia declines as a share, the absolute amount increases. On a per capita basis, the actual consumption level will almost double between 1990 and 2050.

LONG-TERM TRADE MODEL

The long-term trade model (beyond 2015) is similar to the short-term model, with the exception that there are no assumptions about changes in exchange rates. Prices are allowed to adjust based on estimated supply-demand balances (from the industrial-market demand model forecast in the earlier stage). The coefficients are the same as estimated using the historic data.

Because the pooled-cross-sectional model framework reflects the best estimate of the long-term future, it is appropriate to use the same set of coefficients to extend the forecast beyond the last normal forecast year (2015). Because the structural model shows the changing mix of demand and the changing ability to manufacture products for exports, the trade forecast is reasonable and consistent with the long-term future depicted by the structural model.

Table 1-4 ranks the largest and most important trade flows in order of size (Table 1-4 does not rank all trade flows). The model performs as expected, with a slowing of the general growth in trade towards the end of the period. No model of this size and scope and covering this number of years can be developed without some degree of control over the outcome. Long-term aggregate market demand is used as a measure of maximum growth potential for traded goods (imports). In the earlier years (defined as 2010 - 2019), import growth is allowed to be as much as 35 percent faster than market demand for the commodity. Over the next 10 years, imports may be 25 percent faster than market demand growth. Over the 2030 - 2040 period, import demand growth can be 15 percent faster than overall market demand. And in the final period (2040 - 2050), import demand may not grow at a rate more than 5 percent over market demand for the

commodity. This slowing down towards the long-term trend reflects the fact that specialization trends will probably be played out over a period of 50 years of steady trade growth.

Table 1-4. Trade Flows by Order of Size

Country	Description	Value 2000 (Billions 1995 US $s)	Historic Growth (1995-2000)	Short Term Growth (2000-05)	Medium Term Growth (2005-20)	Long Term Growth (2020-50)
US West	Office and Computing Machinery	$ 112.10	21.1%	8.2%	5.9%	3.2%
United Kingdom	Office and Computing Machinery	$ 64.37	25.9%	0.3%	6.7%	4.1%
Germany	Office and Computing Machinery	$ 60.26	22.0%	10.5%	3.6%	1.9%
Japan	Office and Computing Machinery	$ 58.22	18.3%	8.6%	3.0%	2.0%
Netherlands	Office and Computing Machinery	$ 53.35	29.3%	10.6%	5.5%	3.4%
Singapore	Semi-conductors, Electronic Tubes,etc	$ 49.48	16.9%	3.4%	11.0%	9.8%
US West	Semi-conductors, Electronic Tubes,etc	$ 48.80	12.5%	-6.4%	7.7%	4.3%
US West	Motor Vehicles	$ 40.91	17.6%	10.7%	6.7%	3.4%
Germany	Motor Vehicles	$ 40.64	10.8%	9.0%	5.1%	1.7%
US East	Motor Vehicles	$ 39.23	12.7%	9.7%	4.0%	1.8%
France	Aircraft	$ 39.01	19.5%	-1.1%	3.3%	1.7%
US South	Crude Petroleum	$ 38.88	9.2%	8.8%	-0.3%	0.4%
United Kingdom	Motor Vehicles	$ 37.02	16.1%	9.5%	6.5%	3.0%
Singapore	Office and Computing Machinery	$ 36.87	14.9%	10.2%	11.2%	10.1%
US North	Motor Vehicles	$ 36.75	8.7%	4.2%	-2.4%	-2.8%
Malaysia	Semi-conductors, Electronic Tubes,etc	$ 35.49	15.3%	8.3%	10.8%	7.5%
Hong Kong	Office and Computing Machinery	$ 35.48	28.5%	13.0%	7.2%	4.8%
Taiwan	Semi-conductors, Electronic Tubes,etc	$ 35.06	16.1%	9.1%	8.3%	6.4%
France	Office and Computing Machinery	$ 33.45	19.8%	7.5%	5.1%	2.7%
Hong Kong	Semi-conductors, Electronic Tubes,etc	$ 32.90	19.5%	6.1%	7.9%	5.8%
US South	Motor Vehicles	$ 31.21	19.5%	7.7%	6.3%	3.1%
China Mainland	Semi-conductors, Electronic Tubes,etc	$ 31.08	46.2%	26.6%	11.0%	9.1%
Italy	Motor Vehicles	$ 30.25	15.1%	11.3%	6.4%	2.6%
France	Motor Vehicles	$ 30.10	8.6%	8.3%	6.2%	2.3%
Korea	Semi-conductors, Electronic Tubes,etc	$ 29.88	22.7%	9.3%	9.2%	8.0%
Japan	Semi-conductors, Electronic Tubes,etc	$ 29.47	13.9%	4.2%	4.8%	2.3%
US West	Wearing Apparel	$ 28.47	8.9%	1.9%	-0.4%	0.2%
US South	Office and Computing Machinery	$ 28.25	45.1%	14.1%	7.5%	5.3%
Canada	Parts of Motor Vehicles	$ 27.77	6.5%	0.2%	7.6%	3.2%
Canada	Office and Computing Machinery	$ 27.35	18.4%	4.9%	5.8%	3.3%
Japan	Crude Petroleum	$ 26.84	-1.9%	-5.2%	-3.3%	-3.9%
US West	Other Communications Equipment	$ 26.71	11.1%	7.4%	7.8%	4.2%
US East	Office and Computing Machinery	$ 24.39	23.1%	5.8%	6.7%	4.6%
Canada	Motor Vehicles	$ 23.62	9.2%	7.0%	5.0%	2.6%
Germany	Wearing Apparel	$ 23.60	-3.7%	0.5%	-0.6%	0.4%
Japan	Refrigerated Meat/Dairy/Fish	$ 23.02	2.8%	-1.3%	1.3%	0.0%
Germany	Semi-conductors, Electronic Tubes,etc	$ 22.74	15.7%	6.0%	5.5%	2.2%
Germany	Machinery and Equipment, nec	$ 22.68	3.8%	3.2%	3.3%	1.4%
Germany	Parts of Motor Vehicles	$ 22.29	9.3%	5.5%	3.3%	1.6%
Taiwan	Office and Computing Machinery	$ 22.17	31.7%	15.6%	7.9%	5.5%
US East	Non-Ferrous Metals	$ 22.13	23.7%	-9.6%	2.7%	-1.8%
US East	Jewelry	$ 21.37	15.5%	-2.8%	-0.6%	0.6%
Hong Kong	Other Communications Equipment	$ 21.09	11.8%	10.8%	7.4%	5.7%
Japan	Wearing Apparel	$ 20.46	4.7%	6.7%	-3.5%	-2.9%
United Kingdom	Other Communications Equipment	$ 20.17	26.1%	0.3%	7.2%	4.5%
Germany	Non-Ferrous Metals	$ 19.94	12.9%	0.2%	-0.3%	-0.5%
Belgium	Motor Vehicles	$ 19.85	15.3%	11.8%	6.0%	2.2%
Spain	Motor Vehicles	$ 19.70	22.2%	13.6%	7.8%	3.9%
Ireland	Office and Computing Machinery	$ 19.52	28.9%	6.8%	9.7%	7.5%
China Mainland	Office and Computing Machinery	$ 19.26	30.6%	24.6%	10.5%	9.4%
Italy	Office and Computing Machinery	$ 18.57	23.5%	7.8%	4.9%	2.7%
Japan	Non-Ferrous Metals	$ 18.48	13.0%	-4.5%	0.2%	-3.3%
China Mainland	Synthetic Resins	$ 18.31	12.7%	19.5%	7.9%	7.4%
Spain	Parts of Motor Vehicles	$ 18.11	13.7%	11.2%	6.3%	3.8%
US North	Parts of Motor Vehicles	$ 18.05	15.4%	6.6%	2.6%	3.2%
Germany	Iron and Steel	$ 17.49	3.3%	-1.0%	4.0%	1.8%
United Kingdom	Semi-conductors, Electronic Tubes,etc	$ 17.49	12.4%	-4.3%	7.7%	4.6%
France	Machinery and Equipment, nec	$ 17.31	6.0%	4.1%	4.7%	1.9%
Korea	Office and Computing Machinery	$ 17.26	29.1%	10.3%	8.9%	7.1%

Country	Description	Value 2000 (Billions 1995 US $s)	Historic Growth (1995-2000)	Short Term Growth (2000-05)	Medium Term Growth (2005-20)	Long Term Growth (2020-50)
United Kingdom	Parts of Motor Vehicles	$ 16.75	8.1%	7.1%	5.5%	3.0%
Canada	Semi-conductors, Electronic Tubes,etc	$ 16.68	13.0%	-11.4%	7.2%	4.0%
Mexico	Semi-conductors, Electronic Tubes,etc	$ 16.66	36.7%	11.8%	9.8%	4.5%
US East	Wearing Apparel	$ 16.44	9.8%	3.5%	1.0%	0.6%
US West	Parts of Motor Vehicles	$ 16.32	6.3%	9.7%	5.7%	3.0%
Hong Kong	Wearing Apparel	$ 16.15	0.4%	-1.6%	3.9%	-0.4%
Hong Kong	Textiles	$ 16.04	0.1%	3.1%	1.6%	0.5%
Germany	Aircraft	$ 15.88	23.4%	2.2%	3.3%	1.4%
US East	Organic Chemicals	$ 15.54	25.2%	-0.2%	4.4%	1.9%
Germany	Other Communications Equipment	$ 15.21	12.2%	8.3%	4.5%	2.2%
US South	Wearing Apparel	$ 15.19	12.4%	1.5%	3.1%	2.3%
United Kingdom	Machinery and Equipment, nec	$ 14.81	6.8%	4.1%	5.3%	2.8%
Japan	Motor Vehicles	$ 14.76	2.0%	2.7%	4.4%	1.7%
US South	Other Communications Equipment	$ 14.58	32.0%	11.5%	9.3%	5.7%
Mexico	Parts of Motor Vehicles	$ 14.58	20.1%	2.6%	5.7%	3.1%
China Mainland	Textiles	$ 14.52	4.0%	13.8%	7.0%	7.8%
US East	Crude Petroleum	$ 14.51	11.8%	11.8%	-2.8%	0.7%
US West	Toys, Games and Sporting Goods	$ 14.50	9.3%	12.5%	5.3%	3.0%
Canada	Machinery and Equipment, nec	$ 14.44	7.8%	2.6%	4.7%	2.6%
Germany	Synthetic Resins	$ 14.22	4.9%	0.0%	1.7%	0.9%
Philippines	Semi-conductors, Electronic Tubes,etc	$ 14.18	24.5%	12.5%	11.4%	7.7%
United Kingdom	Wearing Apparel	$ 14.16	11.9%	4.7%	0.1%	0.7%
China Mainland	Iron and Steel	$ 14.11	12.5%	18.2%	9.6%	9.6%
France	Iron and Steel	$ 13.95	13.4%	-0.4%	5.4%	2.6%
France	Semi-conductors, Electronic Tubes,etc	$ 13.88	20.4%	-0.2%	7.2%	3.2%
China Mainland	Other Communications Equipment	$ 13.60	20.2%	13.1%	9.9%	10.3%
US East	Other Communications Equipment	$ 13.58	35.7%	-2.9%	9.2%	6.0%
France	Parts of Motor Vehicles	$ 13.57	8.5%	8.5%	5.8%	2.3%
Germany	Organic Chemicals	$ 13.44	8.6%	-2.7%	-1.8%	-1.8%
Italy	Iron and Steel	$ 13.35	8.4%	2.5%	5.9%	2.7%
France	Wearing Apparel	$ 13.25	4.0%	3.8%	-1.4%	0.4%
Japan	Ores	$ 12.94	11.5%	-4.9%	0.9%	0.4%
US West	Machinery and Equipment, nec	$ 12.84	8.0%	11.8%	5.6%	2.6%
Italy	Non-Ferrous Metals	$ 12.81	16.4%	-1.0%	1.7%	-0.3%
France	Crude Petroleum	$ 12.67	5.8%	3.5%	-0.6%	0.2%
Belgium	Office and Computing Machinery	$ 12.49	29.7%	13.5%	5.0%	2.7%
Belgium	Parts of Motor Vehicles	$ 12.40	7.9%	7.4%	4.8%	2.1%
Germany	Metal Products	$ 12.38	1.3%	1.5%	1.2%	0.2%
Thailand	Semi-conductors, Electronic Tubes,etc	$ 12.25	19.9%	7.9%	10.4%	8.8%

TRANSLATION TO TRADE VOLUME AND MODE

Waterborne (ocean) trade reflects a number of factors. It excludes tonnage moved by air and land. Containerized tonnes in this analysis are based on a study of industry trends and differences across commodities, producing different containerization shares for products and trade routes. In most cases, the differences are quite small. TEUs, or containers, reflect estimates derived from industry sources (including PIERS data). TEUs are calculated as follows:

- TEUs [Commodity, Trade Route] = Total Ocean Metric Tonnes [Commodity, Trade Route] x Containerization Share [Commodity, Trade Route] / Tonnes per Container [Commodity, Trade Route].

Ocean Metric Tonnes, Containerized Tonnes, and TEUs are formulated using the value-driven forecast. [5] For 2002, total worldwide TEUs are estimated at approximately 65 million. Growth in TEUs is expected to slow from the over 6 percent per year achieved in the 1990 – 2004 period to around 5 percent in the medium term, but then to increase to as high as 7 percent in the long-term as Asia continues to develop and draws in intermediate and final products. [6]
The baseline used in this analysis assumes that increasing market demand for traded products can be supplied by more efficient producers in other parts of the world. There is no provision for increased trade protection or more open and balanced trade worldwide. Thus, imbalances that are apparent today are expected to remain, and no specific impediment to trade is imposed.

China's long-term growth rates for imports are forecast to exceed exports, which will shift the balance of trade in the region. China will remain a primary engine of growth for the rest of Asia and ultimately for the world. One problem for a country like the U.S. may be the loss of competitive industries able to supply these needs. The shift of manufacturing to Asia will limit the ability of the U.S. to sell into these faster-growing markets as they develop.

Table 1-5 shows the largest and most important traded commodities exported by China. China's share of the world market will continue to expand, especially in low-value products (measured in 1995 U.S. dollars).

Table 1-5. China's Primary Exports

China's Share of World Market	1990	2000	2050
Textiles	9%	12%	13%
Clothing	20%	27%	58%
Footwear	13%	43%	86%

Source: QuERI-International.

MARITIME TRADE FORECASTING

In developing a maritime trade forecast, it is necessary to balance the likely with the unlikely, which is especially true for the very long-term. Analysts naturally concentrate on past trends when thinking about future growth, assuming that a country once poor is always poor and a country once rich is always rich. Trade is no different. If the United States is specialized in importing manufactures and exporting primary products, then it is assumed to remain specialized. Recovery of industries is not anticipated. Nevertheless, there are many examples of industries that were given up for dead but returned to life through innovation and enlightened trade policy. [7]

[5] Using United Nations trade data, UNCTAD has developed an estimate of total ocean metric tonnes that may be compared to the estimate developed here. The UNCTAD total is larger, probably reflecting the fact that it is based on total tonnes.
[6] The model forecasts a strong growth in textiles starting in 2030 and continuing. This benefits the South Atlantic, but may be unrealistic. Without textiles, long-term growth remains high, but is about 1 percent less per year.
[7] The U.S. automobile industry appeared to be on the verge of extinction as Japanese cars flooded the U.S. in the late 1970s and early 1980s. The U.S. asked the Japanese to impose limits on exports, inducing Japan's leading

The baseline forecast, which reflects the underlying economics alone without human intervention, suggests some surprising trends in global trade. For example, global trade in textiles is expected to grow strongly as more people are fully integrated into the world economy, with the U.S. share actually increasing and growing strongly. This may come to pass or may be an illusion created by the statistical model. The U.S. should have a natural advantage in cotton textiles because it is a cotton producer and in high tech fabrics because it has a strong and dynamic chemical industry, but U.S. textile manufacturers are moving to China. Will this trend be reversed and, more importantly, can an industrial base be reestablished once it has disappeared?

Total metric tonnes of world trade will expand as more countries became wealthier over the long term. Without disruption by protectionism, shifts in production and continued specialization will encourage more international exchange.

Figures 1-6 and 1-7 show worldwide growth rates for total ocean trade exports and imports in metric tonnes. Figures 1-6a and 1-7a have metric tonne data. Figure 1-6 indicates strong U.S. export growth, which is based primarily on an expected surge in demand after 2015 for textiles and organic chemicals, both of which are strong suites for the South Atlantic.

Given the resource balances that would occur, some countries with very large populations would have to import substantial amounts of primary, intermediate, and finished products to meet higher living standards if they developed in keeping with the projected economic baseline.

Figures 1-8 and 1-9 present the same information in terms of TEUs as figures 1-6 and 1-7. Figures 1-8a and 1-9a have TEU data. TEU growth rates are closer to, but not entirely the same as, real trade value growth rates. The containerized product share of world trade is growing because of the increasing use of long-distance supply chains linking the population-rich states of the Asian continent with the wealthy markets of Europe and North America. At the same time, a robust and substantial intra-regional trade has begun to develop in Asia and Latin America. Volume for the world in 2002 is estimated to be 70.6 million TEUs. If the forecast is accurate, a worldwide total of over 700 million TEUs could be reached by 2050, constituting about 4.9 percent growth per year (or about 1 percent less than the average for 1990 - 2000).

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automobile makers and their parts suppliers to shift production from Japan to the U.S. Today, Japanese cars are dominant in the U.S., but are mainly produced in the U.S., thus saving American jobs.

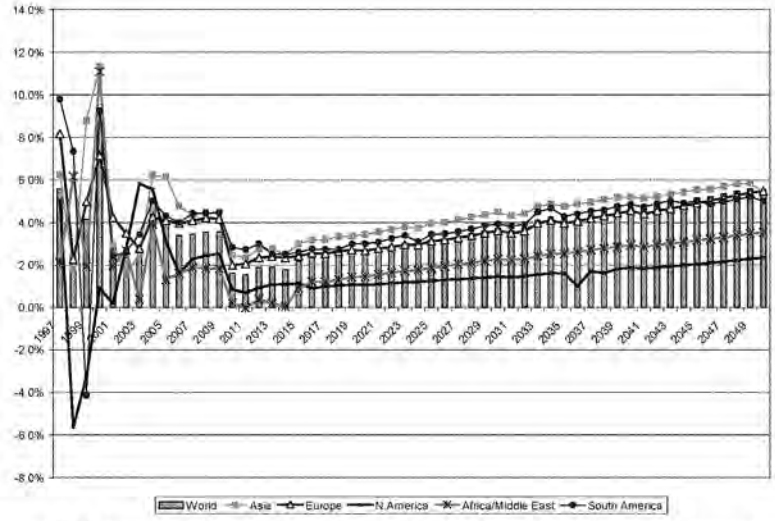


Figure 1-6. Annual Growth Rates for Total Ocean Exports in Metric Tonnes

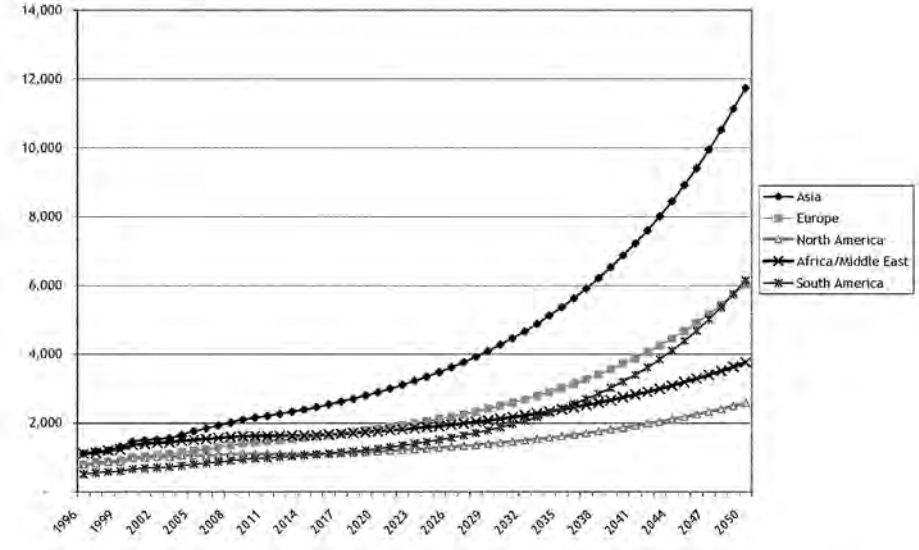


Figure 1-6a. Total Ocean Exports in Millions of Metric Tonnes

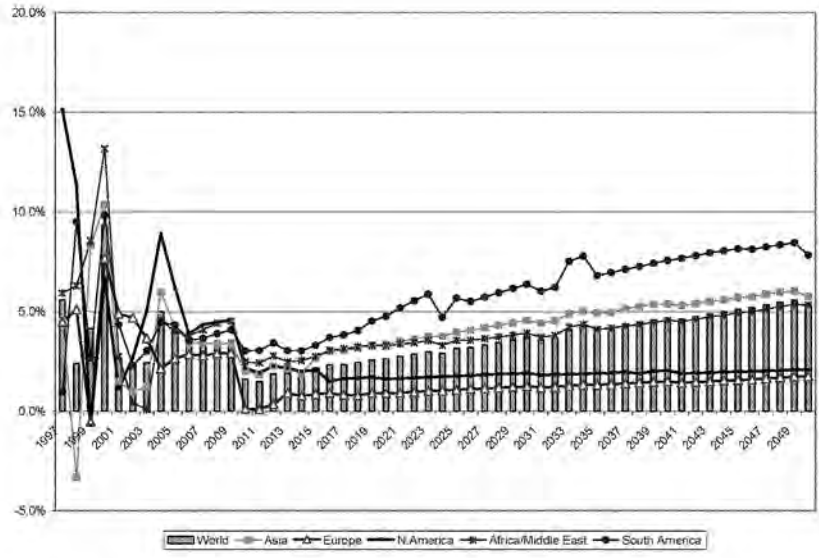


Figure 1-7. Annual Growth Rates for Total Ocean Imports in Metric Tonnes

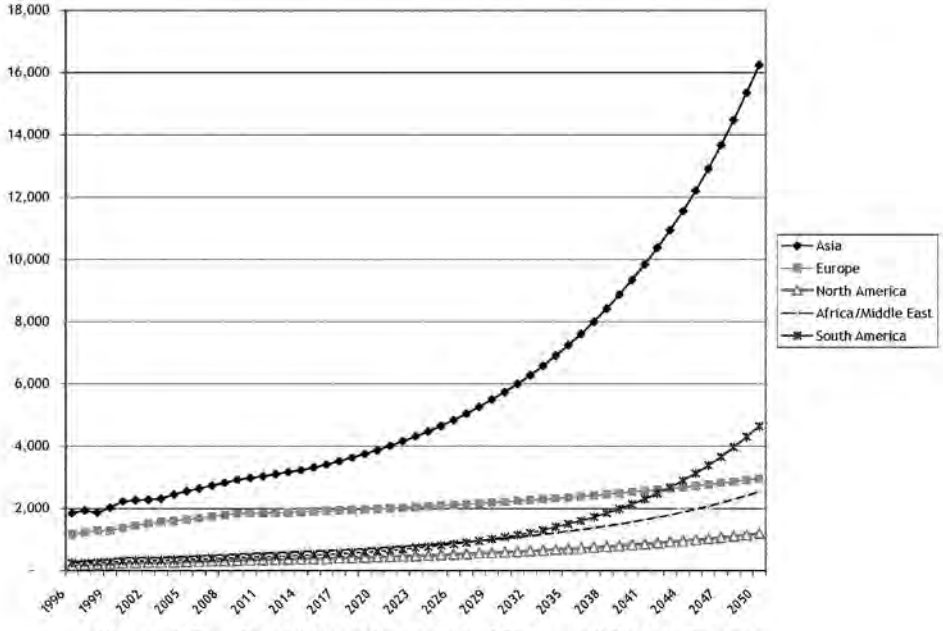


Figure 1-7a. Total Ocean Imports in Millions of Metric Tonnes

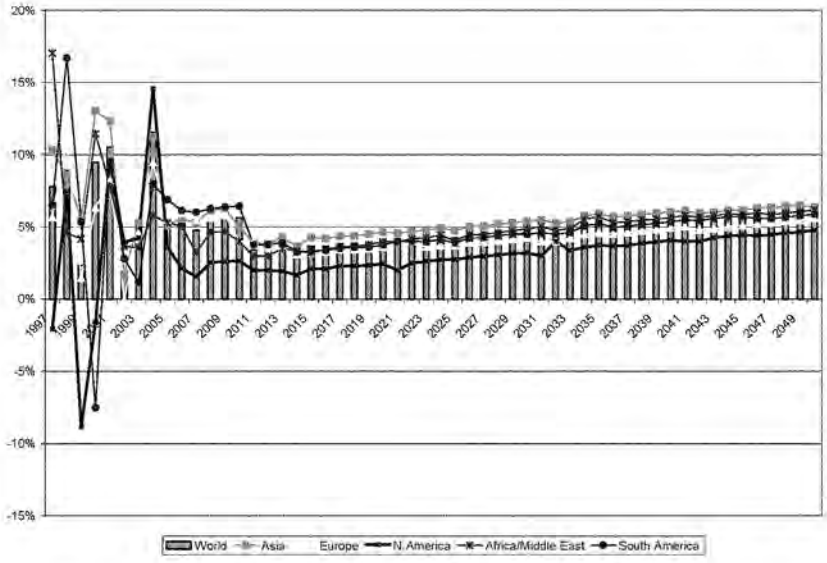


Figure 1-8. Annual Growth Rates for Total Ocean Exports in TEUs

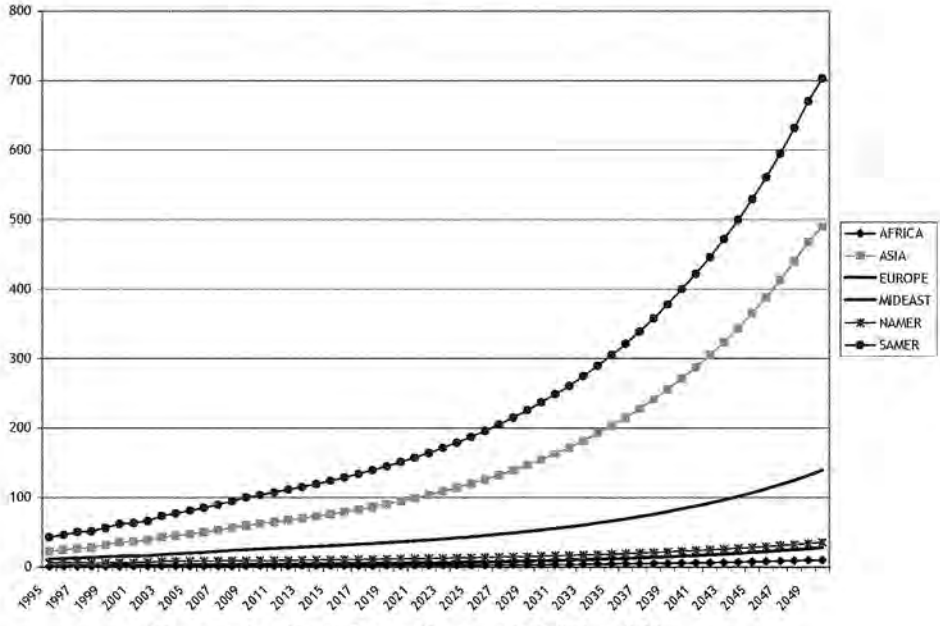


Figure 1-8a. Total Ocean Exports in Million TEUs

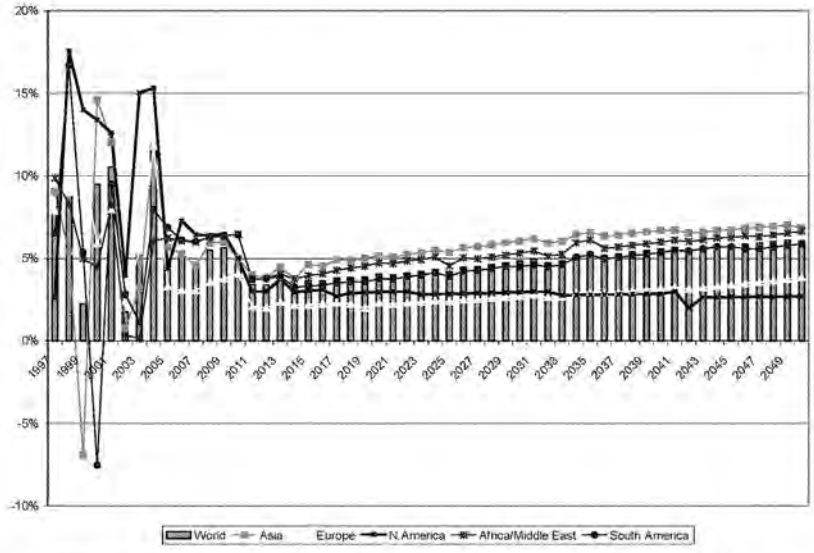


Figure 1-9. Annual Growth Rates for Total Ocean Imports in TEUs

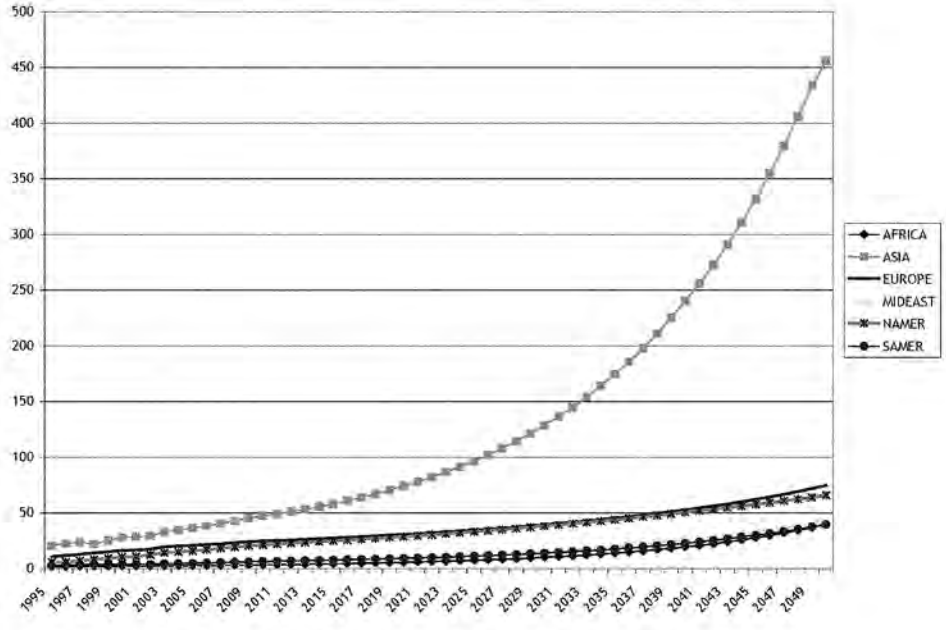


Figure 1-9a. Total Ocean Imports in Million TEUs

V. WORLD TRADE FORECAST

The detailed forecast of world maritime trade for 85 countries and 80 commodities was aggregated to seven world regions and 10 commodity groups for the purpose of summarizing the forecast. The full data set is available by 80 commodities and 85 countries. The seven world regions are as follows: (1) Africa; (2) Asia; (3) Europe; (4) Mideast; (5) North America; (6) South America; and (7) the Caribbean. The 10 commodity aggregations are as follows: (1) Agriculture; (2) Capital Equipment; (3) Chemicals; (4) Consumer Goods; (5) Extractive; (6) Food; (7) Fuels; (8) High Tech; (9) Intermediate Manufacturing; and (10) Materials.

Historical world trade has been compiled annually for the period 1995 - 2003 and forecasted annually for the period 2003 - 2050. For purposes of summarizing and reporting, world trade has been compiled by seven regions, 10 commodities, and 11 years, consisting of actual trade in 1995, 2000, and 2003 and forecasted trade in 2004, 2005, 2010, 2015, 2020, 2030, 2040, and 2050. The selection of reporting years was based on a balance of historic data, near-term projections in 2004, 2005, and 2010, and longer-term projections beyond 2015 in terms of what could be fitted into tables in the main body of the report.[8]

World trade has been projected in metric tonnes and TEUs as follows: (1) All Commodities (metric tonnes); (2) Containerized Commodities (metric tonnes); and (3) TEUs. As explained in the methodology section of this report, the containerized commodities are a subset of all commodities, and TEUs are developed from the containerized commodities based on commodity density relationships. For each forecast grouping (all commodities, containerized commodities, and TEUs), there are two sets of projections for exports (origin/destination) and imports (destination/origin) with respect to the seven world regions.[9]

The world waterborne trade forecasts for the 10 commodity categories for all commodities (metric tonnes), containerized commodities (metric tonnes) and TEUs for exports and imports are contained in an Appendix A. The world trade forecasts are summarized for all commodities in six tables for the seven regions. The forecasts reflect origin/destination (exports) and destination/origin (imports) for all commodities (metric tonnes), containerized commodities (metric tonnes), and TEUs as follows:

Table 1-6 – Origin/Destination World Commodity Forecast (metric tonnes)
Table 1-7 – Destination/Origin World Commodity Forecast (metric tonnes)
Table1-8 – Origin/Destination World Containerized Commodity Forecast (metric tonnes)
Table 1-9 – Destination/Origin World Containerized Commodity Forecast (metric tonnes)
Table 1-10 – Origin/Destination World Containerized Commodity Forecast (TEUs)
Table 1-11 – Destination/Origin World Containerized Commodity Forecast (TEUs)

The most striking phenomenon exhibited by the forecasts is the growth in Asia's, and China's imports and exports. For example, in terms of TEUs (see tables 1-10 and 1-11), exports from Asia to Europe essentially doubled between 1995 and 2003, increasing from 3.584 million TEUs

[8] The full forecast is available on a cd-rom.
[9] Intra-regional trade is measured as a single flow. Thus, Africa-to-Africa flows are identical for "Exports" and "Imports."

Table 1-6. World Commodity Forecast for all Commodities, Sorted by Origin, by Major Region, 1995-2050, Selected Years (Metric Tonnes)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	16,119,815	18,570,062	18,705,672	19,173,593	19,548,245	22,329,642	25,201,003	29,686,727	44,641,008	71,327,388	118,358,623
Africa	Asia	49,626,221	76,567,021	79,636,624	83,997,195	90,550,075	109,504,337	124,508,720	144,909,012	205,787,188	310,283,263	485,596,365
Africa	Europe	174,787,782	210,918,747	246,398,810	252,792,731	256,389,051	273,083,816	270,805,279	275,011,643	290,526,369	312,384,425	340,286,312
Africa	Mideast	15,964,486	27,993,726	28,611,237	29,637,624	31,224,288	40,834,093	43,343,251	47,676,548	60,070,612	77,964,999	104,142,452
Africa	North America	22,056,850	28,204,330	32,290,099	37,183,274	40,556,192	52,640,486	55,809,602	57,806,795	62,877,536	69,112,430	76,416,320
Africa	South America	7,352,106	12,404,419	15,762,403	16,509,515	17,281,858	20,866,812	22,121,008	23,531,827	26,696,272	30,350,741	34,593,543
Africa	Caribbean	418,792	625,039	628,356	629,000	628,529	634,016	637,546	647,949	691,945	775,900	924,319
Asia	Africa	6,980,958	16,210,057	16,758,227	17,466,196	18,179,117	23,358,079	28,654,512	36,082,458	60,964,451	111,959,012	221,478,244
Asia	Asia	830,112,869	1,118,373,970	1,194,236,621	1,272,841,839	1,352,561,453	1,657,775,953	1,898,712,592	2,260,262,964	3,447,796,973	5,717,323,287	10,046,217,613
Asia	Europe	98,467,002	141,446,301	166,540,668	173,876,750	181,964,611	203,689,723	214,748,996	229,160,795	268,601,172	328,863,887	424,160,402
Asia	Mideast	24,574,957	40,378,634	41,236,358	43,506,302	45,702,488	55,331,596	63,956,647	75,639,772	108,878,592	165,477,976	260,840,988
Asia	North America	59,268,697	103,509,700	101,597,810	107,681,260	116,459,281	157,519,494	187,477,705	216,878,919	289,826,523	384,710,137	504,636,031
Asia	South America	18,104,142	30,107,624	33,509,443	35,053,719	36,960,995	43,186,230	46,997,256	50,676,408	60,103,623	76,408,315	106,475,481
Asia	Caribbean	1,202,419	4,717,962	4,931,544	5,184,879	5,442,832	6,267,474	7,207,580	8,449,421	12,867,081	22,192,430	40,976,192
Europe	Africa	40,390,256	53,630,793	54,621,647	58,359,651	61,592,738	81,148,734	101,240,266	127,913,219	211,460,989	377,423,214	740,914,107
Europe	Asia	94,357,313	120,763,061	133,702,791	140,501,149	149,492,927	202,909,651	263,436,137	350,962,048	658,362,252	1,326,520,812	2,731,292,100
Europe	Europe	438,571,984	552,209,847	621,310,371	634,647,887	651,516,950	736,910,196	771,183,663	814,607,020	926,963,664	1,081,261,133	1,287,257,309
Europe	Mideast	55,837,663	93,700,659	100,972,535	106,934,682	112,374,690	140,912,009	162,197,865	190,939,726	267,972,895	381,434,152	533,016,850
Europe	North America	89,763,537	98,703,985	111,082,832	120,701,969	128,340,979	158,481,350	179,362,071	198,590,515	247,213,675	311,360,084	392,517,396
Europe	South America	16,239,675	19,819,191	24,347,217	26,043,025	27,681,782	36,136,170	40,854,986	45,229,569	54,983,435	66,943,951	82,152,203
Europe	Caribbean	17,537,114	39,360,656	40,073,516	44,449,646	46,573,321	53,459,040	59,116,537	64,158,825	69,605,705	72,759,131	75,919,833
Mideast	Africa	24,843,427	45,663,523	45,676,956	46,772,370	47,215,961	50,723,615	54,629,261	61,680,805	81,122,794	114,652,414	176,732,786
Mideast	Asia	551,618,152	662,116,141	633,952,983	662,978,048	657,938,526	664,269,853	653,802,950	701,817,129	880,261,725	1,202,217,564	1,751,641,316
Mideast	Europe	169,087,559	199,826,171	244,104,981	249,746,854	254,919,623	286,885,558	289,409,056	298,313,322	323,867,353	358,093,605	404,304,785
Mideast	Mideast	42,295,785	56,535,021	58,412,028	60,299,301	61,396,153	65,761,444	67,697,100	74,502,725	94,400,128	126,253,725	173,204,151
Mideast	North America	5,530,958	11,140,093	13,490,306	15,040,114	16,198,402	19,920,109	22,161,903	24,272,021	29,380,744	35,887,998	43,954,308
Mideast	South America	14,770,972	11,652,107	14,556,779	13,450,090	13,427,695	13,155,081	12,885,760	13,271,997	14,443,072	16,032,074	18,003,658
Mideast	Caribbean	713,247	1,113,130	1,124,840	1,195,249	1,235,473	1,327,840	1,409,629	1,499,104	1,666,235	1,899,862	2,300,824
North America	Africa	7,366,710	6,351,903	6,737,899	7,037,992	7,237,956	8,294,344	9,294,045	10,400,161	13,188,430	17,716,936	26,621,064
North America	Asia	168,064,833	137,693,263	145,913,294	151,004,865	153,073,719	161,775,300	166,311,968	174,932,536	202,616,239	244,581,385	326,050,436
North America	Europe	116,359,650	94,357,459	88,265,861	90,912,101	94,106,663	98,282,364	97,895,952	100,317,409	107,833,688	119,793,550	137,499,173
North America	Mideast	9,784,617	7,141,269	7,315,863	7,559,351	7,887,963	9,524,833	10,414,314	11,433,056	13,806,034	16,575,365	19,764,212
North America	North America	133,578,195	175,414,217	208,938,211	227,360,830	237,075,625	270,595,095	289,423,256	303,132,407	337,121,983	379,242,485	433,895,400
North America	South America	37,002,408	36,518,821	40,054,102	41,745,697	42,957,909	49,042,574	53,411,507	57,701,122	67,980,103	82,022,131	101,103,909
North America	Caribbean	10,683,203	12,374,610	14,790,806	14,871,001	14,933,453	15,494,072	16,559,534	18,140,498	23,692,694	34,238,695	53,267,937
South America	Africa	6,983,325	14,161,923	14,039,247	14,644,126	15,269,125	18,447,577	20,945,965	23,488,798	28,973,814	35,362,891	43,688,978
South America	Asia	89,515,396	111,935,984	123,243,619	130,868,118	149,287,911	180,175,047	204,838,012	239,549,423	345,386,758	533,970,901	880,592,207
South America	Europe	123,881,263	166,791,773	188,140,161	185,375,151	190,181,906	225,399,917	243,294,751	241,392,817	263,969,619	291,597,938	325,164,234
South America	Mideast	12,873,829	23,105,036	23,508,853	24,249,901	25,371,146	31,376,200	34,152,380	38,097,357	48,316,209	61,734,037	78,142,615
South America	North America	144,736,642	188,742,510	201,087,815	220,354,069	235,088,652	277,068,374	303,303,956	323,794,532	374,388,270	439,630,681	522,046,966
South America	South America	46,188,044	63,572,443	72,463,289	74,585,473	77,867,282	92,356,073	100,912,055	109,931,425	131,447,530	159,977,375	200,493,079
South America	Caribbean	23,990,571	53,968,628	53,627,164	56,387,578	59,331,838	80,567,147	119,979,603	199,611,959	572,140,801	1,502,706,269	3,801,402,272
Caribbean	Africa	434,831	546,595	546,714	577,993	609,287	817,871	1,063,973	1,468,168	3,017,578	6,617,716	13,831,087
Caribbean	Asia	1,748,122	1,866,386	2,129,800	2,272,467	2,431,359	3,474,472	4,211,059	5,130,192	7,388,277	10,719,037	15,607,710
Caribbean	Europe	10,319,536	15,106,302	16,875,241	17,682,432	18,444,789	22,394,400	24,329,931	26,053,989	29,763,734	33,851,531	38,337,559
Caribbean	Mideast	261,644	532,693	564,951	589,456	612,345	708,272	771,122	854,853	1,054,180	1,311,639	1,636,337
Caribbean	North America	3,381,194	5,411,351	6,378,759	6,749,349	7,083,814	8,563,701	9,884,111	11,033,392	13,844,113	17,415,689	21,839,892
Caribbean	South America	4,256,565	5,359,606	5,940,751	6,210,064	6,423,929	7,492,678	8,698,262	8,639,149	9,780,636	11,110,065	12,715,732
Caribbean	Caribbean	8,376,600	11,531,370	11,478,597	12,005,891	12,426,382	14,732,134	17,284,982	20,976,955	33,750,358	58,960,972	107,418,436
Total		**3,816,381,917**	**4,928,636,115**	**5,310,314,649**	**5,575,497,817**	**5,801,007,291**	**6,754,204,846**	**7,396,209,616**	**8,350,059,549**	**11,431,504,060**	**17,212,411,148**	**28,368,402,479**
Average Annual Growth Rate			**5.25%**	**2.52%**	**4.99%**	**4.04%**	**3.09%**	**1.83%**	**2.46%**	**3.19%**	**4.18%**	**5.12%**

Table 1-7. World Commodity Forecast for all Commodities, Sorted by Destination, by Major Region, 1995-2050, Selected Years (Metric Tonnes)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	16,119,815	18,570,062	18,705,672	19,173,593	19,548,245	22,329,642	25,201,003	29,686,727	44,641,008	71,327,388	118,358,623
Africa	Asia	6,980,958	16,210,057	16,758,227	17,466,196	18,179,117	23,358,079	28,654,512	36,082,458	60,964,451	111,959,012	221,478,744
Africa	Europe	40,390,256	53,930,793	54,621,647	58,359,651	61,592,738	81,148,734	101,240,266	127,913,219	211,460,989	377,423,214	740,914,107
Africa	Mideast	24,843,427	45,663,523	45,676,956	46,772,370	47,215,961	50,723,615	54,629,261	61,680,805	81,122,794	114,652,414	176,732,786
Africa	North America	7,366,710	6,351,903	6,737,899	7,037,992	7,237,956	8,294,344	9,294,045	10,400,161	13,188,430	17,716,936	26,621,064
Africa	South America	6,983,325	14,161,923	14,039,247	14,644,126	15,269,125	18,447,577	20,945,965	23,488,798	28,973,814	35,362,891	43,688,978
Africa	Caribbean	434,831	546,595	546,714	577,993	689,287	817,871	1,063,973	1,468,168	3,017,578	6,617,916	13,831,087
Asia	Africa	49,626,221	76,567,021	79,636,623	83,997,195	90,550,075	109,504,337	124,808,720	144,909,012	205,787,188	310,283,263	485,566,365
Asia	Asia	830,112,869	1,118,373,970	1,194,236,621	1,272,841,839	1,352,561,453	1,657,775,953	1,898,712,592	2,260,262,964	3,447,796,973	5,717,323,287	10,046,217,613
Asia	Europe	94,357,313	120,763,061	133,702,791	140,501,149	149,492,927	202,909,651	263,436,137	350,962,048	658,362,252	1,326,520,812	2,731,292,100
Asia	Mideast	551,618,152	662,116,141	633,952,983	602,978,048	657,938,526	664,269,853	653,802,950	701,817,129	880,261,725	1,202,217,564	1,751,641,316
Asia	North America	168,064,835	137,693,263	145,913,294	151,004,865	153,073,719	161,775,300	166,311,968	174,932,536	202,616,239	244,581,385	326,090,436
Asia	South America	89,516,396	111,935,984	123,243,619	136,868,118	149,287,911	180,175,047	204,838,012	239,349,423	345,386,758	533,970,901	880,592,267
Asia	Caribbean	1,748,122	1,866,386	2,129,800	2,272,467	2,431,359	3,474,472	4,211,059	5,130,192	7,388,277	10,719,037	15,607,710
Europe	Africa	174,787,782	210,918,747	246,398,810	252,792,731	256,339,051	273,083,816	270,805,279	275,011,643	290,526,369	312,884,425	340,286,312
Europe	Asia	98,467,002	141,446,301	166,540,668	173,876,750	181,964,611	203,689,723	214,748,996	229,160,795	268,601,172	328,863,897	424,160,492
Europe	Europe	438,571,984	552,209,847	621,310,371	634,647,887	651,516,950	736,910,196	771,183,663	814,607,020	926,963,664	1,081,261,133	1,287,257,309
Europe	Mideast	169,087,559	199,826,171	244,104,981	249,746,854	254,919,623	286,885,558	289,409,056	298,313,322	323,867,353	358,993,605	404,304,785
Europe	North America	116,359,650	94,357,459	88,265,861	90,912,101	94,106,603	98,282,364	97,895,952	100,317,496	107,833,688	119,793,550	137,499,173
Europe	South America	123,881,263	166,791,773	188,140,161	185,375,151	190,181,906	225,399,917	233,294,751	241,392,817	263,969,619	291,597,938	325,164,234
Europe	Caribbean	10,319,536	15,106,302	16,875,241	17,682,432	18,444,789	22,394,400	24,329,931	26,053,989	29,763,734	33,851,531	38,337,559
Mideast	Africa	15,964,486	27,993,726	28,611,237	29,637,624	31,224,288	40,834,093	43,343,251	47,676,548	60,070,612	77,964,999	104,142,452
Mideast	Asia	24,574,957	40,378,634	41,236,358	43,506,302	45,702,488	55,331,596	63,956,647	75,639,772	108,878,582	165,477,976	269,840,988
Mideast	Europe	55,837,663	93,700,659	100,972,535	106,934,682	112,374,690	140,012,009	162,197,865	190,939,726	267,972,895	381,434,152	553,016,850
Mideast	Mideast	42,295,785	56,535,021	58,412,028	60,299,301	61,396,153	65,761,444	67,657,100	74,502,725	94,400,128	126,253,725	175,204,151
Mideast	North America	9,784,617	7,141,269	7,315,863	7,559,351	7,887,963	9,524,833	10,414,314	11,433,056	13,806,034	16,575,365	19,764,212
Mideast	South America	12,873,829	23,105,036	23,508,853	24,249,901	25,371,146	31,376,200	34,152,389	38,007,357	48,316,209	61,734,037	78,142,615
Mideast	Caribbean	261,644	532,693	564,951	589,456	612,345	708,272	771,122	854,853	1,054,180	1,311,639	1,636,337
North America	Africa	22,096,850	28,294,330	32,280,099	37,185,274	40,556,192	52,640,486	55,809,605	57,806,795	62,877,530	69,112,430	76,416,329
North America	Asia	59,268,697	103,309,700	101,597,810	107,641,260	116,459,281	157,519,494	187,477,705	216,878,919	289,826,533	384,710,137	504,636,031
North America	Europe	59,763,537	98,703,985	111,082,832	120,701,969	128,340,979	158,481,350	179,362,071	198,590,515	247,213,675	311,360,084	392,517,396
North America	Mideast	5,530,958	11,140,093	13,490,306	15,040,114	16,198,402	19,920,109	22,161,903	24,272,021	29,380,744	35,887,998	43,954,308
North America	North America	133,578,195	175,414,217	208,938,211	227,360,830	237,075,625	270,595,095	289,423,256	303,132,407	337,121,983	379,242,435	433,893,400
North America	South America	144,736,642	188,742,510	201,087,815	220,354,069	235,088,652	277,068,374	303,303,956	323,704,532	374,388,270	439,630,681	522,046,966
North America	Caribbean	3,381,194	5,411,351	6,378,750	6,749,349	7,083,814	8,563,701	9,884,111	11,033,392	13,844,113	17,415,689	21,839,882
South America	Africa	7,352,106	12,404,419	15,762,403	16,509,515	17,281,858	20,366,812	22,121,008	23,531,827	26,696,272	30,350,741	34,593,543
South America	Asia	18,104,142	30,107,624	33,509,443	35,053,719	36,960,995	43,186,230	46,997,236	50,676,408	60,103,623	76,408,315	106,475,481
South America	Europe	16,239,675	19,819,191	24,347,217	26,043,025	27,681,782	36,136,170	40,854,986	45,229,569	54,983,435	66,943,951	82,152,203
South America	Mideast	14,770,972	11,652,107	14,556,779	13,450,090	13,427,695	13,155,081	12,885,760	13,271,997	14,443,072	16,032,074	18,003,658
South America	North America	37,002,408	36,518,821	40,054,102	41,745,697	42,957,909	49,042,574	53,411,507	57,701,122	67,989,103	82,022,131	101,103,903
South America	South America	46,188,044	63,572,443	72,463,289	74,385,473	77,867,282	92,356,073	100,912,055	109,931,425	131,447,530	159,977,375	200,493,079
South America	Caribbean	4,256,565	5,359,606	5,940,751	6,210,064	6,423,929	7,492,678	8,098,262	8,639,149	9,780,636	11,110,063	12,715,732
Caribbean	Africa	418,792	625,039	628,356	629,000	628,529	634,016	637,546	647,949	691,943	775,900	924,319
Caribbean	Asia	1,202,419	4,717,962	4,931,544	5,184,879	5,442,832	6,267,474	7,207,580	8,449,421	12,867,081	22,192,430	40,976,192
Caribbean	Europe	17,537,114	39,360,656	40,073,516	44,449,646	46,573,321	53,459,040	59,116,537	64,158,825	69,605,705	72,759,131	75,919,833
Caribbean	Mideast	713,247	1,113,130	1,124,840	1,195,249	1,235,473	1,327,840	1,409,629	1,499,104	1,666,235	1,899,862	2,300,824
Caribbean	North America	10,683,203	12,374,610	14,790,806	14,871,001	14,933,453	15,494,072	16,559,534	18,140,498	23,692,694	34,238,695	53,267,937
Caribbean	South America	23,990,571	53,968,628	53,627,164	56,387,578	59,331,838	80,567,147	119,979,603	199,611,959	572,140,801	1,502,706,269	3,801,402,272
Caribbean	Caribbean	8,376,600	11,531,370	11,478,597	12,005,891	12,426,882	14,732,134	17,284,982	20,976,955	33,750,358	58,960,972	107,418,436
Total		**3,816,381,917**	**4,928,636,115**	**5,310,314,649**	**5,575,497,817**	**5,801,007,291**	**6,754,204,846**	**7,396,209,616**	**8,350,059,549**	**11,431,504,060**	**17,212,411,148**	**28,368,402,479**
Average Annual Growth Rate			**5.25%**	**2.52%**	**4.99%**	**4.04%**	**3.09%**	**1.83%**	**2.46%**	**3.19%**	**4.18%**	**5.12%**

Table 1-8. Containerized World Commodity Forecast for all Commodities, Sorted by Origin, by Major Region, 1995-2050, Selected Years
(Metric Tonnes)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	2,474,462	3,213,048	3,376,790	3,473,708	3,551,520	4,003,242	4,573,477	5,718,471	10,191,732	20,591,039	45,597,326
Africa	Asia	1,892,668	2,960,890	3,221,246	3,388,523	3,592,101	4,566,118	5,576,150	7,001,502	11,559,063	20,178,055	36,611,711
Africa	Europe	4,336,969	5,940,507	7,161,032	7,346,194	7,535,650	8,311,190	8,879,570	9,417,855	10,754,439	12,470,050	14,699,406
Africa	Mideast	941,810	1,273,536	1,372,173	1,445,902	1,518,432	1,856,649	2,138,382	2,582,583	3,815,741	5,990,279	10,070,544
Africa	North America	327,030	571,612	696,310	751,047	813,100	1,003,799	1,128,656	1,246,182	1,529,706	1,870,638	2,276,751
Africa	South America	347,245	115,660	144,710	153,407	160,664	201,269	225,980	249,518	306,436	362,661	447,084
Africa	Caribbean	21,531	40,963	43,996	46,455	48,210	56,418	62,634	70,711	97,077	147,624	247,001
Asia	Africa	3,088,089	6,034,181	6,432,963	6,654,995	6,931,432	9,292,892	12,322,795	17,213,124	35,775,553	77,453,383	171,345,098
Asia	Asia	115,858,050	175,781,292	203,207,516	215,876,210	229,375,836	301,722,036	376,355,836	484,996,222	852,017,120	1,595,757,295	3,034,438,387
Asia	Europe	26,359,908	45,395,716	56,898,641	58,580,775	59,827,680	69,696,496	77,760,483	87,459,923	114,113,643	156,806,734	230,248,148
Asia	Mideast	8,044,587	12,430,793	12,956,284	13,699,906	14,426,518	18,376,184	22,060,992	27,574,269	45,629,194	81,479,443	155,367,629
Asia	North America	27,587,129	46,304,923	55,925,187	58,193,565	62,539,566	84,608,368	101,234,032	117,906,209	159,647,375	213,800,261	281,603,888
Asia	South America	2,349,835	3,703,420	4,466,996	4,815,618	5,151,690	7,035,463	8,402,615	10,172,935	15,832,816	27,091,622	50,815,569
Asia	Caribbean	639,564	1,161,295	1,192,523	1,253,420	1,316,480	1,735,213	2,395,662	3,387,497	7,158,913	15,388,229	32,358,848
Europe	Africa	10,677,015	12,470,444	13,060,935	13,889,636	14,636,676	19,150,020	22,753,825	26,784,241	36,909,017	51,622,499	74,607,491
Europe	Asia	23,422,247	29,923,994	34,101,556	36,012,424	38,271,954	51,697,400	65,344,098	85,754,716	157,923,404	312,755,877	638,813,047
Europe	Europe	45,605,245	61,098,182	71,307,555	73,477,146	75,897,831	88,598,259	98,093,047	108,367,893	133,914,988	170,661,002	225,216,359
Europe	Mideast	12,441,557	16,889,937	18,837,755	20,360,128	21,948,096	30,153,249	35,704,759	42,716,948	61,256,824	87,837,720	125,894,359
Europe	North America	13,628,875	21,832,926	23,433,737	24,733,752	26,765,317	34,079,315	38,965,596	43,392,965	55,385,249	70,888,393	90,466,708
Europe	South America	4,779,461	5,675,077	7,015,252	7,671,424	8,337,840	11,876,375	13,738,486	15,530,335	19,627,670	24,705,205	31,103,672
Europe	Caribbean	2,190,274	2,207,322	2,288,428	2,443,497	2,580,271	3,162,721	3,362,084	3,553,048	3,938,117	4,442,219	5,212,204
Mideast	Africa	1,167,717	2,167,002	2,251,599	2,391,455	2,535,809	3,604,249	5,133,080	7,717,551	17,749,964	40,988,028	91,457,363
Mideast	Asia	3,535,366	5,484,639	5,996,597	6,304,669	6,560,693	7,975,394	9,760,332	12,327,559	21,356,097	39,377,030	71,627,578
Mideast	Europe	5,280,846	8,511,953	9,905,068	10,426,318	10,945,924	12,036,663	14,675,891	16,461,215	20,903,608	27,355,945	37,715,556
Mideast	Mideast	4,869,459	7,200,602	7,641,882	8,117,473	8,604,497	10,985,883	12,968,542	15,840,547	24,790,791	41,356,535	68,680,044
Mideast	North America	652,531	1,182,653	1,448,274	1,596,208	1,766,142	2,234,000	2,580,478	2,934,090	3,786,505	4,858,808	6,178,539
Mideast	South America	129,506	221,611	277,636	292,832	309,332	392,572	438,882	485,073	596,202	759,637	1,040,772
Mideast	Caribbean	26,764	71,317	74,141	77,923	81,040	91,923	101,437	114,431	161,058	262,183	490,818
North America	Africa	667,931	553,740	644,999	643,981	649,774	769,086	913,669	1,153,605	2,053,009	4,094,471	8,919,236
North America	Asia	39,450,592	56,971,982	44,297,457	45,933,185	46,566,616	50,088,870	53,336,781	58,896,840	75,871,102	106,033,723	161,046,773
North America	Europe	13,260,314	14,307,089	15,566,287	16,028,802	16,354,248	17,264,777	18,301,901	19,725,794	23,367,519	28,550,599	36,228,516
North America	Mideast	1,039,273	1,386,259	1,625,053	1,669,416	1,689,721	2,054,165	2,274,927	2,519,891	3,089,383	3,775,407	4,587,414
North America	North America	915,364	1,481,709	2,319,919	2,451,494	2,564,711	3,224,188	3,678,078	4,115,582	5,103,339	6,265,706	7,610,101
North America	South America	7,657,465	7,973,009	7,904,649	8,284,607	8,499,900	10,031,440	11,188,407	12,464,141	16,000,637	21,498,121	29,428,521
North America	Caribbean	2,104,018	2,780,587	3,210,012	3,381,648	3,542,289	4,421,405	5,576,838	7,080,471	12,291,353	22,584,006	41,737,104
South America	Africa	476,801	658,631	686,646	716,026	731,189	881,104	1,022,005	1,213,838	1,847,195	3,117,232	5,918,715
South America	Asia	4,789,821	5,513,544	6,290,797	6,585,070	6,827,716	8,315,940	9,582,174	11,516,373	17,993,039	31,155,276	58,691,218
South America	Europe	7,526,027	9,977,116	12,575,320	13,078,592	13,481,176	15,939,507	17,098,291	17,564,540	20,425,528	24,477,897	31,115,685
South America	Mideast	985,393	1,642,410	1,732,073	1,835,807	1,952,052	2,483,955	2,876,780	3,422,898	5,081,265	7,789,459	11,767,760
South America	North America	4,766,716	7,634,131	11,467,719	11,940,004	12,558,142	15,572,475	17,645,952	19,620,599	24,368,998	30,271,096	37,073,079
South America	South America	4,587,595	6,806,509	8,291,400	8,810,733	9,370,967	12,436,508	14,382,577	16,604,420	22,465,121	31,405,336	45,704,374
South America	Caribbean	1,175,465	2,130,322	2,175,683	2,315,459	2,446,002	3,198,349	4,119,047	5,529,354	10,841,830	22,559,981	47,443,132
Caribbean	Africa	28,169	49,880	51,663	52,923	53,933	62,643	76,373	103,173	217,118	494,189	1,072,726
Caribbean	Asia	192,712	270,947	309,621	313,450	315,187	372,456	393,191	425,337	540,134	714,546	1,043,444
Caribbean	Europe	1,158,457	1,379,305	1,692,923	1,771,521	1,826,302	1,962,056	2,057,694	2,150,786	2,365,698	2,671,238	3,136,545
Caribbean	Mideast	62,459	122,170	132,200	133,075	135,090	138,478	140,484	152,809	183,907	237,004	316,688
Caribbean	North America	612,129	1,454,979	1,688,319	1,735,700	1,800,413	1,926,314	2,107,976	2,279,042	2,720,501	3,299,595	4,035,481
Caribbean	South America	537,945	854,158	1,006,848	1,058,668	1,101,269	1,316,569	1,420,760	1,528,383	1,753,905	2,030,929	2,405,267
Caribbean	Caribbean	953,394	2,016,072	2,053,868	2,180,321	2,297,677	2,964,826	3,775,541	4,991,092	9,546,754	19,099,246	37,458,686
Total		**415,903,802**	**585,779,045**	**680,466,339**	**714,406,073**	**750,794,332**	**944,828,009**	**1,118,704,744**	**1,350,216,056**	**2,084,839,637**	**3,479,383,450**	**6,112,163,178**
Average Annual Growth Rate			**7.09%**	**5.12%**	**4.99%**	**5.09%**	**4.70%**	**3.44%**	**3.83%**	**4.44%**	**5.26%**	**5.80%**

Table 1-9. Containerized World Commodity Forecast for all Commodities, Sorted by Destination, by Major Region, 1995-2050, Selected Years
(Metric Tonnes)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	2,474,462	3,213,048	3,376,790	3,478,708	3,551,520	4,003,242	4,573,477	5,718,471	10,191,732	20,591,039	45,597,326
Africa	Asia	3,088,089	6,034,181	6,432,963	6,634,995	6,931,432	9,292,892	12,325,295	17,215,124	35,775,353	77,453,583	171,543,098
Africa	Europe	10,677,015	12,470,444	13,060,935	13,889,636	14,636,676	19,150,020	22,753,825	26,784,241	36,909,017	51,622,499	74,607,491
Africa	Mideast	1,167,717	2,167,002	2,251,599	2,391,455	2,535,809	3,604,249	5,133,080	7,717,551	17,749,964	40,988,028	91,457,363
Africa	North America	667,933	553,740	644,999	643,981	649,774	769,086	913,669	1,153,605	2,053,009	4,094,471	8,919,236
Africa	South America	476,801	658,631	686,646	716,026	731,189	881,104	1,022,005	1,213,838	1,847,195	3,117,232	5,918,715
Africa	South America	28,169	49,880	51,663	52,923	53,933	62,643	76,373	103,173	217,118	494,189	1,072,726
Asia	Africa	1,892,668	2,909,890	3,221,246	3,388,523	3,592,101	4,566,118	5,576,150	7,001,502	11,559,063	20,178,055	36,611,711
Asia	Asia	135,858,050	175,781,202	203,207,516	215,876,210	229,375,536	301,722,036	376,355,836	484,996,222	852,017,120	1,595,757,293	3,034,438,337
Asia	Europe	23,422,247	29,923,994	34,101,556	36,012,424	38,271,954	51,697,400	65,344,098	85,734,716	157,923,404	312,755,877	638,813,047
Asia	Mideast	3,535,366	5,484,639	5,996,597	6,304,669	6,560,693	7,975,394	9,760,332	12,327,559	21,356,097	39,377,030	71,627,578
Asia	North America	39,430,592	36,971,982	44,297,457	45,933,185	46,566,616	50,088,870	55,336,781	58,896,340	75,871,102	106,033,723	161,046,773
Asia	South America	4,789,821	5,513,544	6,200,797	6,585,070	6,827,716	8,315,940	9,582,174	11,516,372	17,993,039	31,155,276	58,691,218
Asia	South America	192,712	270,947	309,621	313,430	315,187	372,456	393,191	425,337	530,134	714,546	1,043,444
Europe	Africa	4,336,969	5,940,507	7,161,032	7,348,194	7,535,650	8,311,190	8,879,570	9,417,853	10,754,439	12,470,050	14,690,406
Europe	Asia	26,359,908	45,395,716	56,898,641	58,580,775	59,827,680	69,696,496	77,760,483	87,459,923	114,113,643	156,806,734	230,248,148
Europe	Europe	45,605,245	61,098,182	71,307,355	73,477,146	75,897,831	88,598,259	98,093,047	108,367,883	133,914,988	170,661,002	225,216,359
Europe	Mideast	5,280,846	8,311,953	9,905,068	10,426,318	10,945,924	12,936,663	14,675,891	16,461,215	20,903,608	27,355,945	37,715,556
Europe	North America	13,260,314	14,507,089	15,566,287	16,028,802	16,354,248	17,264,777	18,301,901	19,723,794	23,367,519	28,550,599	36,228,516
Europe	South America	7,526,027	9,977,116	12,575,320	13,078,592	13,481,176	15,939,507	17,698,291	17,564,540	20,425,528	24,477,897	31,115,685
Europe	South America	1,158,457	1,379,305	1,692,923	1,771,521	1,826,302	1,962,656	2,057,694	2,150,786	2,365,698	2,671,238	3,136,545
Mideast	Africa	941,810	1,273,536	1,372,173	1,445,902	1,518,432	1,856,049	2,138,382	2,582,583	3,815,741	5,990,279	10,070,544
Mideast	Asia	8,044,587	12,430,793	12,956,284	13,699,906	14,426,518	18,376,184	22,060,992	27,574,269	48,629,194	81,479,443	155,367,629
Mideast	Europe	12,441,557	16,889,937	18,837,755	20,360,128	21,948,096	30,153,549	35,704,759	42,716,948	61,256,824	87,837,720	125,894,359
Mideast	Mideast	4,869,459	7,200,602	7,641,882	8,117,473	8,604,497	10,985,883	12,968,542	15,840,547	24,790,791	41,356,335	68,680,044
Mideast	North America	1,039,273	1,386,259	1,625,055	1,669,416	1,689,721	2,054,105	2,274,927	2,519,891	3,089,383	3,775,407	4,587,414
Mideast	South America	985,393	1,642,410	1,732,073	1,835,807	1,952,052	2,483,955	2,876,780	3,422,898	5,081,265	7,789,459	11,767,760
Mideast	South America	62,459	122,170	132,200	133,075	135,090	138,478	140,484	152,802	183,907	237,004	316,688
North America	Africa	327,030	571,612	696,310	751,047	813,100	1,003,799	1,128,656	1,246,182	1,529,706	1,870,638	2,276,751
North America	Asia	27,587,129	46,304,923	55,925,187	58,193,565	62,539,566	84,608,568	101,234,032	117,906,209	159,647,375	215,800,261	281,603,888
North America	Europe	13,928,875	21,832,936	23,433,737	24,733,752	26,765,317	34,079,515	38,965,596	43,592,963	55,385,249	70,888,393	90,466,708
North America	Mideast	652,531	1,182,633	1,448,274	1,596,208	1,760,142	2,234,000	2,580,478	2,934,090	3,786,505	4,858,809	6,178,339
North America	North America	915,384	1,481,709	2,319,919	2,451,494	2,564,711	3,224,188	3,678,078	4,115,582	5,103,339	6,265,706	7,610,161
North America	South America	4,766,716	7,634,131	11,467,719	11,949,004	12,558,142	15,572,475	17,643,952	19,620,599	24,368,998	30,271,096	37,673,079
North America	South America	612,129	1,454,979	1,688,819	1,735,700	1,800,413	1,926,314	2,107,976	2,279,042	2,720,501	3,299,595	4,035,481
South America	Africa	347,245	115,660	144,710	153,407	160,664	201,269	225,980	249,518	300,436	362,561	447,084
South America	Asia	2,349,835	3,703,420	4,466,996	4,815,618	5,151,650	7,035,463	8,402,615	10,172,933	15,832,816	27,091,622	50,815,569
South America	Europe	4,779,461	5,675,077	7,015,252	7,671,424	8,337,840	11,876,375	13,738,486	15,530,335	19,627,670	24,705,205	31,103,672
South America	Mideast	129,506	221,611	277,636	292,832	309,332	392,572	438,882	485,073	596,202	759,637	1,040,772
South America	North America	7,657,465	7,973,009	7,904,649	8,284,607	8,499,900	10,031,440	11,188,407	12,464,141	16,000,637	21,498,121	29,428,521
South America	South America	4,587,595	6,806,509	8,291,400	8,810,733	9,370,967	12,436,808	14,382,577	16,604,420	22,465,121	31,405,336	45,704,374
South America	South America	537,945	854,158	1,006,848	1,058,666	1,101,269	1,316,569	1,420,760	1,528,383	1,753,905	2,030,929	2,405,267
South America	Africa	21,531	40,963	43,996	46,455	48,210	56,418	62,634	70,711	97,077	147,624	247,001
South America	Asia	639,564	1,161,295	1,192,323	1,253,420	1,316,480	1,735,213	2,395,662	3,387,497	7,158,913	15,388,229	32,558,848
South America	Europe	2,190,274	2,207,322	2,288,428	2,443,497	2,580,271	3,162,721	3,362,084	3,553,048	3,938,117	4,442,219	5,212,204
South America	Mideast	26,764	71,317	74,141	77,923	81,040	91,923	101,437	114,431	161,058	262,183	490,818
South America	North America	2,104,018	2,780,587	3,216,012	3,381,648	3,542,289	4,421,405	5,576,838	7,080,471	12,291,353	22,584,006	41,737,104
South America	South America	1,175,465	2,130,322	2,175,683	2,315,459	2,446,003	3,198,349	4,119,047	5,529,354	10,841,830	22,559,981	47,443,152
South America	South America	953,394	2,016,072	2,053,868	2,180,321	2,297,677	2,964,826	3,775,541	4,991,092	9,546,754	19,099,246	37,458,686
Total		**415,903,802**	**585,779,045**	**680,466,339**	**714,406,073**	**750,794,332**	**944,828,009**	**1,118,704,744**	**1,350,216,056**	**2,084,839,637**	**3,479,383,450**	**6,112,163,178**
Average Annual Growth Rate			**7.09%**	**5.12%**	**4.99%**	**5.09%**	**4.70%**	**3.44%**	**3.83%**	**4.44%**	**5.26%**	**5.80%**

Table 1-10. Containerized World Commodity Forecast for all Commodities, Sorted by Origin, by Major Region, 1995-2050, Selected Years
(TEUs)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	211,943	273,353	285,859	294,968	302,619	345,690	395,141	493,191	874,579	1,758,140	3,868,028
Africa	Asia	150,665	230,294	255,274	267,992	283,645	361,725	440,843	553,156	916,316	1,613,705	2,961,716
Africa	Europe	409,041	581,103	707,010	725,859	743,229	817,467	875,853	931,963	1,076,240	1,264,689	1,508,433
Africa	Mideast	82,105	111,403	119,845	126,351	132,777	162,545	186,950	225,359	332,255	520,576	872,043
Africa	North America	27,712	49,513	77,010	83,168	90,877	118,308	135,195	148,827	184,022	221,764	267,695
Africa	South America	29,912	10,512	15,177	13,982	14,668	18,542	20,868	23,087	27,903	33,935	42,495
Africa	Caribbean	1,935	3,877	4,155	4,403	4,589	5,453	6,039	6,793	9,259	13,965	23,053
Asia	Africa	309,636	567,351	599,350	618,449	645,061	881,369	1,201,306	1,736,061	3,817,707	8,584,533	19,467,464
Asia	Asia	13,173,210	19,976,221	22,081,778	24,403,160	25,845,049	34,223,230	42,764,231	55,281,685	97,774,721	183,913,722	347,757,385
Asia	Europe	3,584,347	6,273,458	7,830,453	8,039,602	8,213,759	9,710,127	10,941,238	12,427,261	16,626,620	23,505,254	35,647,458
Asia	Mideast	1,034,303	1,548,868	1,605,255	1,697,581	1,791,456	2,307,932	2,802,970	3,553,775	6,084,820	11,230,701	22,045,903
Asia	North America	3,843,635	6,801,526	8,949,767	9,327,872	10,040,316	13,779,467	16,457,973	19,215,082	26,120,288	35,065,417	46,195,584
Asia	South America	333,869	500,527	596,892	643,345	690,617	959,427	1,151,339	1,396,445	2,179,858	3,724,561	6,952,992
Asia	Caribbean	80,892	142,759	144,888	152,750	161,239	218,991	319,581	449,139	977,402	2,132,790	4,533,282
Europe	Africa	968,021	1,155,312	1,202,109	1,281,211	1,355,866	1,806,769	2,161,706	2,552,643	3,538,557	4,976,825	7,221,579
Europe	Asia	2,684,122	3,393,464	3,850,026	4,069,864	4,331,414	5,902,173	7,492,387	9,873,564	18,321,955	36,366,845	74,151,269
Europe	Europe	4,287,873	5,988,423	7,005,258	7,250,437	7,533,863	8,988,787	10,094,705	11,295,620	14,310,935	18,659,025	25,094,197
Europe	Mideast	1,211,442	1,669,081	1,850,615	2,008,076	2,174,982	3,035,648	3,616,417	4,347,245	6,295,095	9,118,254	13,189,503
Europe	North America	1,366,085	2,341,880	2,754,276	2,886,693	3,105,584	3,990,915	4,599,473	5,184,189	6,661,566	8,581,549	10,970,931
Europe	South America	487,886	598,637	737,394	810,605	886,152	1,288,488	1,698,946	1,699,121	2,160,207	2,734,363	3,458,230
Europe	Caribbean	217,987	223,964	230,483	247,352	262,678	328,642	350,338	370,921	413,247	468,542	550,282
Mideast	Africa	102,197	188,910	195,815	207,595	220,033	310,959	441,774	663,578	1,527,660	3,534,332	7,899,605
Mideast	Asia	362,109	572,516	624,404	656,964	684,431	837,379	1,026,021	1,298,471	2,257,470	4,169,143	7,573,623
Mideast	Europe	523,922	852,180	1,000,619	1,057,859	1,114,997	1,846,604	1,544,029	1,749,219	2,268,986	3,034,457	4,269,202
Mideast	Mideast	457,431	684,572	726,392	771,966	819,124	1,048,917	1,240,887	1,516,926	2,376,204	3,966,421	6,622,557
Mideast	North America	76,168	144,809	199,982	218,342	239,432	298,904	347,689	395,980	526,727	699,363	918,809
Mideast	South America	13,167	21,954	27,175	28,734	30,371	38,611	43,164	47,723	58,771	75,172	103,510
Mideast	Caribbean	2,684	6,841	7,105	7,494	7,856	9,049	10,066	11,471	16,609	27,909	53,846
North America	Africa	59,120	53,533	63,431	63,677	64,493	75,085	87,580	107,793	183,324	353,583	784,045
North America	Asia	3,775,267	3,586,181	4,532,811	4,699,748	4,760,613	5,105,829	5,461,351	6,066,559	7,949,128	11,404,531	17,834,683
North America	Europe	1,331,149	1,492,684	1,736,931	1,793,581	1,833,805	1,994,851	2,148,798	2,339,190	2,830,105	3,535,675	4,591,569
North America	Mideast	101,196	133,104	158,883	163,400	167,511	202,562	223,713	247,790	303,724	371,162	452,095
North America	North America	78,191	140,365	431,074	450,829	478,091	607,365	683,572	760,057	929,950	1,127,815	1,356,231
North America	South America	785,929	839,523	819,583	861,599	884,301	1,043,790	1,166,433	1,297,618	1,658,007	2,216,176	3,061,292
North America	Caribbean	232,594	335,278	405,205	428,905	453,200	594,343	792,354	1,054,069	1,985,399	3,870,237	7,448,769
South America	Africa	40,468	55,081	57,535	59,885	61,227	74,095	85,718	101,230	151,165	248,493	458,401
South America	Asia	420,123	480,304	552,854	576,441	596,633	727,037	837,434	1,007,559	1,577,759	2,730,600	5,170,057
South America	Europe	703,214	940,148	1,191,972	1,244,537	1,288,407	1,553,657	1,676,825	1,728,379	2,034,577	2,466,409	3,162,815
South America	Mideast	90,193	148,856	157,412	166,726	177,164	225,234	256,598	302,386	437,203	651,283	961,737
South America	North America	438,219	716,030	1,671,683	1,734,654	1,826,293	2,212,172	2,442,093	2,707,052	3,359,515	4,207,263	5,302,882
South America	South America	445,188	664,436	810,291	861,977	917,740	1,222,941	1,418,486	1,642,654	2,242,279	3,182,414	4,756,856
South America	Caribbean	115,422	209,086	213,135	226,736	239,628	313,229	400,103	532,466	1,029,213	2,116,342	4,386,198
Caribbean	Africa	2,367	4,471	4,647	4,753	4,838	5,389	6,841	9,331	20,014	46,133	101,031
Caribbean	Asia	17,309	23,633	26,888	27,147	27,422	32,574	34,621	37,734	47,880	65,974	98,811
Caribbean	Europe	105,059	124,638	153,969	160,943	165,278	178,607	187,559	196,966	219,161	250,357	296,640
Caribbean	Mideast	5,819	11,867	12,844	12,955	13,179	13,572	13,801	15,026	18,243	23,902	32,844
Caribbean	North America	94,721	212,906	269,826	279,818	294,217	337,673	380,365	422,673	528,325	658,388	814,279
Caribbean	South America	50,693	70,890	94,153	99,072	103,105	124,193	135,347	146,741	171,250	202,574	247,223
Caribbean	Caribbean	94,207	197,477	200,980	213,537	225,420	293,467	377,496	505,281	986,410	2,005,663	3,983,664
Total		**45,020,247**	**65,360,809**	**78,168,449**	**82,033,595**	**86,309,191**	**110,077,980**	**130,976,208**	**158,681,047**	**246,398,624**	**411,739,926**	**719,492,679**
Average Annual Growth Rate			**7.74%**	**6.15%**	**4.94%**	**5.21%**	**4.99%**	**3.54%**	**3.91%**	**4.50%**	**5.27%**	**5.74%**

Table 1-11. Containerized World Commodity Forecast for all Commodities, Sorted by Destination, by Major Region, 1995-2050, Selected Years
(TEUs)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	211,943	273,353	285,859	294,968	302,619	345,690	395,141	493,191	874,579	1,758,140	3,868,028
Africa	Asia	309,636	567,351	599,350	618,449	645,061	881,369	1,201,306	1,736,061	3,817,707	8,584,533	19,467,464
Africa	Europe	968,021	1,155,312	1,202,109	1,281,211	1,355,806	1,806,769	2,161,796	2,552,641	3,538,557	4,976,825	7,221,379
Africa	Mideast	102,197	188,910	195,813	207,595	220,033	310,959	441,774	663,578	1,527,660	3,534,332	7,899,605
Africa	North America	59,120	51,535	63,431	63,677	64,493	75,085	87,580	107,793	183,324	353,583	754,045
Africa	South America	40,468	55,081	57,535	59,885	61,227	74,093	85,718	101,230	151,165	248,493	458,401
Africa	Caribbean	2,867	4,471	4,647	4,753	4,838	5,589	6,841	9,331	20,014	46,135	101,031
Asia	Africa	150,665	230,294	255,274	267,992	283,645	361,725	440,843	553,156	916,316	1,613,705	2,961,716
Asia	Asia	13,173,210	19,976,221	22,981,778	24,403,160	25,845,049	34,223,230	42,764,231	55,281,685	97,774,721	183,913,722	347,757,385
Asia	Europe	2,684,122	3,293,464	3,850,026	4,069,864	4,331,414	5,902,173	7,492,387	9,877,564	18,321,955	36,366,845	74,151,266
Asia	Mideast	362,109	572,516	624,404	656,964	684,431	837,379	1,026,021	1,298,471	2,257,470	4,169,143	7,573,623
Asia	North America	3,775,267	3,586,181	4,552,811	4,699,748	4,760,613	5,105,829	5,461,351	6,066,559	7,949,128	11,404,531	17,834,683
Asia	South America	420,123	480,304	552,834	576,441	596,633	727,037	837,434	1,007,559	1,577,759	2,739,600	5,170,057
Asia	Caribbean	17,509	23,633	26,888	27,147	27,422	32,574	34,621	37,734	47,880	65,974	98,811
Europe	Africa	409,041	581,103	707,010	725,859	743,229	817,467	875,853	931,963	1,076,249	1,264,689	1,508,433
Europe	Asia	3,584,347	6,273,458	7,830,453	8,039,602	8,213,759	9,710,127	10,941,238	12,427,261	16,626,620	23,505,254	35,647,458
Europe	Europe	4,287,373	5,988,423	7,005,258	7,250,437	7,533,863	8,988,787	10,094,705	11,295,620	14,310,935	18,659,025	25,094,197
Europe	Mideast	523,922	852,180	1,000,619	1,057,859	1,114,997	1,346,604	1,544,029	1,749,219	2,268,986	3,034,457	4,269,282
Europe	North America	1,331,149	1,492,084	1,736,931	1,793,581	1,833,805	1,994,851	2,148,798	2,339,190	2,830,105	3,535,675	4,591,369
Europe	South America	705,214	940,148	1,191,972	1,244,537	1,288,407	1,553,637	1,676,825	1,728,379	2,034,577	2,466,409	3,162,815
Europe	Caribbean	105,059	124,638	153,969	160,945	165,278	178,607	187,559	196,906	219,161	250,357	296,640
Mideast	Africa	82,105	111,403	119,845	126,351	132,777	162,545	186,950	225,359	332,255	520,576	872,043
Mideast	Asia	1,034,303	1,548,868	1,605,255	1,697,581	1,791,456	2,307,932	2,802,970	3,553,775	6,084,820	11,230,701	22,045,905
Mideast	Europe	1,211,442	1,669,081	1,850,615	2,008,076	2,174,982	3,035,648	3,616,417	4,347,245	6,295,095	9,118,254	13,189,305
Mideast	Mideast	457,431	684,572	726,392	771,966	819,124	1,048,917	1,240,887	1,516,926	2,376,204	3,966,421	6,622,357
Mideast	North America	101,196	133,104	158,853	163,400	167,511	202,562	223,713	247,790	303,724	371,162	452,095
Mideast	South America	90,193	148,856	157,412	166,726	177,164	223,234	256,598	302,386	437,203	681,283	961,737
Mideast	Caribbean	5,819	11,867	12,844	12,955	13,179	13,572	13,801	15,026	18,243	23,902	32,844
North America	Africa	27,712	49,513	77,010	83,168	90,877	118,308	135,195	148,827	184,022	221,764	267,696
North America	Asia	3,843,655	6,801,526	8,949,767	9,327,872	10,040,316	13,779,467	16,457,973	19,215,082	26,120,288	35,065,417	46,195,584
North America	Europe	1,366,085	2,341,880	2,754,276	2,886,693	3,105,584	3,990,913	4,599,473	5,184,189	6,661,566	8,581,549	10,970,931
North America	Mideast	76,168	144,809	199,082	218,342	239,432	298,904	347,689	395,980	526,727	699,363	918,809
North America	North America	78,191	140,365	431,074	450,829	478,091	607,365	683,572	760,057	929,950	1,127,815	1,356,231
North America	South America	438,219	716,039	1,671,683	1,734,654	1,826,293	2,212,172	2,442,993	2,707,052	3,359,515	4,207,263	5,302,882
North America	Caribbean	94,731	212,906	269,826	279,818	294,217	337,673	380,365	422,673	528,325	658,388	814,279
South America	Africa	29,912	10,512	13,177	13,982	14,668	18,542	20,868	23,087	27,903	33,935	42,495
South America	Asia	333,869	500,527	596,892	643,345	690,617	959,427	1,151,339	1,396,445	2,179,858	3,724,561	6,952,992
South America	Europe	487,886	598,637	737,394	810,605	886,152	1,288,488	1,498,946	1,699,121	2,160,207	2,734,363	3,458,230
South America	Mideast	13,167	21,954	27,173	28,734	30,371	38,611	43,164	47,723	58,771	75,172	103,510
South America	North America	785,929	839,523	819,583	861,599	884,301	1,043,790	1,166,433	1,297,618	1,658,007	2,216,176	3,061,292
South America	South America	445,188	664,436	810,291	861,977	917,740	1,222,941	1,418,486	1,642,654	2,242,279	3,182,414	4,756,856
South America	Caribbean	50,693	79,890	94,153	99,072	103,105	124,193	135,347	146,741	171,250	202,574	247,223
Caribbean	Africa	1,935	3,877	4,155	4,403	4,589	5,453	6,039	6,793	9,259	13,965	23,053
Caribbean	Asia	80,892	142,759	144,688	152,750	161,239	218,991	310,581	449,139	977,402	2,152,790	4,533,282
Caribbean	Europe	217,987	223,964	230,483	247,352	262,678	328,642	350,338	370,921	413,347	468,542	550,282
Caribbean	Mideast	2,684	6,841	7,105	7,494	7,856	9,049	10,066	11,471	16,609	27,909	53,846
Caribbean	North America	232,594	335,278	405,205	428,903	453,200	594,343	792,354	1,054,069	1,985,399	3,870,237	7,448,769
Caribbean	South America	115,422	209,086	213,139	226,756	239,628	313,229	400,103	532,466	1,029,215	2,116,342	4,386,198
Caribbean	Caribbean	94,207	197,477	200,980	213,537	225,420	293,467	377,496	505,281	986,410	2,005,663	3,983,664
Total		**45,020,247**	**65,360,809**	**78,168,449**	**82,033,595**	**86,309,191**	**110,077,980**	**130,976,208**	**158,681,047**	**246,398,624**	**411,739,926**	**719,492,679**
Average Annual Growth Rate			**7.74%**	**6.15%**	**4.94%**	**5.21%**	**4.99%**	**3.54%**	**3.91%**	**4.50%**	**5.27%**	**5.74%**

in 1995 to 7.830 million TEUs in 2003. Similarly for North America (principally the U.S.), Asia's export TEUs increased from 3.843 million in 1995 to 8.949 million in 2003. The projected growth of Asian exports after 2003 is diminished for Europe but continues for North America (see Table 1-10).

The average annual compound growth rates of world trade are depicted for individual commodity groups and all commodities in tables 1-12, 1-13 and 1-14 for the periods 1995-2000, 2000-2003, 2003-2004, 2004-2005, 2005-2010, 2010-2015, 2015-2020, 2020-2030, 2030-2040, and 2040-2050. The growth rates are shown for imports/exports for all commodities, containerized commodities, and TEUs. For all commodities (see Table 1-12), world trade (imports and exports) measured in metric tonnes grew at an average annual rate of 5.25 percent between 1995 and 2000. Between 2000 and 2003, world trade (metric tonnes) grew at an average annual rate of 2.52 percent. World trade (all commodities) is projected to grow 4.99 percent between 2003 and 2004 and decrease to 4.04 percent between 2004 and 2005. Trade growth decreases to 3.09 percent between 2005 and 2010 and then declines further to 1.83 percent between 2010 and 2015 before increasing after 2015.

World trade growth of TEUs is higher than for all commodities (see Table 1-14). World annual TEUs grew 7.74 percent between 1995 and 2000 and 6.15 percent between 2000 and 2003. World annual TEUs are projected to grow 4.94 percent between 2003 and 2004, increase to 5.21 percent between 2004 and 2005, then decrease to 4.99 percent between 2005 and 2010. Average annual world growth of TEUs is 3.53 percent between 2010 and 2015, then increases for the duration of the forecast intervals: 2015-2020 (3.91 percent), 2020-2030 (4.50 percent), 2030-2040 (5.27 percent), and 2040-2050 (5.74 percent).

Asia, principally China, is a major driver of the forecasts, particularly for containerized commodities and TEUs. The largest TEU market in 2003 was intra-Asia trade (see Table 1-11, "Asia to Asia"). In 2003, there were 22.981 million TEUs of intra-Asian trade compared to 7.830 million TEUs of Asia exports to Europe and 8.949 million TEUs of Asia exports to North America. Intra-Asian trade in TEUs in 2003 was nearly 30 percent of total world trade (78.168 million TEUs).

World trade in TEUs is projected to grow approximately 41 percent, from 78.168 million TEUs in 2003 to 110.078 million TEUs by 2010 (see Table 1-11). During this time, intra-Asian trade will grow approximately 49 percent, from 22.981 million TEUs to 34.223 million TEUs. Exports from Asia to Europe will grow 24 percent, from 7.830 million TEUs to 9.710 million TEUs. Exports from Asia to North America will grow 54 percent, from 8.949 million TEUs to 13.779 million TEUs. The three largest markets in Table 1-11 (intra-Asian trade, Asia to Europe, and Asia to North America) increase by approximately 18 million TEUs between 2003 and 2010. Total world trade increases nearly 32 million TEUs in the same period (111.077 – 78.168 = 31.91 million TEUs).

The long-term importance of Asia, primarily China, as the economic engine for world trade is suggested by the latter years of forecasts in Table 1-11. Total world trade in TEUs rises 56 percent from 158.681 million in 2020 to 246.398 million in 2030, then rises 67 percent from 246.398 million in 2030 to 411.739 million in 2040, and then rises 75 percent from 411.739

Table 1-12. Growth Rate of World Commodity Forecast, by Major Commodity, 1995-2050 (Percent Change Per Period)

Major Commodity	1995-2000	2000-03	2003-04	2004-05	2005-10	2010-15	2015-20	2020-30	2030-40	2040-50
Agriculture	5.86%	1.69%	5.53%	3.97%	3.11%	2.01%	1.60%	1.90%	1.90%	2.39%
Capital Equipment	6.56%	5.05%	8.28%	8.67%	6.93%	4.24%	4.07%	4.41%	4.96%	4.81%
Chemicals	6.44%	4.50%	3.87%	4.13%	3.98%	3.23%	3.52%	4.33%	5.43%	6.25%
Consumer Goods	11.36%	7.24%	4.96%	6.19%	6.05%	3.15%	3.33%	3.57%	3.85%	4.22%
Extractive	4.65%	1.96%	4.90%	3.39%	2.12%	0.54%	1.48%	2.35%	3.55%	4.85%
Food	4.99%	3.13%	5.60%	5.12%	4.63%	2.14%	2.23%	2.32%	2.50%	2.78%
Fuels	5.85%	2.26%	4.01%	3.68%	3.22%	2.87%	2.98%	3.45%	4.11%	4.72%
High-tech Products	11.20%	0.95%	8.67%	9.42%	9.31%	6.28%	5.90%	5.83%	5.98%	5.98%
Intermediate Manufactured Products	6.51%	3.35%	7.41%	7.99%	6.50%	5.16%	4.99%	5.21%	5.73%	6.13%
Materials	6.44%	6.07%	2.16%	1.26%	1.40%	1.68%	3.19%	4.03%	5.15%	6.10%
All Commodities	**5.25%**	**2.52%**	**4.99%**	**4.04%**	**3.09%**	**1.83%**	**2.46%**	**3.19%**	**4.18%**	**5.12%**

Table 1-13. Growth Rate in Metric Tonnes of World Containerized Commodity Forecast, by Major Commodity, 1995-2050 (Percent Change Per Period)

Major Commodity	1995-2000	2000-03	2003-04	2004-05	2005-10	2010-15	2015-20	2020-30	2030-40	2040-50
Agriculture	5.04%	3.61%	3.79%	2.38%	2.70%	1.72%	1.72%	2.27%	2.82%	3.29%
Capital Equipment	6.23%	4.85%	8.73%	9.30%	8.00%	5.05%	4.91%	5.22%	5.73%	5.20%
Chemicals	8.82%	5.51%	5.68%	5.66%	5.44%	4.34%	4.69%	5.42%	6.30%	6.82%
Consumer Goods	11.24%	5.88%	4.81%	5.76%	5.84%	3.08%	3.30%	3.58%	3.91%	4.33%
Extractive	4.08%	3.28%	3.99%	2.98%	1.72%	0.41%	1.12%	1.78%	2.69%	3.77%
Food	5.09%	3.97%	3.57%	3.75%	2.92%	1.49%	1.82%	2.11%	2.57%	3.08%
Fuels	5.31%	11.43%	3.71%	4.01%	3.42%	3.06%	3.29%	3.93%	4.80%	5.51%
High-tech Products	10.96%	0.18%	8.83%	9.39%	9.28%	6.29%	5.95%	5.90%	6.07%	6.06%
Intermediate Manufactured Products	7.77%	5.94%	6.68%	7.58%	6.02%	4.63%	4.70%	5.08%	5.67%	6.14%
Materials	7.07%	6.48%	2.53%	1.75%	2.49%	2.34%	3.55%	4.45%	5.57%	6.39%
All Commodities	**7.09%**	**5.12%**	**4.99%**	**5.09%**	**4.70%**	**3.44%**	**3.83%**	**4.44%**	**5.26%**	**5.80%**

Table 1-14. Growth Rate in TEUs of World Containerized Commodity Forecast, by Major Commodity, 1995-2050
(Percent Change Per Period)

Major Commodity	1995-2000	2000-03	2003-04	2004-05	2005-10	2010-15	2015-20	2020-30	2030-40	2040-50
Agriculture	5.06%	4.14%	3.73%	2.35%	2.82%	1.75%	1.73%	2.29%	2.86%	3.29%
Capital Equipment	6.58%	6.12%	8.36%	8.89%	7.71%	4.87%	4.78%	5.13%	5.66%	5.14%
Chemicals	9.05%	5.91%	5.79%	5.82%	5.52%	4.42%	4.76%	5.47%	6.32%	6.82%
Consumer Goods	11.90%	7.51%	4.48%	5.51%	5.74%	2.98%	3.21%	3.51%	3.82%	4.22%
Extractive	5.03%	3.12%	3.39%	2.86%	1.83%	0.34%	1.19%	1.98%	3.12%	4.37%
Food	5.21%	4.75%	3.62%	3.87%	2.96%	1.46%	1.80%	2.10%	2.58%	3.09%
Fuels	4.37%	7.31%	1.74%	3.09%	2.85%	2.74%	3.19%	3.99%	4.99%	5.74%
High-tech Products	10.86%	1.12%	9.09%	9.17%	9.14%	6.19%	5.87%	5.83%	5.99%	6.03%
Intermediate Manufactured Products	8.18%	7.07%	6.52%	7.46%	6.08%	4.68%	4.74%	5.16%	5.77%	6.23%
Materials	7.53%	8.15%	1.98%	1.50%	2.46%	2.29%	3.50%	4.45%	5.59%	6.42%
All Commodities	**7.74%**	**6.15%**	**4.94%**	**5.21%**	**4.99%**	**3.54%**	**3.91%**	**4.50%**	**5.27%**	**5.74%**

million in 2040 to 719.492 million in 2050. During these time frames, intra-Asian trade in TEUs rises 77 percent (from 55.281million in 2020 to 97.774 million in 2030), 88 percent (from 97.774 million in 2030 to 183.913 million in 2040), and 90 percent (from 183.913 million in 2040 to 347.757 million in 2050).

VI. SUMMARY AND CONCLUSIONS

In summation:

- World outlook is improving as the recovery builds up momentum, at least in the U.S., Latin America, and Asia induced by China's demand for raw materials, intermediate inputs, and finished products.

- Growth in containerized products will grow at historic averages of between 5 percent and 6 percent for most of the period.

- The model provides a dynamic long-term forecast that takes into account the larger growth expected in Asia and elsewhere once short-term disturbances are ignored. Although there will be problems (wars, environmental damage, shortages of materials, and political mistakes), experience suggests that the long-term trends will ultimately be achieved.

- Alternative forecast baselines can be developed that would show different trends. One alternative scenario could be to impose a tighter balance in trade, forcing countries with chronic trade deficits to limit imports, thus slowing long-term expansion and impacting industrial development. This would produce a somewhat low rate of expansion. Another, more optimistic, alternative would force countries with chronic surpluses to import more from countries with chronic deficits, which would probably yield a worldwide forecast even greater than the one developed.

- A rising tide of trade protection would produce a more pessimistic assessment of worldwide growth in demand, which would shave about 1 percent from the growth rate projected for world trade. An alternative scenario would be the collapse of China and India as a result of environmental or other disasters. Given the huge share of world trade that China will maintain (both as an exporter and importer) by 2030 and beyond, this would reduce world trade growth substantially, probably by about 2 percent per year after 2030.

- A more optimistic assessment of world trade must assume that the countries with chronic deficits in the early period would move quickly into balance. This could occur only if countries in surplus like Japan shift towards import rather than export growth. The likelihood of this happening is low. Given the huge size of U.S. imports in the early period (more than 15 percent of world TEU trade), there are few markets sufficiently large to enable this to occur. The baseline projection of a gradual rebalancing of world trade by 2050, with China becoming the key engine of world growth, is optimistic because it assumes that the structural changes that are implicit in the relative relationships between the countries today are fulfilled.

- Forecasts reflect assumptions about the global environment that may not transpire. The models are non-linear and statistical, allowing for shifts in consumption patterns at different stages of economic development. Many factors can impede long-term progress.

The most obvious one is that resource balances could become disturbed. The current shortages of iron ore, bauxite, and petroleum products induced by China's rapid growth and the lack of significant new investments to meet the growing demand could cause prices to rise dramatically. Price changes are allowed for in the model and are based on resource demand balances that are endogenous to the model structure. Nevertheless, actual adjustments caused by shifts in supply-demand balances often overshoot, leading to sudden falloffs in demand or higher inflation (inducing a counter response from monetary authorities). For example, higher energy prices may cut demand for power and force technological change and adaptation that cannot be easily forecast by statistical models. New products may be introduced that are entirely unexpected or unanticipated. New production techniques may reduce trade as small- scale, highly efficient production substitutes for specialization. Under this scenario, companies would be able to produce closer to market, with only raw materials shipped internationally.

Part 2: U.S. WATERBORNE TRADE FORECAST

I. INTRODUCTION

Global trade models usually allow for the U.S. to be represented by regions that reflect the principal coastal ranges such as the North Atlantic (Maine through Virginia), South Atlantic, Gulf Coast, Pacific South, and Pacific North. National waterborne coastal trade share forecasts were initiated by DRI/McGraw-Hill (DRI) for the Institute for Water Resources (IWR) as part of a U.S. trade forecast. These data were completed in the mid-1990s for IWR. The capability to disaggregate U.S. trade flows to regional levels remains inherent in the economic forecast done by DRI. A trade flow forecast for the South Atlantic (excluding Norfolk) is the normal output of these regional (U.S.) models of waterborne world trade flows.

II. OBJECTIVES

This part of the report describes the U.S. waterborne trade forecasts and summarizes the forecasts for particular portions of the nation. These forecasts will be used in subsequent efforts to develop a South Atlantic coastal range, including Hampton Roads, which is normally regarded as part of the North Atlantic port coastal range.

III. OVERVIEW

Over the 1990s and into the early 2000s, the U.S. kept the global economy vibrant. Nearly 40 percent of the increase in production of the rest of the world was consumed as additional imports by the U.S. during the period 1995-2002, and U.S. demand for Asian products helped propel the region towards self sustained growth and development.

As can be seen in Figure 2-1, the U.S. share of world trade will decline as other regions progress. Asia's strong growth and increased integration with the world has changed the dynamics. As the U.S. economy reaches saturation and as population growth slows, the dynamic expansion in U.S. trade will slow. At the same time, the trade growth of other regions will probably accelerate.

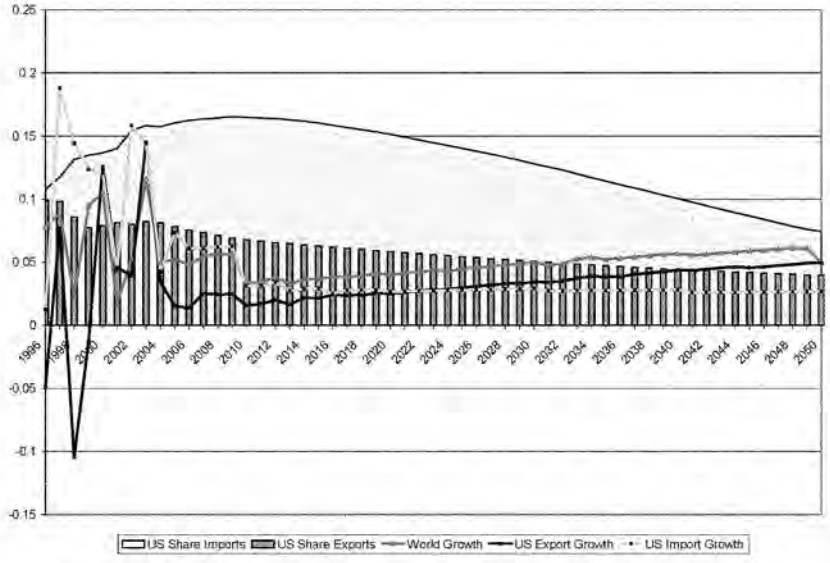


Figure 2-1. U.S. and World Trade in Containerized Products, 1995-2050

World trade growth decelerates until about 2030, when emerging markets with rising standards of living begin to dominate. At the same time, more advanced nations will have reached a point of stabilization. The U.S. share of imports, which reached a peak in 2009, will begin a gradual decline from over 16 percent to around 7 percent by the end of the period (2050), but the falloff in the U.S. share of world exports will be less precipitous.

Growth in containerized trade worldwide, which reached 10-12 percent in the recovery phase of 2003, will fall back by the mid-2020s to around 4 percent, where it will remain for about 10

years before gradually pushing back towards 5.5 - 6 percent by 2050. U.S. import demand for containerized products during this period of rising growth will remain at about 3 percent, but the increased demand for primary, intermediates, and finished manufactures will push U.S. export growth to around 5 percent by 2050.

As can be seen in figures 2-2 and 2-2a, the Chinese share of world trade will grow strongly over the period, and the U.S. share will decline. This is true for both Chinese exports and imports. However, as with the U.S. before, China's export-led growth will cease to drive the economy when its share of world trade reaches a point of maximum domination. The export share after this point will remain relatively constant because to grow from a larger base, China will have to sell an increasing amount of the world's trade, excluding the Chinese import volume. This will prove to be an impossible task, and China's import growth by about 2010 will begin to slightly exceed its export growth. Over time, the difference will reach around 2 percent.

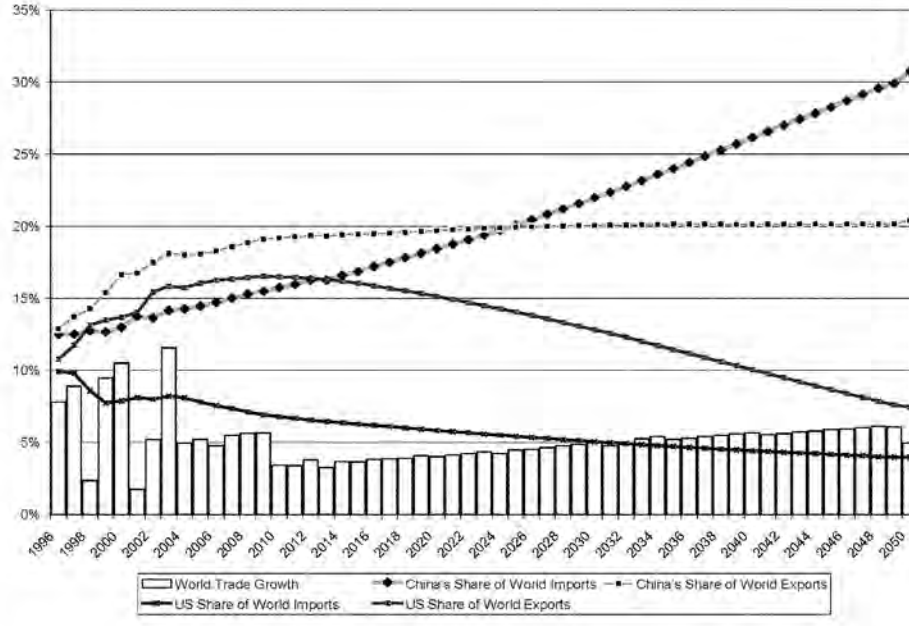


Figure 2-2. U.S. and China Share of World Containerized Trade

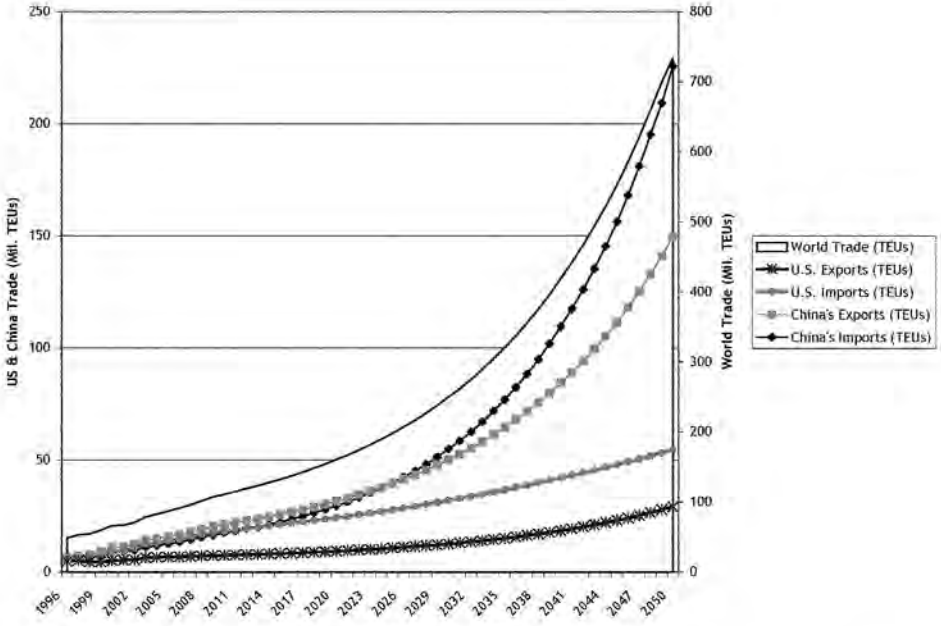


Figure 2-2a. U.S. and China Share of World Containerized Trade in Total TEUs

IV. METHODOLOGY

The QuERI World Trade Model is inclusive of the entire world trade. The model, which is based on nominal U.S. dollars and 1995 U.S. dollar trade flows, covers 92 countries and regions. Within this group, the U.S. is divided into seven regions (U.S. East Coast, U.S. South, U.S. North, U.S. West, U.S. Alaska, U.S. Hawaii, and Puerto Rico). The U.S. South Region covers the South Atlantic Port Range and the Gulf Port Range, and the U.S. West covers the North Pacific Port Range and the South Pacific Port Range.

The Maritime Model (Metric Tonnes, Containerized Metric Tonnes, and TEUs) is based on a relationship between the real value model and the metric tonne or maritime trade models. Table 2-1 details the countries and regions included in the Maritime Model. There are 71 distinct countries or regional groupings, including nine coastal ranges for the U.S. market (six coasts plus three regions outside the Continental U.S.).

The econometrically developed World Trade Model uses the U.S. as a whole rather than the regions separately. Economic factors drive trade and are appropriate for a country rather than a regional area alone.

After developing a baseline forecast for the U.S. as a whole, a second-level model is developed to split this trade between the seven regions based on the expected change in the share of each region in total U.S. trade. Shares will increase or decrease over time, so that the real growth of trade volume into or out of a region will vary, just as it varies historically.

A growth trend is measured for each region's share with a specific partner for a single commodity group. This share is allowed to grow at a maximum rate of 1.25 percent per year or decline at a rate of 1.25 percent per year. Estimated trade by region is based on the U.S. trade multiplied by these forecast shares.

FORECASTING REGIONAL U.S. TRADE

The model takes the general form of:

$$RM[jk,usr] = \frac{M[jk,usr]}{M[jk,us]} or$$

$$RX[jk,usr] = \frac{X[jk,usr]}{X[jk,us]},$$

$$grm[jk,usr] = C.A.G.R[RM(t,t-n),$$

$$grx[jk,usr] = C.A.G.R[RX(t,t-n)$$

$$\max/\min growth = -.0125 or +.0125.$$

$$RM[jk,usr]t+1 = RM[jk,usr]t \times (1+grm)$$

$$RX[jk,usr]t+1 = RX[jk,usr]t \times (1+grx).$$

$$M[jk,usr]t+1 = RM[jk,usr]t+1 \times M[jk,us]t+1$$

$$X[jk,usr]t+1 = RX[jk,usr]t+1 \times X[jk,us]t+1,$$

Table 2-1. Counties Within Each Aggregated Region

Aggregated Region	Country
Africa	East Africa
	North Africa
	Other Southern Africa
	South Africa
Asia	Australia
	China
	Hong Kong
	India
	Indonesia
	Japan
	Korea
	Malaysia
	New Zealand
	Other Indian Subcontinent
	Pakistan
	Philippines
	Singapore
	Taiwan
	Thailand
	Vietnam
Europe	Austria
	Belgium
	Bulgaria
	Czechoslovakia
	Denmark
	Finland
	Former Soviet Union
	France
	Germany
	Greece
	Hungary
	Ireland
	Italy
	Netherlands
	Norway
	Other Western Europe
	Poland
	Portugal
	Romania
	Spain
	Sweden
	Switzerland
	United Kingdom
Mideast	Israel
	Mediterranean
	Persian Gulf
	Turkey
North America	Canada
	Mexico
	United States
	North Atlantic
	South Atlantic
	Gulf Coast
	South Pacific
	North Pacific
	Great Lakes
	Alaska
	Hawaii
	Puerto Rico
South America	Argentina
	Bolivia
	Brazil
	Chile
	Colombia
	Costa Rica
	Ecuador
	Panama
	Peru
	Venezuela
Caribbean	Caribbean
	Other Central Latin America
	Other Eastern Latin America

RM = Ratio Import, measures regional imports relative to U.S. imports
j = export or import region
k = product
usr = U.S. region or port
RX = Ratio Exports
M = Imports
grm = growth rate, compound annual growth rate, for RM, from period t to t-n
grx = growth rate, compound annual growth rate for RX, from period t to t-n
max/min growth = limits growth to range between -1.25 % to + 1.25 % per year
RM[jk,usr]t+1 = Forecast of ratio of imports to total U.S. imports for a port region in period t+1
RX[jk,usr]t+1 = Forecast of ratio of exports to total U.S. exports for a port region in period t+1

Total U.S. trade is the sum of the separate subregional trade flows. Growth rates for regions can thus be different from the average for the U.S. as a single entity. Table 2-2 shows how this approach allows for a different growth rate for individual U.S. regions. The maximum and minimum growth rates for ratios limit the impact and the differentiation between regions. The key assumption is that although there may have been changes in market shares in the past, the adjustment process will be quite slow. Allowing for a rapid change would lead to situations in the long-term where the regions' imports were close to or equal to zero. Because this rarely happens, limiting the net change in the ratio is appropriate.

Table 2-2. U.S. Imports of Miscellaneous Transport Equipment From Taiwan (1995 U.S. $ Value)

Regions	1995-2002	2003-05	2005-10	2010-50	Growth Rate Ratio (2002-1995)
U.S.	25.7%	15.0%	10.4%	2.8%	N/A
U.S. Hawaii	4.7%	11.8%	7.7%	0.3%	-16.7%
U.S. Alaska	23.9%	15.2%	10.6%	2.9%	-1.4%
U.S. South	18.8%	12.3%	7.8%	0.3%	-5.4%
U.S. North	9.5%	12.4%	7.8%	0.3%	-12.8%
U.S. West	26.1%	15.2%	10.6%	2.9%	0.3%
U.S. East	30.2%	15.2%	10.6%	2.9%	3.6%
Puerto Rico	12.0%	12.4%	7.8%	0.3%	-10.9%

Source: QuERI-International.

Translation to Maritime Trade

The U.S. Maritime model operates in terms of nine regions as identified in Table 2-3. The U.S. South is divided into the U.S. Gulf and the U.S. South Atlantic, and the U.S. West is divided into the U.S. North Pacific and U.S. South Pacific. The U.S. East equates to the U.S. North Atlantic,

and the U.S. North to the U.S. Great Lakes. The other regions are the same geographic areas as in the value model.

Table 2-3. Relationship of U.S. Regions to U.S. Maritime Regions

U.S. Maritime Region	U.S. Value Region
U.S. North Atlantic	U.S. East
U.S. South Atlantic	U.S. South
U.S. Gulf Coast	U.S. South
U.S. South Pacific	U.S. West
U.S. North Pacific	U.S. West
U.S. Great Lakes	U.S. North
U.S. Alaska	U.S. Alaska
U.S. Hawaii	U.S. Hawaii
U.S. Puerto Rico	U.S. Puerto Rico

The growth rate for each of the maritime regions is based on the growth rate for the comparable U.S. value-based region. [10] The equation for imports or exports is as follows:

$$M[jk,usmr]t+1 = M[jk,usmr]t \times (\frac{M[jk,usr]t+1}{M[jk,usr]t}), where$$

M is imports from the jth region/country for the kth product group, and for U.S. maritime region i in time period t+1 is a function of the imports in period t times the growth rate calculated for the value based imports from a corresponding region (usr).

The maritime trade forecast for the U.S. is the aggregate of the regional trade forecast:

$$MUS[jk] = \sum_{usmr=1to9} M[jk,usmr].$$

SUMMARY

The U.S. trade forecast for maritime is thus built up using data collected and adjusted based on changes in shares by region. These adjustments in the flow are assumed to be passed along from the value-based estimates to the volume-based maritime trade estimates. The Port Choice Model is more detailed and allows for a choice of port destinations within the South Atlantic region. However, the aggregate for the South Atlantic will remain fixed based on the historical pattern of adjustment within the U.S. proper. The Port Choice Model allocates flows over time between competing ports within a single region, rather than changing the overall distribution of trade

[10] It is assumed that the value-based model already picks up the general trend of gain or loss by the region. The growth rate of the value-based region is applied to the last historical period of the maritime region (2003), and the series is extended through 2050.

between U.S. coasts. This assumption insures that the forecast is "conservative" and reflects historic demand or supply share and the relative growth trend based on the last six years (1995-2002).

V. U.S. AND WORLD TRADE FORECAST

Table 2-4 identifies the recent performance (1995-2000) and projected growth of World and U.S. trade for all commodities (metric tonnes), containerized commodities (metric tonnes) and TEUs. The data shows U.S. trade generally growing faster than world trade up to 2010. For example, U.S. imports grew faster than world trade between 1995-2000, and this trend is projected in the period 2000-2010. However, after 2010 world waterborne trade is projected to grow faster than U.S. waterborne trade.

Tables 2-5a – 2-5d contains TEUs for U.S. imports, exports, and world trade for the period 2000 (actual) and projected for 2005, 2020, and 2050. The data indicate that U.S. trade will generally grow faster than world trade for the period 2000-2005, then slowing after 2005. The growth trends are summarized in Table 2-6. During the period 1995-2005, U.S. share of world trade in TEUs increases from 19 percent to 24 percent. However, after 2005 slower growth of U.S. trade results in decreasing share of world trade in TEUs, with the share declining to 20 percent by 2020 and 11 percent by 2050.

Table 2-4. World and U.S. Waterborne Trade Trends, Metric Tonnes, Containerized Tonnes and TEUs, 1995-2050

Metric Tons	1995	2000	2010	2020	2030	2040	2050
World	3,842,217,735	4,973,822,121	6,810,175,138	8,434,774,517	11,572,418,007	17,460,920,028	28,816,278,574
U.S. Exports	250,448,128	204,626,102	231,025,023	258,566,858	302,642,068	366,042,928	480,363,412
U.S. Imports	355,584,866	500,189,784	763,614,633	909,100,086	1,077,113,618	1,298,288,445	1,580,636,737
Containerized Tons	**1995**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
World	421,091,550	593,980,608	957,404,738	1,370,036,084	2,121,199,816	3,549,683,527	6,250,783,648
U.S. Exports	51,395,815	50,837,744	67,064,525	81,003,004	105,958,355	149,946,572	228,342,233
U.S. Imports	42,711,628	68,636,674	118,650,133	155,850,130	203,010,524	264,546,655	341,810,660
TEUs	**1995**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
World Exports*	45,482,238	66,106,291	111,219,776	160,540,460	249,932,294	418,782,065	733,684,677
U.S. Exports	5,115,684	5,211,079	7,549,835	9,362,200	12,620,040	18,513,987	29,212,603
U.S. Imports*	5,213,310	9,036,701	18,329,483	24,326,290	32,064,710	42,122,885	54,652,315
Metric Tons		**1995-2000**	**2000-2010**	**2010-20**	**2020-30**	**2030-40**	**2040-50**
World		5%	3%	2%	3%	4%	5%
U.S. Exports		-4%	1%	1%	2%	2%	3%
U.S. Imports		7%	4%	2%	2%	2%	2%
Containerized Tons		**1995-2000**	**2000-2010**	**2010-20**	**2020-30**	**2030-40**	**2040-50**
World		7%	5%	4%	4%	5%	6%
U.S. Exports		0%	3%	2%	3%	4%	4%
U.S. Imports		10%	6%	3%	3%	3%	3%
TEUs		**1995-2000**	**2000-2010**	**2010-20**	**2020-30**	**2030-40**	**2040-50**
World Exports		8%	5%	4%	5%	5%	6%
U.S. Exports		0%	4%	2%	3%	4%	5%
U.S. Imports		12%	7%	3%	3%	3%	3%

*Totals are slightly higher than totals in yearly summaries due to exclusion (in yearly summaries) of crude fertilizer TEUs.

Source: QuERI-International World Trade and Industry Model, March 2004

Table 2-5a. U.S. and World Trade Shares of TEUs by Major Commodity Groups, 1995-2000

Description	Imports 2000 TEUs	Growth 1995-2000	Exports 2000 TEUs	Growth 1995-2000	World Market TEUs	Growth 1995-2000	US Share of World 1995	US Share of World 2000
Grain	8,850	10.5%	17,515	4.5%	187,666	12.3%	6.6%	14.0%
Oil Seeds	8,661	30.7%	7,418	-0.7%	52,224	10.8%	11.9%	30.8%
Vegetables and Fruits, requiring refrigeration	64,358	21.1%	61,301	-2.4%	1,235,024	7.6%	4.5%	10.2%
Vegetables and Fruits, not requiring refrigeration	34,938	8.4%	98,690	4.4%	872,967	7.2%	6.9%	15.3%
Cork and Wood	109,306	22.4%	148,623	-4.7%	620,504	1.8%	19.3%	41.6%
Cotton	2,041	84.5%	120,695	-9.2%	400,247	-2.1%	23.2%	30.7%
Other Raw Textile Materials	5,248	-7.8%	1,045	-12.4%	196,184	0.5%	2.6%	3.2%
Other Agriculture	20,471	5.8%	30,413	5.5%	516,028	5.1%	4.2%	9.9%
Coffee	89,486	4.2%	5,825	-12.1%	335,607	5.0%	13.2%	26.8%
Cut Flowers and Foliage, etc.	9,091	4.3%	4,393	-5.3%	147,723	13.3%	5.8%	9.1%
Stone, Clay and Other Crude Minerals	51,720	15.7%	150,469	3.8%	989,614	4.3%	8.3%	20.4%
Ores	4,255	5.5%	2,381	-8.0%	147,090	2.8%	2.5%	4.5%
Coal and Coke	163	8.0%	351	3.4%	13,175	9.8%	1.9%	3.9%
Crude Petroleum	8	24.9%	0	0.0%	8,046	4.9%	0.0%	0.1%
Natural Gas	640	83.1%	5,190	61.3%	83,381	11.0%	0.4%	7.0%
Scrap metal	5,491	9.6%	39,768	-3.7%	252,119	6.4%	11.8%	18.0%
Meat/Dair/Fish Requiring Refrigeration	166,237	8.2%	285,987	4.3%	2,187,289	6.9%	9.2%	20.7%
Other Meat/Dairy, Fish, Fruit and Vegetables	170,406	6.3%	119,180	0.6%	2,420,095	6.3%	5.8%	12.0%
Sugar	8,308	21.3%	14,127	13.9%	306,545	7.9%	2.0%	7.3%
Animal Feed	7,676	0.8%	330,004	6.9%	872,828	3.8%	15.3%	38.7%
Animal and Vegetable Oils	20,268	13.1%	3,409	-4.5%	430,475	7.1%	2.1%	5.5%
Other Food	168,941	6.3%	120,786	0.5%	2,624,857	4.3%	5.1%	11.0%
Beverages	286,596	14.6%	50,923	-15.8%	1,145,870	3.4%	12.6%	29.5%
Tobacco	29,544	6.6%	62,303	-4.0%	312,613	3.6%	17.0%	29.4%
Textiles	264,365	12.2%	112,444	2.3%	3,352,338	7.2%	4.6%	12.0%
Wearing Apparel	612,993	12.2%	81,580	17.8%	2,145,438	11.2%	11.2%	32.4%
Leather and Leather Products	147,656	13.3%	82,761	6.5%	670,642	8.3%	12.4%	34.4%
Footwear	321,281	8.8%	4,848	-7.0%	916,797	6.2%	13.6%	35.6%
Wood Products	137,082	26.3%	34,597	-12.0%	1,523,704	8.8%	4.3%	11.8%
Furniture and Fixtures	906,773	22.4%	35,278	-1.6%	2,341,752	18.1%	11.0%	40.2%
Waste Paper	713	-6.6%	409,270	-1.0%	725,654	6.1%	34.2%	56.7%
Pulp	7,063	16.0%	146,600	1.2%	515,300	5.6%	15.6%	29.8%
Paper and Paperboard Products	207,782	12.6%	431,830	0.2%	3,285,161	8.3%	9.9%	19.5%
Printing and Publishing	27,581	10.3%	10,720	-2.7%	161,005	8.0%	10.8%	25.8%
Organic Chemicals	68,226	3.1%	102,297	-3.6%	982,633	6.8%	10.7%	17.4%
Inorganic Chemicals	88,640	11.7%	89,149	1.9%	658,681	7.7%	11.9%	27.9%
Fertilizers and Pesticides	8,585	3.6%	20,935	42.3%	193,472	4.5%	3.1%	15.3%
Synthetic Resins	194,392	9.5%	518,367	2.0%	5,568,577	10.0%	6.6%	12.8%
Paints, Varnishes and Lacquers	23,453	15.1%	21,460	3.4%	530,842	9.5%	3.4%	8.5%
Drugs & Medicines	12,659	13.2%	15,510	3.3%	145,945	8.9%	8.3%	19.3%
Soap and Cleaning Preparations	29,679	17.7%	48,412	3.2%	655,733	10.5%	5.2%	11.9%
Chemical Products, nec	135,374	8.2%	126,016	4.9%	1,536,842	8.5%	7.5%	17.6%
Petroleum Refineries	2,863	-20.1%	41,411	5.1%	253,276	4.5%	9.0%	17.5%
Rubber Products	275,928	11.2%	44,660	-3.2%	1,165,377	7.8%	10.9%	25.5%
Plastic Products, nec	251,071	16.6%	77,470	8.2%	1,518,009	12.7%	7.2%	21.6%
Pottery, China, etc.	87,475	9.3%	2,905	-12.0%	410,036	10.5%	9.4%	22.0%
Glass Products	122,976	11.2%	43,166	0.0%	1,089,613	8.1%	6.3%	15.1%
Non-metallic Products, n.e.c.	178,095	16.5%	20,954	-13.0%	2,092,089	7.7%	3.5%	9.3%
Iron and Steel	152,375	13.1%	23,762	-7.0%	1,697,071	5.4%	3.9%	10.4%
Non-ferrous Metals	63,090	8.6%	97,134	-1.1%	1,524,279	7.0%	5.5%	10.5%
Metal Products	454,284	13.7%	84,759	-7.1%	1,999,085	8.7%	10.9%	25.0%
Engines and Turbines	27,071	11.8%	9,814	-8.8%	283,530	6.9%	6.3%	12.9%
Agricultureal Machinery	32,524	10.6%	36,332	-2.0%	137,513	3.5%	23.6%	50.1%
Metal and Wood Working Machinery	38,733	7.3%	4,768	-10.5%	253,051	4.2%	7.7%	17.2%
Special Industrial Machinery	133,167	8.0%	68,827	-0.7%	715,622	3.1%	12.2%	28.2%
Office and Computing Maefinery	381,643	13.0%	36,378	7.4%	1,251,347	17.2%	12.8%	33.4%
Machinery and Equipment, nec	214,284	9.4%	139,490	0.2%	1,816,997	6.5%	8.7%	19.5%
Radio and TV Appliances	129,562	6.6%	11,718	-7.3%	435,991	3.0%	13.7%	32.4%
Semi-conductors, Electronic tubes, parts	15,512	7.2%	7,102	-2.5%	348,542	10.3%	3.4%	6.5%
Other Communications Equipment	168,446	4.7%	15,589	-3.7%	589,131	7.3%	10.1%	20.2%
Electrical Appliances and Housewares	131,187	12.1%	19,620	-6.7%	481,673	8.4%	12.7%	31.3%
Electrical Apparatus, nec	277,605	10.1%	55,468	5.0%	1,060,935	10.7%	12.7%	31.4%
Shipbuilding and Repairing	3,455	12.6%	8,254	-0.1%	71,544	9.1%	9.6%	19.2%
Railroad Equipment	931	8.2%	1,313	-6.7%	24,815	13.4%	6.5%	9.0%
Motor Vehicles	95,316	9.4%	120,669	0.3%	316,089	5.7%	32.2%	68.1%
Parts for Motor Vehicles	437,316	3.1%	168,283	4.2%	1,641,789	6.5%	18.0%	36.9%
Aircraft	9,821	19.6%	3,846	-2.0%	30,863	12.3%	17.2%	44.8%
Transport Equipment, nec	15,909	4.6%	354	-1.6%	53,006	10.3%	15.3%	30.7%
Professional Equipment	38,493	15.9%	36,446	5.4%	227,709	12.8%	13.1%	32.9%
Photographic and Optical Goods	11,774	4.9%	13,236	10.5%	71,285	7.8%	14.4%	35.1%

Table 2-5b. U.S. and World Trade Shares of TEUs by Major Commodity Groups, 2000-2005

Description	Imports 2005 TEUs	Growth 2000-2005	Exports 2005 TEUs	Growth 2000-05	World Market TEUs	Growth 2000-05	US Share of World 2000	US Share of World 2005
Grain	32,534	39.7%	18,275	0.9%	228,244	4.0%	6.3%	22.3%
Oil Seeds	11,573	5.6%	15,135	15.3%	73,569	7.0%	12.8%	36.1%
Vegetables and Fruits, requiring refrigeration	93,438	7.7%	90,259	8.0%	1,557,179	4.7%	4.5%	11.8%
Vegetables and Fruits, not requiring refrigeration	61,866	12.1%	97,848	-0.2%	1,026,652	3.3%	7.0%	15.6%
Cork and Wood	191,264	11.8%	137,639	-1.5%	742,851	3.7%	13.9%	44.3%
Cotton	1,314	-8.4%	224,989	13.3%	533,805	5.9%	13.1%	42.4%
Other Raw Textile Materials	4,271	-4.0%	2,632	20.3%	269,418	1.3%	1.6%	3.3%
Other Agriculture	25,773	4.7%	59,503	5.4%	547,318	1.2%	4.8%	11.9%
Coffee	81,313	-1.9%	22,814	31.4%	405,862	2.7%	12.5%	25.7%
Cut Flowers and Foliage, etc.	13,712	8.6%	5,454	4.4%	172,645	3.2%	4.2%	11.1%
Stone, Clay and Other Crude Minerals	36,504	-6.7%	154,440	0.8%	1,083,120	1.8%	9.8%	17.6%
Ores	3,460	-41.1%	7,049	24.2%	176,752	3.7%	2.0%	5.0%
Coal and Coke	32	-27.8%	591	11.0%	14,658	2.1%	1.8%	4.2%
Crude Petroleum	5	-8.8%	1	-32.2%	9,606	3.6%	0.0%	0.1%
Natural Gas	143	-25.9%	2,710	-12.2%	99,875	3.7%	3.2%	2.9%
Scrap metal	3,694	-7.6%	88,065	17.2%	325,408	5.2%	7.8%	28.2%
Mea/Dair/Fish Requiring Refrigeration	272,417	10.4%	278,896	0.5%	2,488,122	2.6%	9.7%	22.2%
Other Meat/Dairy, Fish, Fruit and Vegetables	216,791	4.9%	145,684	4.1%	2,921,754	3.8%	5.4%	12.4%
Sugar	14,892	12.4%	19,179	6.3%	469,028	5.9%	3.1%	8.3%
Animal Feed	8,591	2.3%	424,396	5.2%	1,097,818	4.7%	17.1%	39.4%
Animal and Vegetable Oils	28,020	6.7%	8,119	19.0%	556,552	5.3%	2.4%	6.5%
Other Food	273,120	10.1%	326,828	22.0%	3,409,437	5.4%	4.8%	17.6%
Beverages	441,063	9.0%	53,498	1.0%	1,501,035	5.5%	12.8%	32.9%
Tobacco	36,420	4.3%	49,571	-4.5%	340,856	1.7%	14.1%	25.2%
Textiles	446,657	11.1%	205,222	12.8%	3,894,819	4.3%	5.3%	16.7%
Wearing Apparel	834,863	6.4%	61,342	-5.5%	2,511,709	3.2%	14.9%	35.7%
Leather and Leather Products	200,377	6.3%	81,938	-0.2%	816,734	4.0%	15.5%	34.6%
Footwear	317,220	-0.3%	6,860	7.2%	952,749	0.8%	17.4%	34.0%
Wood Products	328,235	19.1%	27,760	-4.3%	2,086,059	6.5%	4.8%	17.1%
Furniture and Fixtures	1,745,512	14.0%	36,688	0.8%	3,682,246	9.5%	15.6%	48.4%
Waste Paper	1,128	9.6%	853,656	15.8%	1,233,000	11.2%	21.0%	69.3%
Pulp	4,216	-9.8%	150,705	0.6%	605,887	3.3%	13.7%	25.6%
Paper and Paperboard Products	587,303	23.1%	417,024	-0.7%	4,517,561	6.6%	8.2%	22.2%
Printing and Publishing	45,008	10.3%	10,135	-1.1%	212,787	5.7%	10.2%	25.9%
Organic Chemicals	81,779	3.7%	126,089	4.3%	1,263,777	5.2%	7.6%	16.4%
Inorganic Chemicals	95,842	1.6%	96,809	1.7%	820,958	4.5%	12.0%	23.5%
Fertilizers and Pesticides	17,471	15.3%	16,846	-4.3%	246,508	5.0%	6.7%	13.9%
Synthetic Resins	271,038	6.9%	654,610	4.8%	7,431,859	5.9%	5.5%	12.5%
Paints, Varnishes and Lacquers	35,031	8.4%	30,894	7.6%	729,870	6.6%	3.6%	9.0%
Drugs & Medicines	31,026	19.6%	23,660	8.8%	259,805	9.5%	7.5%	23.8%
Soap and Cleaning Preparations	68,487	18.2%	62,118	5.1%	907,099	6.7%	5.0%	14.4%
Chemical Products, nec	210,196	9.2%	141,429	2.3%	2,096,884	6.4%	7.2%	16.8%
Petroleum Refineries	6,197	16.7%	77,248	13.3%	327,563	5.3%	7.6%	25.5%
Rubber Products	314,881	2.7%	40,938	-1.7%	1,510,370	5.3%	12.0%	23.6%
Plastic Products, nec	422,145	11.0%	86,492	2.2%	2,154,696	7.3%	8.9%	23.6%
Pottery, China, etc	123,019	7.1%	4,107	7.2%	548,745	6.0%	9.4%	23.2%
Glass Products	203,868	10.6%	51,427	3.6%	1,579,116	7.5%	6.2%	16.2%
Non-metallic Products, n.e.c.	555,313	25.5%	27,449	5.5%	3,205,213	8.9%	3.8%	18.2%
Iron and Steel	121,895	-4.4%	92,023	31.1%	2,352,371	6.7%	4.3%	9.1%
Non-ferrous Metals	51,922	-3.8%	130,880	6.1%	1,888,879	4.4%	4.7%	9.7%
Metal Products	728,567	9.9%	106,007	4.6%	2,909,323	7.8%	11.0%	28.7%
Engines and Turbines	54,182	14.9%	11,456	3.1%	442,125	9.1%	5.1%	14.8%
Agricultureal Machinery	44,967	6.7%	50,364	6.7%	173,161	4.7%	22.2%	55.1%
Metal and Wood Working Machinery	40,685	1.0%	8,468	12.5%	330,013	5.5%	7.5%	14.9%
Special Industrial Machinery	185,020	6.8%	84,618	4.2%	928,574	5.3%	12.3%	29.0%
Office and Computing Machinery	418,652	1.9%	39,144	1.5%	1,454,201	3.0%	15.4%	31.5%
Machinery and Equipment, nec	399,831	13.3%	150,110	1.5%	2,456,411	6.2%	8.3%	22.4%
Radio and TV Appliances	221,520	11.3%	8,242	-6.8%	637,714	7.9%	13.2%	36.0%
Semi-conductors, Electronic tubes, parts	33,515	16.6%	3,872	-11.4%	421,405	3.9%	2.9%	8.9%
Other Communications Equipment	108,624	1.0%	22,005	7.1%	663,455	2.4%	9.5%	19.7%
Electrical Appliances and Housewares	246,936	13.5%	22,409	2.7%	751,285	9.3%	12.2%	35.9%
Electrical Apparatus, nec	389,429	7.0%	52,964	-0.9%	1,405,218	5.8%	13.5%	31.5%
Shipbuilding and Repairing	13,784	20.4%	13,483	16.2%	109,531	8.9%	7.6%	28.5%
Railroad Equipment	1,414	8.7%	2,857	16.8%	41,763	11.0%	3.4%	10.2%
Motor Vehicles	233,323	19.6%	190,861	9.7%	585,954	13.1%	23.9%	72.4%
Parts for Motor Vehicles	600,432	6.5%	199,506	3.5%	2,407,014	8.0%	15.0%	33.2%
Aircraft	11,856	3.8%	5,184	6.1%	43,108	6.9%	18.5%	39.5%
Transport Equipment, nec	21,058	5.8%	284	-4.3%	86,820	10.4%	11.6%	24.6%
Professional Equipment	86,937	11.7%	41,399	2.6%	284,339	4.5%	14.6%	38.1%
Photographic and Optical Goods	12,084	0.5%	18,043	6.4%	94,661	5.8%	15.1%	31.8%
Watches and Clocks	12,629	6.7%	383	2.9%	54,508	1.4%	9.0%	23.9%
Toys, Games and Sporting Goods	935,970	6.9%	36,228	-0.2%	2,166,374	6.5%	18.9%	44.9%
Jewelry	10,869	30.5%	186	-5.2%	38,369	9.8%	4.9%	28.1%
Misc. Manufacturing Goods	193,967	-0.5%	10,091	4.6%	866,703	3.6%	13.0%	23.5%
Total Trade in TEUs	13,958,624	10.2%	6,810,085	6.9%	87,090,741	5.8%	18.6%	23.8%

Table 2-5c. U.S. and World Trade Shares of TEUs by Major Commodity Groups, 2005-2020

Description	Imports 2020 TEUs	Growth 2005 2020	Exports 2020 TEUs	Growth 2005 20	World Market 2020 TEUs	Growth 2005 20	US Share of World 2005	US Share of World 2020
Grain	47,498	2.6%	22,394	1.4%	319,488	2.3%	9.3%	21.9%
Oil Seeds	3,345	-7.8%	27,286	4.0%	106,890	2.5%	14.7%	28.8%
Vegetables and Fruits, requiring refrigeration	99,884	0.4%	163,590	4.0%	2,534,249	3.3%	4.5%	10.4%
Vegetables and Fruits, not requiring refrigeration	95,120	2.9%	139,825	2.4%	1,699,562	3.4%	5.9%	13.8%
Cork and Wood	251,947	1.9%	151,292	0.6%	972,381	1.8%	19.2%	41.3%
Cotton	545	-5.7%	268,001	1.2%	613,557	0.9%	19.7%	43.8%
Other Raw Textile Materials	1,045	-9.0%	2,103	-1.5%	231,742	0.7%	1.6%	1.4%
Other Agriculture	31,102	1.3%	26,883	-2.5%	509,371	-0.5%	6.2%	11.4%
Coffee	40,027	-4.6%	12,505	-3.9%	290,696	-2.2%	14.9%	18.1%
Cut Flowers and Foliage, etc.	20,257	2.6%	6,361	1.2%	246,857	2.4%	4.6%	10.9%
Stone, Clay and Other Crude Minerals	26,217	-2.2%	166,259	0.5%	1,176,470	0.6%	8.5%	16.4%
Ores	4,505	1.8%	11,089	3.1%	234,311	1.9%	2.6%	6.7%
Coal and Coke	26	-1.4%	386	-0.1%	14,119	-0.2%	2.7%	4.3%
Crude Petroleum	0	2.1%	0	0.0%	13,590	2.4%	0.0%	0.1%
Natural Gas	166	1.0%	2,962	0.6%	112,937	0.8%	1.3%	2.8%
Scrap metal	3,352	-0.6%	90,453	0.2%	377,060	1.0%	13.1%	24.9%
Meat/Dairy/Fish Requiring Refrigeration	360,026	1.9%	338,170	1.3%	2,711,474	0.6%	10.6%	25.7%
Other Meat/Dairy, Fish, Fruit and Vegetables	263,809	1.3%	136,399	-0.4%	3,471,775	1.2%	5.7%	11.5%
Sugar	20,505	2.2%	33,258	3.7%	791,277	4.5%	2.8%	6.8%
Animal Feed	11,570	2.0%	649,195	2.9%	1,765,014	3.2%	15.1%	37.4%
Animal and Vegetable Oils	46,614	3.5%	10,317	1.6%	896,438	3.2%	2.5%	6.4%
Other Food	411,341	2.8%	582,793	3.9%	5,111,415	2.7%	7.0%	19.4%
Beverages	484,329	0.6%	77,776	2.5%	2,228,742	2.7%	13.3%	25.2%
Tobacco	51,634	2.4%	10,550	-9.8%	278,250	-1.3%	13.9%	22.3%
Textiles	708,772	3.1%	647,861	8.0%	7,270,509	4.2%	5.8%	18.7%
Wearing Apparel	935,601	0.8%	61,734	0.0%	2,947,425	1.1%	16.4%	33.8%
Leather and Leather Products	236,907	1.1%	97,879	1.2%	1,037,670	1.6%	15.2%	32.3%
Footwear	95,504	-7.7%	7,696	0.8%	905,373	-0.3%	17.4%	11.4%
Wood Products	593,781	4.0%	22,617	-1.4%	3,219,939	2.9%	6.7%	19.1%
Furniture and Fixtures	3,999,951	5.2%	66,703	4.1%	7,850,529	5.2%	15.5%	51.8%
Waste Paper	468	-5.7%	487,729	-3.7%	789,252	-2.9%	42.3%	61.9%
Pulp	953	-9.4%	89,045	-3.4%	365,266	-3.3%	16.0%	24.6%
Paper and Paperboard Products	474,551	-1.4%	475,232	0.9%	7,716,314	3.6%	8.2%	12.3%
Printing and Publishing	82,169	4.1%	11,844	1.0%	365,901	3.7%	9.5%	25.7%
Organic Chemicals	99,277	1.3%	157,610	1.5%	1,877,781	2.1%	6.6%	13.1%
Inorganic Chemicals	146,031	2.8%	140,845	2.5%	1,356,155	4.4%	8.1%	18.4%
Fertilizers and Pesticides	7,438	-5.5%	19,361	0.9%	380,564	2.9%	5.5%	7.0%
Synthetic Resins	270,657	0.0%	956,643	2.6%	15,412,184	5.0%	4.1%	8.6%
Paints, Varnishes and Lacquers	72,715	5.0%	76,115	6.2%	1,841,931	6.4%	2.6%	8.1%
Drugs & Medicines	65,766	5.1%	42,913	4.0%	471,486	4.9%	7.8%	23.1%
Soap and Cleaning Preparations	117,702	3.7%	130,233	5.1%	1,980,292	5.3%	4.5%	12.3%
Chemical Products, nec	431,750	4.9%	276,354	4.6%	4,772,307	5.6%	5.1%	14.8%
Petroleum Refineries	9,139	2.6%	64,547	-1.2%	505,528	2.9%	10.0%	14.6%
Rubber Products	681,570	5.3%	79,929	4.6%	3,674,581	6.1%	6.9%	20.7%
Plastic Products, nec	605,159	2.4%	170,442	4.6%	4,380,114	4.8%	7.8%	17.7%
Pottery, China, etc.	166,851	2.1%	4,457	0.5%	998,377	4.1%	8.2%	17.2%
Glass Products	403,569	4.7%	73,695	2.4%	3,869,602	6.2%	4.7%	12.3%
Non-metallic Products, n.e.c.	828,054	2.7%	33,099	1.3%	5,403,024	3.5%	6.8%	15.9%
Iron and Steel	333,757	6.9%	169,924	4.2%	6,053,585	6.3%	2.5%	8.3%
Non-ferrous Metals	83,129	3.2%	267,230	4.9%	3,645,964	4.5%	3.3%	9.6%
Metal Products	1,693,361	5.7%	160,774	2.8%	6,488,695	5.5%	8.9%	28.3%
Engines and Turbines	133,344	6.2%	22,415	4.6%	1,159,707	6.6%	4.1%	15.4%
Agricultureal Machinery	44,977	0.0%	67,101	1.9%	222,464	1.7%	24.1%	50.4%
Metal and Wood Working Machinery	90,135	5.4%	12,268	2.5%	843,347	6.5%	4.2%	12.1%
Special Industrial Machinery	292,089	3.1%	113,843	2.0%	1,797,630	4.5%	9.9%	22.6%
Office and Computing Machinery	1,029,002	6.2%	123,906	8.0%	3,738,235	6.5%	8.8%	30.0%
Machinery and Equipment, nec	943,307	5.9%	252,917	3.5%	3,993,247	6.1%	6.5%	20.0%
Radio and TV Appliances	535,671	6.1%	21,864	6.7%	1,717,950	6.8%	9.8%	32.5%
Semi-conductors, Electronic tubes, parts	119,346	8.8%	11,599	7.6%	1,691,962	9.7%	1.8%	7.1%
Other Communications Equipment	346,558	8.0%	36,320	3.4%	2,047,881	7.8%	4.8%	18.7%
Electrical Appliances and Housewares	562,839	5.6%	30,924	2.2%	1,735,515	5.7%	10.8%	34.2%
Electrical Apparatus, nec	574,857	2.6%	92,612	3.8%	2,808,012	4.7%	10.5%	23.8%
Shipbuilding and Repairing	9,126	-2.7%	14,799	-1.1%	113,053	0.2%	14.0%	21.2%
Railroad Equipment	3,385	6.0%	6,889	6.0%	113,071	6.9%	2.8%	9.1%
Motor Vehicles	555,099	5.9%	274,503	2.5%	1,246,821	5.2%	23.1%	66.5%
Parts for Motor Vehicles	1,322,620	5.4%	370,673	4.2%	6,401,439	6.7%	9.1%	26.5%
Aircraft	26,253	5.4%	10,352	4.7%	91,028	5.1%	12.7%	40.2%
Transport Equipment, nec	47,000	5.5%	563	4.7%	166,372	4.4%	8.4%	28.6%
Professional Equipment	139,669	5.0%	65,805	3.1%	612,977	5.3%	12.1%	33.5%
Photographic and Optical Goods	21,610	4.0%	42,691	5.9%	200,614	5.1%	10.2%	32.1%
Watches and Clocks	32,679	6.3%	411	0.5%	86,156	3.1%	9.3%	38.4%
Toys, Games and Sporting Goods	1,987,515	5.1%	53,262	2.6%	4,082,284	4.3%	15.6%	50.0%
Jewelry	15,742	2.7%	362	4.5%	67,441	3.8%	10.2%	23.9%
Misc. Manufacturing Goods	40,969	-9.8%	13,362	1.9%	970,934	0.8%	11.1%	5.6%
Total Trade in TEUs	24,273,176	4.3%	9,362,200	2.7%	160,383,447	4.5%	18.6%	21.0%

Table 2-5d. U.S. and World Trade Shares of TEUs by Major Commodity Groups, 2020-2050

Description	Imports 2050 TEUs	Growth 2020-50	Exports 2050 TEUs	Growth 2020-50	World Market TEUs	Growth 2020-50	US Share of World 2020	US Share of World 2050
Grain	74,069	1.5%	28,465	0.8%	310,517	1.6%	10.9%	20.2%
Oil Seeds	242	-8.4%	35,442	0.9%	161,088	1.4%	14.4%	22.1%
Vegetables and Fruits, requiring refrigeration	880,157	-0.7%	578,129	2.8%	6,309,816	5.1%	5.2%	7.3%
Vegetables and Fruits, not requiring refrigeration	136,231	1.2%	275,968	2.3%	4,561,685	5.3%	6.9%	9.0%
Cork and Wood	371,211	1.3%	173,528	0.5%	1,871,072	2.2%	20.7%	29.1%
Cotton	156	-4.1%	390,506	1.3%	1,040,559	1.8%	21.5%	37.5%
Other Raw Textile Materials	225	-5.0%	4,437	2.5%	680,185	3.7%	0.7%	11.7%
Other Agriculture	58,089	2.1%	17,616	-1.4%	1,002,910	2.3%	5.1%	7.5%
Coffee	16,685	-2.9%	5,231	-2.9%	694,364	2.9%	9.0%	3.2%
Cut Flowers and Foliage, etc.	333,035	1.6%	9,807	1.8%	522,484	2.5%	5.4%	8.2%
Stone, Clay and Other Crude Materials	17,208	-1.4%	240,536	1.2%	2,341,737	2.3%	8.2%	11.0%
Ores	5,323	0.6%	32,601	3.7%	580,422	2.9%	3.3%	6.9%
Coal and Coke	21	-0.8%	697	0.6%	16,143	0.4%	2.2%	4.4%
Crude Petroleum	16	1.1%	0	0.0%	82,198	6.1%	0.0%	0.0%
Natural Gas	213	0.8%	5,205	1.9%	257,193	2.8%	1.4%	2.1%
Scrap metal	2,712	-0.3%	91,755	0.0%	545,442	1.2%	12.4%	17.3%
Meat/Dairy/Fish Requiring Refrigeration	431,188	0.6%	380,648	0.4%	3,823,056	1.2%	12.9%	21.2%
Other Meat/Dairy, Fish, Fruit and Vegetables	346,867	0.9%	167,436	0.7%	7,203,932	2.5%	5.8%	7.1%
Sugar	21,849	0.2%	56,954	1.8%	1,107,490	2.6%	3.4%	4.6%
Animal Feed	15,817	1.0%	1,087,500	1.7%	4,049,104	2.8%	18.7%	27.2%
Animal and Vegetable Oils	66,080	1.2%	15,738	1.4%	1,930,909	2.6%	3.2%	4.3%
Other Feed	605,552	1.3%	993,188	1.8%	13,191,080	3.2%	9.7%	12.1%
Beverages	587,039	0.6%	104,832	1.0%	5,046,903	2.8%	12.6%	13.7%
Tobacco	62,280	0.6%	1,948	-5.3%	339,043	0.7%	11.2%	18.9%
Textiles	1,394,597	2.3%	5,897,311	7.6%	43,197,411	6.1%	9.8%	16.9%
Wearing Apparel	1,207,911	0.9%	57,225	-0.3%	9,376,604	3.9%	16.9%	13.5%
Leather and Leather Products	256,101	0.3%	173,722	1.9%	2,521,290	2.7%	16.1%	18.5%
Footwear	29,925	-3.8%	11,167	1.2%	6,439,194	6.8%	3.7%	0.6%
Wood Products	965,725	1.6%	181,710	-0.7%	8,305,662	3.3%	9.6%	11.7%
Furniture and Fixtures	9,921,641	3.1%	331,064	5.5%	22,502,382	3.6%	25.9%	45.6%
Waste Paper	178	-3.2%	219,404	-2.6%	902,959	-0.4%	30.9%	24.3%
Pulp	39	-10.1%	61,037	-1.3%	246,195	-1.3%	12.3%	24.8%
Paper and Paperboard Products	554,138	0.5%	905,276	2.2%	46,125,569	6.1%	6.2%	3.2%
Printing and Publishing	245,275	3.7%	28,281	2.9%	1,569,471	5.0%	12.8%	17.4%
Organic Chemicals	85,357	-0.5%	461,687	3.6%	7,028,800	4.5%	6.8%	7.8%
Inorganic Chemicals	216,470	1.3%	272,188	2.2%	9,922,711	6.4%	9.2%	4.9%
Fertilizers and Pesticides	2,458	-3.6%	93,198	0.6%	2,831,985	6.2%	3.5%	1.1%
Synthetic Resins	343,081	0.8%	2,883,655	3.8%	98,221,923	6.4%	4.0%	3.3%
Paints, Varnishes and Lacquers	203,556	3.5%	769,994	8.0%	13,701,567	6.9%	4.0%	7.1%
Drugs & Medicines	136,998	2.5%	171,693	4.0%	1,620,508	4.2%	11.5%	19.0%
Soap and Cleaning Preparations	258,873	2.7%	277,790	6.1%	7,129,611	4.4%	6.3%	14.5%
Chemical Products, nec	1,109,417	3.2%	1,618,865	6.1%	26,209,215	5.8%	7.4%	10.4%
Petroleum Refineries	18,326	2.3%	65,065	0.0%	2,115,772	4.9%	1.5%	3.9%
Rubber Products	1,750,788	3.2%	398,251	3.5%	21,370,766	6.0%	10.4%	10.1%
Plastic Products, nec	1,103,687	2.0%	1,240,534	6.8%	26,126,203	6.1%	8.9%	9.0%
Pottery, China, etc.	320,261	2.2%	4,665	0.2%	5,492,330	5.9%	8.6%	5.9%
Glass Products	1,171,758	3.6%	155,652	2.5%	26,351,980	6.6%	6.2%	5.0%
Non-metallic Products, n.e.s.	1,251,357	1.4%	88,020	2.4%	17,097,758	5.9%	8.0%	7.8%
Iron and Steel	1,280,296	4.6%	382,818	2.7%	35,023,025	6.6%	4.2%	4.7%
Non-ferrous Metals	82,298	0.0%	941,669	4.3%	21,328,536	6.1%	4.8%	4.8%
Metal Products	5,380,433	4.0%	500,730	3.9%	32,080,713	5.5%	14.1%	18.3%
Engines and Turbines	352,803	3.3%	53,843	3.0%	6,689,944	6.6%	6.7%	6.1%
Agricultural Machinery	35,582	-0.8%	86,113	0.8%	288,784	0.9%	25.2%	42.1%
Metal and Wood Working Machinery	225,902	3.1%	21,576	1.9%	4,484,072	5.7%	6.1%	5.5%
Special Industrial Machinery	486,244	1.7%	254,186	2.7%	7,788,517	5.0%	11.3%	9.5%
Office and Computing Machinery	2,822,874	3.4%	1,416,689	8.3%	18,417,868	5.5%	15.5%	23.0%
Machinery and Equipment, nec	2,383,520	3.1%	715,698	3.5%	31,176,824	5.7%	10.0%	9.0%
Radio and TV Appliances	1,455,657	3.4%	113,548	5.6%	7,371,584	5.0%	16.2%	21.3%
Semi-conductors, Electronic tubes, parts	593,129	5.5%	107,019	7.7%	16,216,377	7.8%	3.9%	4.3%
Other Communications Equipment	1,257,080	4.4%	117,628	4.0%	12,480,494	6.2%	9.3%	11.0%
Electrical Appliances and Housewares	1,430,414	3.2%	114,678	4.8%	6,166,074	4.3%	17.1%	25.1%
Electrical Apparatus, nec	1,342,011	2.5%	610,145	6.5%	15,751,187	5.9%	11.9%	12.4%
Shipbuilding and Repairing	16,498	2.0%	17,167	0.5%	288,788	2.5%	10.6%	14.1%
Railroad Equipment	7,927	2.9%	16,904	3.0%	644,519	6.0%	4.5%	3.9%
Motor Vehicles	1,432,289	3.0%	485,969	1.9%	3,279,425	3.3%	43.3%	55.8%
Parts for Motor Vehicles	3,134,968	2.9%	1,168,201	4.0%	28,766,221	5.1%	13.2%	15.1%
Aircraft	66,637	3.2%	77,281	3.3%	249,454	3.4%	20.1%	38.3%
Transport Equipment, nec	103,044	2.7%	1,588	3.5%	565,885	2.7%	14.3%	29.1%
Professional Equipment	316,091	2.8%	254,926	4.8%	2,281,817	4.5%	16.8%	25.0%
Photographic and Optical Goods	48,062	2.7%	345,811	7.2%	1,083,523	5.8%	18.0%	36.4%
Watches and Clocks	127,827	4.1%	746	2.0%	252,843	3.7%	19.2%	50.8%
Toys, Games and Sporting Goods	4,783,283	3.0%	273,274	5.6%	12,225,922	3.7%	25.0%	41.4%
Jewelry	30,174	2.2%	1,185	4.0%	199,716	3.5%	11.9%	13.7%
Misc. Manufactured Goods	1,430	-10.6%	46,099	4.2%	3,210,264	4.1%	2.8%	1.5%
Total Trade in TEUs	54,585,110	2.9%	29,212,608	4.8%	732,497,096	5.8%	21.1%	11.4%

Table 2-6. U.S. and World TEUs Growth Summary Trends, 1995-2050

	U.S. Import TEUs	U.S. Export TEUs	World TEUs	U.S. TEU Share of World
1995-2000	12%	0%	8%	19% (2000)
2000-2005	10%	6%	6%	24% (2005)
2005-2020	4%	3%	4%	21% (2020)
2020-2050	3%	5%	5%	11% (2050)

VI. U.S. TRADE FORECAST

Historic U.S. waterborne trade for the period 1995 - 2003 is presented along with a forecast for 2004 - 2050. U.S. waterborne trade is forecasted for nine domestic regions: (1) Alaska; (2) Gulf Coast; (3) Great Lakes; (4) Hawaii; (5) North Atlantic; (6) North Pacific; (7) Puerto Rico; (8) South Atlantic; and (9) South Pacific. The 85 countries that comprise the world trade have been aggregated into seven regions: (1) Africa; (2) Asia; (3) Europe; (4) Mideast; (5) North America (Canada, U.S., and Mexico); (6) South America; and (7) the Caribbean. For summary reporting of the U.S. waterborne trade results, the six continental U.S. regions were used, excluding Alaska, Hawaii, and Puerto Rico.[11]

Detailed U.S. world maritime trade was aggregated to 10 commodity groups: (1) Agriculture; (2) Capital Equipment; (3) Chemicals; (4) Consumer Goods; (5) Extractive; (6) Food; (7) Fuels; (8) High Tech; (9) Intermediate Manufacturing; and (10) Materials. For summary reporting, U.S. world waterborne trade has been compiled by six continental regions, 10 commodities, and 11 years, consisting of actual trade in 1995, 2000, and 2003 and forecasted trade in 2004, 2005, 2010, 2015, 2020, 2030, 2040 and 2050. The selection of reporting years was based on a balance of historic data, near-term projections in 2004, 2005, and 2010, and longer-term projections beyond 2015 in terms of what could be fitted into tables in the main body of the report.

U.S. waterborne world trade has been projected in metric tonnes and TEUs as follows: (1) All Commodities (metric tonnes); (2) Containerized Commodities (metric tonnes); and (3) TEUs. The containerized commodities are a subset of all commodities. TEUs are developed from the containerized commodities based on commodity density relationships. For each forecast grouping (all commodities, containerized commodities, and TEUs), there are two sets of projections for exports (origin/destination) and imports (destination/origin) with respect to the U.S. and the seven world regions.

The U.S. waterborne trade forecasts for the 10 commodity categories for all commodities (metric tonnes), containerized commodities (metric tonnes), and TEUs for exports and imports are contained in an Appendix B. The U.S. waterborne world trade forecasts are summarized for all commodities in six tables for the seven regions. The forecasts reflect U.S. origin/destination (exports) and U.S. destination/origin (imports) for all commodities (metric tonnes), containerized commodities, (metric tonnes), and TEUs as follows:

Table 2-7 – Origin/Destination U.S. Commodity Forecast (metric tonnes)
Table 2-8 – Destination/Origin U.S. Commodity Forecast (metric tonnes)
Table 2-9 – Origin/Destination U.S. Containerized Commodity Forecast (metric tonnes)
Table 2-10 – Destination/Origin U.S. Containerized Commodity Forecast (metric tonnes)
Table 2-11 – Origin/Destination U.S. Containerized Commodity Forecast (TEUs)
Table 2-12 – Destination/Origin U.S. Containerized Commodity Forecast (TEUs)

[11] The full forecast is available on a cd-rom.

Table 2-7. U.S. Commodity Forecast for All Commodities, Sorted by Origin, by Major Region, 1995-2050, Selected Years (Metric Tonnes)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	916,871	548,084	221,442	220,103	218,992	231,185	238,810	250,300	280,898	329,257	415,351
North Atlantic	Asia	13,960,750	6,961,449	8,837,144	9,250,606	9,270,680	9,482,315	9,785,641	10,535,969	12,835,386	16,881,243	24,537,916
North Atlantic	Europe	33,959,934	18,675,604	13,643,554	15,900,644	13,980,998	12,838,292	12,490,208	12,524,759	13,081,176	14,779,128	18,442,629
North Atlantic	Mideast	3,597,865	1,095,576	1,432,449	1,429,521	1,493,730	1,579,931	1,662,666	1,780,991	2,073,737	2,427,349	2,857,108
North Atlantic	North America	869,534	2,078,706	1,623,821	1,641,668	1,651,805	1,806,570	1,892,641	1,984,001	2,219,464	2,388,733	2,706,130
North Atlantic	South America	6,148,312	4,626,630	3,139,320	3,202,490	3,302,950	3,653,081	3,863,212	4,062,578	4,562,833	5,183,353	5,936,026
North Atlantic	Caribbean	100,528	80,703	142,365	145,643	151,307	186,891	241,927	315,981	578,891	1,106,083	2,109,882
South Atlantic	Africa	197,153	144,011	142,940	143,401	144,078	154,159	163,624	183,492	256,057	415,959	790,866
South Atlantic	Asia	6,318,402	6,073,964	6,737,734	7,026,350	7,151,692	7,498,514	7,900,876	8,554,073	10,484,268	13,638,385	18,705,511
South Atlantic	Europe	5,910,111	5,885,058	5,430,558	5,630,642	5,662,891	5,411,108	5,408,690	5,665,013	6,478,314	7,819,933	9,883,605
South Atlantic	Mideast	454,779	345,066	544,798	546,675	549,330	634,646	677,705	735,986	872,838	1,035,794	1,223,534
South Atlantic	North America	391,338	537,203	476,446	471,935	490,000	583,525	634,611	678,184	786,567	904,965	1,031,263
South Atlantic	South America	3,390,596	3,060,587	2,677,723	2,759,693	2,794,110	3,099,502	3,396,914	3,769,843	4,926,495	6,901,953	9,967,905
South Atlantic	Caribbean	558,100	784,677	869,413	927,918	990,685	1,372,204	1,957,095	2,740,407	5,569,284	11,360,967	22,472,124
Gulf Coast	Africa	1,754,896	1,033,634	1,265,369	1,260,911	1,253,069	1,310,434	1,378,398	1,488,698	1,887,804	2,745,000	4,595,166
Gulf Coast	Asia	22,534,794	19,555,035	20,083,467	20,982,229	21,276,557	22,347,376	23,156,422	24,458,167	28,131,025	31,114,050	39,182,352
Gulf Coast	Europe	29,528,045	19,168,784	14,360,905	15,104,291	15,328,787	15,057,383	15,367,352	16,046,989	17,794,666	20,667,667	25,169,483
Gulf Coast	Mideast	2,613,897	3,491,026	2,823,074	2,976,822	3,121,045	4,164,248	4,683,426	5,236,308	6,475,586	7,867,993	9,391,467
Gulf Coast	North America	4,914,212	14,555,052	12,414,616	12,871,348	13,126,503	14,074,818	14,680,405	15,678,132	17,967,023	20,637,355	23,525,324
Gulf Coast	South America	15,729,282	14,333,617	16,908,499	17,527,707	17,898,394	20,064,945	21,878,441	23,595,774	27,825,928	34,274,512	43,885,569
Gulf Coast	Caribbean	2,838,530	4,423,930	5,808,261	6,065,273	6,270,681	6,949,632	7,496,419	8,090,060	9,714,935	12,385,447	16,886,469
South Pacific	Africa	34,159	11,778	14,069	13,371	12,934	15,857	17,342	18,851	22,244	26,130	30,969
South Pacific	Asia	28,486,063	24,641,560	23,410,196	24,316,177	24,515,495	26,160,441	27,600,996	30,178,203	38,077,504	52,442,033	79,466,983
South Pacific	Europe	1,355,579	1,029,245	730,629	739,029	727,466	779,181	810,539	849,964	954,200	1,107,602	1,342,382
South Pacific	Mideast	30,287	58,241	102,867	103,941	104,853	124,921	136,319	148,596	176,665	209,584	246,758
South Pacific	North America	1,253,197	2,096,695	495,389	499,319	502,128	481,006	460,719	465,932	477,638	491,282	504,373
South Pacific	South America	1,010,733	974,363	1,045,873	1,123,265	1,136,925	1,255,800	1,350,098	1,432,853	1,598,452	1,782,813	1,995,689
South Pacific	Caribbean	149,995	93,784	422,386	435,032	443,040	482,718	527,387	582,412	768,363	1,146,266	1,846,025
North Pacific	Africa	24,192	3,939	16,695	16,302	16,059	17,458	18,384	19,345	21,388	24,940	32,687
North Pacific	Asia	27,833,968	18,647,696	21,016,436	22,295,615	22,824,938	25,979,234	27,679,340	29,222,349	33,461,595	36,251,553	44,819,538
North Pacific	Europe	658,528	637,029	810,330	839,423	859,109	923,086	980,647	1,049,175	1,219,540	1,435,293	1,709,073
North Pacific	Mideast	10,089	10,544	13,570	13,589	13,840	15,479	16,845	18,180	20,951	24,052	27,505
North Pacific	North America	2,237,545	1,057,309	1,660,956	1,753,418	1,672,103	1,972,776	2,048,062	2,145,782	2,393,602	2,781,005	3,317,107
North Pacific	South America	962,465	463,915	885,460	940,325	957,092	1,077,819	1,183,594	1,277,244	1,454,246	1,639,254	1,845,812
North Pacific	Caribbean	41,041	39,866	439,859	444,300	446,717	461,472	472,252	479,263	488,261	495,267	502,160
Great Lakes	Africa	171,081	25,009	4,635	4,479	4,420	4,229	4,099	4,103	4,212	4,477	4,884
Great Lakes	Asia	331,452	81,003	368,856	378,181	382,078	420,862	458,372	491,377	590,543	761,288	1,072,652
Great Lakes	Europe	1,348,580	1,661,411	1,633,213	1,721,543	1,803,064	2,063,743	2,354,898	2,625,535	3,218,035	3,949,404	4,871,924
Great Lakes	Mideast	29,136	71,912	6,358	6,688	7,039	9,445	10,887	12,349	15,629	19,426	23,805
Great Lakes	North America	16,842,153	14,752,127	24,293,911	23,868,126	24,478,372	26,210,660	27,396,484	28,369,693	30,642,002	32,126,843	35,002,936
Great Lakes	South America	25,281	20,067	3,636	3,862	3,917	4,503	4,972	5,378	6,281	7,331	8,551
Great Lakes	Caribbean	39	1,069	1,173	1,223	1,277	1,533	1,947	2,522	4,559	8,711	16,707
Total		**239,523,492**	**193,836,959**	**196,960,396**	**203,603,079**	**207,041,145**	**220,962,980**	**232,489,665**	**247,774,814**	**290,419,084**	**351,599,680**	**462,404,197**
Average Annual Growth Rate			**-4.14%**	**0.53%**	**3.37%**	**1.69%**	**1.31%**	**1.02%**	**1.28%**	**1.60%**	**1.93%**	**2.78%**

Table 2-8. U.S. Commodity Forecast for all Commodities, Sorted by Destination, by Major Region, 1995-2050, Selected Years
(Metric Tonnes)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	9,710,130	9,604,922	12,260,142	14,287,698	15,725,261	20,855,774	22,813,749	24,115,787	27,172,984	30,713,394	34,708,691
North Atlantic	Asia	8,578,743	9,896,597	12,987,501	13,468,830	14,519,365	18,577,584	21,119,369	23,566,628	29,827,339	37,934,816	47,990,628
North Atlantic	Europe	15,164,582	27,873,047	33,037,656	36,018,092	38,240,094	45,854,928	51,912,651	57,981,634	74,016,111	95,259,228	122,033,214
North Atlantic	Mideast	593,395	1,142,043	1,501,171	1,675,248	1,849,642	2,267,838	2,570,539	2,861,117	3,553,976	4,440,180	5,579,757
North Atlantic	North America	17,735,161	24,616,678	30,977,371	34,650,309	36,294,560	42,330,964	46,677,265	50,235,302	58,691,693	69,450,554	83,430,744
North Atlantic	South America	28,099,053	34,702,337	34,956,757	37,512,311	39,562,170	45,829,627	50,282,806	54,083,094	63,896,391	77,466,655	96,385,331
North Atlantic	Caribbean	142,715	336,549	292,969	293,707	302,434	360,097	395,034	427,815	496,945	570,148	647,978
South Atlantic	Africa	245,751	484,120	406,065	432,665	471,899	562,162	614,214	659,569	778,302	921,403	1,083,681
South Atlantic	Asia	3,022,497	6,464,596	7,043,515	7,465,238	8,129,331	11,524,486	14,296,967	17,364,640	25,926,009	38,905,434	57,922,317
South Atlantic	Europe	6,488,200	11,169,284	12,931,340	13,557,925	14,406,539	18,142,957	20,255,114	22,169,927	27,353,293	34,546,540	44,001,769
South Atlantic	Mideast	388,985	745,107	1,159,064	1,309,197	1,479,834	1,846,819	2,078,875	2,289,092	2,768,434	3,334,361	3,978,774
South Atlantic	North America	5,937,732	6,554,488	8,154,597	8,374,182	8,008,402	8,233,821	8,317,913	8,352,880	8,566,179	9,048,233	9,966,034
South Atlantic	South America	9,649,545	13,168,052	17,872,386	19,311,076	20,789,950	24,980,210	28,212,218	31,194,100	38,172,370	46,688,585	56,960,970
South Atlantic	Caribbean	334,728	729,691	780,118	788,568	815,837	920,119	1,006,159	1,094,158	1,312,853	1,576,094	1,887,404
Gulf Coast	Africa	7,686,232	8,369,253	8,106,259	9,189,378	9,874,187	11,300,051	11,051,626	10,488,459	9,671,516	9,144,260	8,892,144
Gulf Coast	Asia	8,727,364	16,270,911	11,019,025	11,793,172	12,869,158	16,910,519	19,445,429	21,954,977	28,526,131	37,783,039	50,549,949
Gulf Coast	Europe	13,858,305	23,983,099	27,313,865	29,593,935	31,123,283	36,148,929	39,511,285	41,972,608	48,649,355	57,975,912	70,184,283
Gulf Coast	Mideast	685,753	1,786,257	1,263,634	1,435,341	1,604,515	2,062,241	2,586,079	3,094,306	4,325,372	5,874,048	7,722,591
Gulf Coast	North America	57,429,421	75,243,298	90,041,237	101,566,871	107,912,685	125,687,622	133,776,510	137,969,709	148,984,815	163,143,420	180,735,244
Gulf Coast	South America	81,982,708	93,400,891	91,933,028	101,443,064	108,610,657	125,287,594	133,344,841	137,612,732	148,448,592	162,013,909	178,193,194
Gulf Coast	Caribbean	894,555	1,547,631	1,806,722	1,979,773	2,096,243	2,439,989	2,611,129	2,723,417	3,020,295	3,406,825	3,890,607
South Pacific	Africa	66,999	78,865	1,063,302	1,243,221	1,370,928	1,832,693	2,013,769	2,136,454	2,423,453	2,751,751	3,118,165
South Pacific	Asia	20,284,006	41,972,608	43,338,892	45,812,779	49,616,445	67,408,232	79,639,406	91,759,661	121,583,822	158,975,052	203,690,275
South Pacific	Europe	1,919,621	3,773,182	3,370,019	3,651,839	3,998,636	5,165,532	5,993,703	6,870,090	9,187,204	12,331,936	16,406,167
South Pacific	Mideast	26,612	181,565	321,986	367,986	422,521	594,615	765,613	964,036	1,524,444	2,393,258	3,694,806
South Pacific	North America	3,987,710	6,724,763	9,313,202	10,130,847	10,441,570	12,028,701	13,352,411	14,459,899	17,318,672	21,201,549	26,459,338
South Pacific	South America	6,572,908	10,049,249	10,837,875	12,208,388	13,117,002	15,910,423	17,700,974	19,025,792	22,143,026	25,868,273	30,239,189
South Pacific	Caribbean	166,227	288,194	685,254	717,008	748,616	787,447	847,022	885,522	963,124	1,056,137	1,170,664
North Pacific	Africa	1,198	7,893	8,074	8,726	9,226	9,620	10,329	11,126	13,249	14,466	14,600
North Pacific	Asia	8,525,799	10,838,233	9,669,812	10,279,840	11,167,292	15,347,721	18,350,658	21,297,244	28,559,308	37,721,834	48,799,133
North Pacific	Europe	164,465	313,934	341,281	352,413	377,134	462,325	543,493	619,702	800,861	1,000,683	1,262,394
North Pacific	Mideast	157,543	629,472	486,021	561,879	601,281	752,980	919,580	1,096,490	1,560,168	2,257,451	3,381,810
North Pacific	North America	5,535,978	6,374,301	6,705,291	7,257,390	7,530,717	8,933,842	10,312,148	11,695,412	14,989,817	19,129,645	24,259,894
North Pacific	South America	1,028,620	1,672,264	2,206,078	2,489,944	2,671,813	3,200,504	3,519,826	3,741,438	4,270,979	4,903,269	5,637,009
North Pacific	Caribbean	31,536	32,441	22,289	22,930	23,882	24,091	24,794	25,213	26,152	27,534	29,384
Great Lakes	Africa	138,323	125,679	130,775	130,869	131,027	131,317	131,513	131,692	132,041	132,385	132,723
Great Lakes	Asia	360,791	727,343	200,051	214,426	236,231	336,868	410,563	490,729	712,621	1,046,378	1,536,310
Great Lakes	Europe	2,116,412	2,422,363	1,328,080	1,449,425	1,596,065	2,116,398	2,691,363	3,222,097	4,539,162	6,266,163	8,446,878
Great Lakes	Mideast	206	17,898	8,882	10,053	11,571	17,191	25,868	36,098	67,566	121,007	207,118
Great Lakes	North America	12,604,672	14,729,609	16,754,846	17,727,701	18,097,746	19,967,680	20,443,999	20,580,016	21,009,377	21,626,634	22,418,339
Great Lakes	South America	1,233,949	838,821	870,486	864,000	975,465	1,252,247	1,397,386	1,505,890	1,766,871	2,078,884	2,431,474
Great Lakes	Caribbean	21	40	3	3	3	3	3	3	3	3	3
Total		**342,279,150**	**469,887,568**	**513,506,921**	**561,648,246**	**597,831,216**	**718,404,761**	**791,974,192**	**852,766,555**	**1,007,750,872**	**1,211,101,330**	**1,470,080,976**
Average Annual Growth Rate			**6.54%**	**3.00%**	**9.38%**	**6.44%**	**3.74%**	**1.97%**	**1.49%**	**1.68%**	**1.86%**	**1.96%**

Table 2-9. Containerized U.S. Commodity Forecast for all Commodities, Sorted by Origin, by Major Region, 1995-2050, Selected Years
(Metric Tonnes)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	155,673	116,687	145,972	142,372	141,002	157,838	171,520	184,613	215,401	258,341	327,416
North Atlantic	Asia	3,257,433	3,197,706	5,291,108	5,447,710	5,421,796	5,488,907	5,727,530	6,284,658	8,105,690	11,613,353	18,530,460
North Atlantic	Europe	3,467,878	3,174,448	3,044,402	3,106,671	3,148,029	3,423,110	3,768,017	4,178,586	5,276,538	7,002,312	9,912,869
North Atlantic	Mideast	314,488	370,792	300,239	307,715	314,243	363,922	397,917	436,004	523,612	628,225	751,472
North Atlantic	North America	24,263	15,661	29,329	29,206	29,430	29,306	29,953	32,099	36,775	42,217	48,271
North Atlantic	South America	1,190,937	1,108,259	992,857	1,036,398	1,044,398	1,161,705	1,263,689	1,371,771	1,637,112	1,988,224	2,436,367
North Atlantic	Caribbean	42,584	71,121	117,154	122,002	127,724	163,672	221,460	299,949	579,864	1,143,113	2,216,724
South Atlantic	Africa	64,889	82,641	57,843	57,313	57,867	69,520	82,572	102,778	174,979	334,360	710,805
South Atlantic	Asia	3,022,237	3,490,230	4,550,815	4,749,467	4,816,949	5,034,474	5,310,283	5,813,036	7,263,757	9,593,971	13,152,591
South Atlantic	Europe	2,207,659	2,491,972	2,621,351	2,712,309	2,731,237	2,653,835	2,714,374	2,888,243	3,397,050	4,224,472	5,499,863
South Atlantic	Mideast	219,435	313,436	430,999	432,305	430,103	505,921	544,622	593,771	710,820	852,232	1,016,274
South Atlantic	North America	47,137	105,832	109,640	114,242	117,501	135,782	151,304	163,403	189,291	217,052	246,690
South Atlantic	South America	2,225,247	2,125,267	1,823,287	1,893,402	1,919,515	2,155,403	2,399,493	2,699,039	3,674,255	5,389,813	8,050,297
South Atlantic	Caribbean	479,622	731,854	823,680	877,815	936,833	1,311,855	1,919,069	2,739,060	5,720,748	11,856,586	23,656,422
Gulf Coast	Africa	73,790	133,990	181,305	177,604	177,106	215,838	246,313	287,028	418,920	652,805	1,041,517
Gulf Coast	Asia	1,224,516	838,582	1,256,107	1,314,990	1,330,746	1,424,858	1,574,522	1,810,645	2,591,302	4,130,959	7,139,491
Gulf Coast	Europe	2,268,672	2,850,724	3,071,223	3,101,186	3,087,737	3,368,724	3,642,043	3,941,597	4,718,709	5,863,767	7,618,868
Gulf Coast	Mideast	222,998	399,751	523,515	534,251	540,111	653,083	727,685	807,194	991,057	1,209,878	1,461,134
Gulf Coast	North America	60,984	245,189	1,034,500	1,109,981	1,175,194	1,565,690	1,794,353	2,014,895	2,483,217	2,988,347	3,514,786
Gulf Coast	South America	2,371,941	2,321,560	2,263,894	2,373,924	2,405,583	2,741,573	3,065,370	3,445,239	4,625,130	6,697,741	9,872,953
Gulf Coast	Caribbean	694,456	975,730	1,225,270	1,277,055	1,326,114	1,573,046	1,890,889	2,293,140	3,613,954	6,069,706	10,492,443
South Pacific	Africa	8,658	7,723	10,552	10,055	9,780	11,593	12,739	13,882	16,595	19,903	24,271
South Pacific	Asia	15,966,463	15,420,181	17,864,484	18,433,056	18,585,761	19,974,852	21,334,942	23,664,986	30,876,508	44,471,145	70,644,464
South Pacific	Europe	650,993	621,031	576,980	579,615	563,639	611,551	636,091	666,099	747,960	869,678	1,058,717
South Pacific	Mideast	26,728	52,711	82,590	83,671	84,267	102,125	112,695	123,505	148,193	177,137	209,712
South Pacific	North America	7,606	35,473	27,002	29,414	30,732	36,510	40,461	43,581	49,944	56,919	64,677
South Pacific	South America	304,246	317,106	274,763	280,364	281,506	299,142	311,991	329,586	380,540	455,213	555,279
South Pacific	Caribbean	30,654	62,201	94,413	99,913	105,283	134,485	172,533	224,740	416,068	817,619	1,568,093
North Pacific	Africa	3,877	3,325	13,571	13,208	12,934	14,130	14,858	15,420	16,202	16,867	17,546
North Pacific	Asia	10,086,754	8,441,668	8,773,273	9,156,602	9,391,896	10,519,551	11,224,340	12,199,507	14,765,190	18,369,976	24,205,502
North Pacific	Europe	227,832	218,964	225,283	237,713	242,197	256,523	253,276	263,225	309,585	386,010	503,040
North Pacific	Mideast	1,852	3,467	6,748	6,692	6,773	7,663	8,397	9,120	10,615	12,304	14,194
North Pacific	North America	8,408	16,065	26,787	26,944	27,728	31,147	34,371	37,862	45,239	53,427	62,374
North Pacific	South America	112,825	98,961	94,949	99,296	101,235	113,193	121,795	130,705	148,999	170,904	198,548
North Pacific	Caribbean	852	16,452	21,736	22,377	22,936	25,515	27,085	28,547	31,837	36,435	43,361
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	42	0	3,679	3,878	4,218	6,488	7,907	8,359	9,423	10,585	11,738
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**51,074,627**	**50,476,759**	**57,991,298**	**60,000,717**	**60,750,104**	**66,342,530**	**71,956,461**	**80,145,876**	**104,921,079**	**148,681,598**	**226,879,229**
Average Annual Growth Rate			**-0.24%**	**4.73%**	**3.47%**	**1.25%**	**1.78%**	**1.64%**	**2.18%**	**2.73%**	**3.55%**	**4.32%**

Table 2-10. Containerized U.S. Commodity Forecast for all Commodities, Sorted by Destination, by Major Region, 1995-2050, Selected Years
(Metric Tonnes)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	143,285	276,149	329,362	353,172	381,118	458,640	504,997	548,736	657,590	787,554	945,623
North Atlantic	Asia	3,081,907	5,018,788	7,164,437	7,328,864	7,888,540	10,293,457	11,835,198	13,337,385	17,254,664	22,312,655	28,549,081
North Atlantic	Europe	6,276,153	8,945,162	9,218,066	9,684,897	10,439,853	12,515,349	13,591,315	14,575,485	17,281,329	20,731,239	24,839,644
North Atlantic	Mideast	383,754	587,441	678,147	746,208	821,997	993,739	1,114,331	1,233,692	1,511,043	1,834,988	2,200,044
North Atlantic	North America	67,359	68,812	59,644	64,924	67,169	80,904	89,757	98,682	123,132	157,179	201,901
North Atlantic	South America	1,770,658	2,659,346	4,112,297	4,308,605	4,491,022	5,474,624	6,182,330	6,863,643	8,534,506	10,566,204	13,101,782
North Atlantic	Caribbean	24,359	69,688	95,654	94,937	95,027	88,613	85,267	80,634	72,308	65,936	62,291
South Atlantic	Africa	45,152	66,421	108,051	116,425	128,107	169,203	196,852	225,306	292,652	372,303	463,822
South Atlantic	Asia	1,689,840	2,844,511	4,023,957	4,242,260	4,607,202	6,515,967	8,165,272	10,079,383	15,568,902	24,097,522	36,816,628
South Atlantic	Europe	1,977,002	3,559,871	4,107,672	4,315,734	4,663,397	5,847,028	6,560,176	7,250,188	9,133,839	11,765,249	15,248,731
South Atlantic	Mideast	116,021	213,985	309,220	340,958	379,531	481,940	545,558	609,896	768,492	972,221	1,225,101
South Atlantic	North America	45,906	163,224	104,839	110,313	117,301	138,870	154,112	166,689	195,880	232,138	277,337
South Atlantic	South America	1,363,254	1,882,160	2,805,120	2,902,979	3,070,109	3,791,727	4,190,319	4,552,992	5,360,804	6,279,284	7,362,521
South Atlantic	Caribbean	319,886	716,291	699,288	711,879	739,580	833,062	924,539	1,020,501	1,260,428	1,549,317	1,889,429
Gulf Coast	Africa	48,389	97,960	106,487	115,442	123,482	130,561	134,189	137,768	154,088	176,631	202,274
Gulf Coast	Asia	352,837	489,093	622,750	649,782	702,374	935,304	1,106,344	1,284,275	1,772,510	2,499,200	3,553,818
Gulf Coast	Europe	1,841,371	2,642,074	2,696,920	2,882,089	3,153,437	4,025,351	4,563,526	5,035,592	6,354,562	8,296,071	10,945,030
Gulf Coast	Mideast	64,187	133,040	106,306	116,816	129,333	161,762	188,004	213,627	274,521	350,176	441,489
Gulf Coast	North America	256,074	306,356	389,152	388,952	398,487	447,136	486,191	522,637	612,447	723,383	855,913
Gulf Coast	South America	783,122	1,515,404	2,311,903	2,389,742	2,512,857	2,956,428	3,207,970	3,422,452	3,946,394	4,612,484	5,457,685
Gulf Coast	Caribbean	154,641	313,402	345,961	352,427	367,150	415,206	468,525	525,153	675,185	870,476	1,114,953
South Pacific	Africa	10,741	13,669	17,338	18,793	20,737	27,595	32,413	36,810	48,227	61,802	77,493
South Pacific	Asia	15,315,374	27,093,798	31,215,619	32,515,110	34,977,173	46,836,695	55,324,253	63,847,834	84,925,159	111,307,606	142,645,251
South Pacific	Europe	1,243,720	2,025,636	1,981,764	2,161,224	2,397,330	3,026,492	3,434,484	3,858,326	4,938,855	6,362,411	8,181,989
South Pacific	Mideast	22,133	92,113	170,802	195,046	223,252	315,135	384,098	464,042	672,035	963,542	1,359,220
South Pacific	North America	104,482	239,240	234,284	251,404	255,216	301,117	333,476	361,935	429,201	512,413	613,557
South Pacific	South America	269,198	420,230	731,074	759,625	792,231	942,782	1,058,612	1,162,431	1,428,954	1,779,468	2,239,143
South Pacific	Caribbean	45,953	209,051	362,454	386,610	401,299	351,643	353,244	337,543	303,262	279,507	273,621
North Pacific	Africa	366	1,563	1,655	1,802	1,963	2,478	2,827	3,195	4,049	5,014	6,057
North Pacific	Asia	4,363,037	5,514,287	6,166,552	6,443,568	6,930,495	9,303,147	11,032,575	12,729,657	16,909,878	22,100,847	28,242,788
North Pacific	Europe	55,627	98,056	108,903	117,040	129,256	168,367	196,775	225,871	297,157	385,615	500,272
North Pacific	Mideast	84	1,237	11,239	12,253	13,441	18,922	23,966	29,374	42,737	61,483	88,950
North Pacific	North America	223,192	131,574	96,943	104,278	107,138	123,460	137,801	152,026	184,313	222,211	266,113
North Pacific	South America	109,816	64,103	84,926	85,133	86,477	99,487	109,852	119,600	143,997	174,832	212,971
North Pacific	Caribbean	6,371	14,005	17,830	17,635	17,622	15,935	15,257	14,255	12,358	10,990	10,238
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	1	0	113	126	140	148	146	143	133	120	107
Great Lakes	Europe	11,866	569	29,284	28,730	30,351	35,760	41,188	46,558	58,447	71,994	87,549
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**42,587,118**	**68,488,306**	**81,626,014**	**85,315,782**	**91,661,192**	**118,324,034**	**136,775,739**	**155,174,314**	**202,204,039**	**263,552,065**	**340,560,419**
Average Annual Growth Rate			**9.97%**	**6.02%**	**4.52%**	**7.44%**	**5.24%**	**2.94%**	**2.56%**	**2.68%**	**2.69%**	**2.60%**

Table 2-11. Containerized U.S. Commodity Forecast for all Commodities, Sorted by Origin, by Major Region, 1995-2050, Selected Years
(TEUs)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	17,714	15,201	24,691	24,530	24,633	27,559	29,548	31,229	35,108	40,155	47,995
North Atlantic	Asia	310,054	319,145	558,179	570,496	566,122	556,525	574,208	633,137	833,846	1,237,439	2,040,377
North Atlantic	Europe	393,819	405,608	439,053	451,167	458,574	516,885	569,824	632,804	805,392	1,080,815	1,548,565
North Atlantic	Mideast	32,235	40,396	40,944	42,447	44,335	49,358	53,501	58,232	69,014	81,665	96,539
North Atlantic	North America	2,196	1,973	1,703	1,729	1,777	1,987	2,142	2,356	2,798	3,276	3,784
North Atlantic	South America	139,930	134,698	124,654	130,986	132,473	150,080	164,053	177,505	209,005	247,137	292,045
North Atlantic	Caribbean	6,080	11,823	19,089	20,350	21,646	28,779	37,402	49,004	90,536	175,411	337,142
South Atlantic	Africa	6,928	8,401	6,455	6,383	6,439	7,400	8,065	8,805	10,702	13,381	17,816
South Atlantic	Asia	281,296	332,102	464,106	483,674	491,975	523,576	564,710	631,311	832,835	1,186,089	1,805,039
South Atlantic	Europe	230,004	275,207	329,724	341,682	344,962	356,716	377,072	405,753	482,644	597,086	762,937
South Atlantic	Mideast	22,439	32,412	39,473	39,410	39,498	47,698	51,478	56,456	68,354	82,741	99,427
South Atlantic	North America	5,091	10,427	14,625	15,454	16,111	19,669	22,922	25,737	32,090	39,707	48,805
South Atlantic	South America	270,767	257,994	214,724	225,095	228,939	260,479	292,084	328,407	444,435	652,027	1,015,889
South Atlantic	Caribbean	72,902	115,722	127,923	137,013	147,072	210,712	312,874	451,900	961,834	2,020,247	4,065,810
Gulf Coast	Africa	5,776	10,187	11,741	11,620	11,628	13,448	15,266	17,894	26,953	43,270	68,949
Gulf Coast	Asia	95,974	69,056	109,465	113,331	115,021	128,545	148,131	176,022	268,491	449,707	797,829
Gulf Coast	Europe	213,093	258,827	295,708	300,263	300,211	326,356	349,762	375,911	448,293	559,316	732,018
Gulf Coast	Mideast	19,639	31,953	44,049	44,804	45,718	56,262	62,652	69,706	85,933	105,136	127,154
Gulf Coast	North America	7,123	27,192	220,425	236,959	251,967	344,664	395,166	444,464	546,896	655,735	769,447
Gulf Coast	South America	189,223	201,876	194,628	204,612	206,964	233,107	258,732	288,242	378,377	534,669	772,870
Gulf Coast	Caribbean	70,459	99,379	135,059	140,617	146,153	177,090	221,753	279,860	480,613	873,409	1,603,338
South Pacific	Africa	861	754	1,156	1,111	1,094	1,309	1,449	1,566	1,804	1,998	2,170
South Pacific	Asia	1,636,745	1,586,577	1,991,897	2,047,080	2,064,261	2,217,863	2,381,638	2,652,889	3,496,334	5,098,038	8,191,244
South Pacific	Europe	70,917	74,394	91,528	93,108	94,447	111,297	125,808	139,777	171,636	212,992	270,620
South Pacific	Mideast	2,940	5,291	8,127	8,482	8,764	10,827	12,144	13,470	16,349	19,443	22,686
South Pacific	North America	710	7,406	7,472	7,998	8,368	9,986	11,360	12,276	13,863	15,367	16,982
South Pacific	South America	38,624	40,237	40,102	40,432	40,546	42,622	45,077	48,790	61,620	83,315	116,636
South Pacific	Caribbean	3,720	10,357	23,149	25,515	28,177	45,666	73,934	111,269	246,259	522,132	1,054,595
North Pacific	Africa	272	327	776	759	736	848	875	930	1,021	1,111	1,201
North Pacific	Asia	906,658	762,800	822,420	854,304	874,974	974,426	1,039,333	1,131,816	1,374,465	1,729,282	2,297,663
North Pacific	Europe	20,917	19,449	24,462	25,532	25,957	27,827	28,471	30,270	36,726	47,347	63,824
North Pacific	Mideast	149	425	653	647	659	762	849	944	1,146	1,381	1,653
North Pacific	North America	1,673	2,471	1,730	1,720	1,764	2,164	2,470	2,738	3,267	3,802	4,345
North Pacific	South America	6,967	8,174	7,085	7,365	7,529	8,537	9,235	9,963	11,516	13,468	16,031
North Pacific	Caribbean	98	788	1,780	1,830	1,875	2,119	2,347	2,607	3,416	4,946	7,816
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	6	0	0	0	0	0	0	0	0	0	0
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**5,083,997**	**5,179,030**	**6,438,753**	**6,658,504**	**6,761,368**	**7,493,146**	**8,246,337**	**9,304,038**	**12,553,568**	**18,433,039**	**29,121,240**
Average Annual Growth Rate			**0.37%**	**7.53%**	**3.41%**	**1.54%**	**2.08%**	**1.93%**	**2.44%**	**3.04%**	**3.92%**	**4.68%**

Table 2-12. Containerized U.S. Commodity Forecast for all Commodities, Sorted by Destination, by Major Region, 1995-2050, Selected Years
(TEUs)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	11,506	23,405	41,942	45,459	49,887	63,108	70,335	75,165	90,274	104,231	122,395
North Atlantic	Asia	352,430	593,947	978,938	1,013,910	1,093,435	1,467,614	1,703,541	1,941,361	2,543,300	3,313,334	4,249,978
North Atlantic	Europe	624,978	1,015,725	1,180,015	1,229,544	1,314,223	1,594,454	1,753,693	1,901,094	2,289,891	2,777,845	3,346,466
North Atlantic	Mideast	45,055	76,321	105,340	115,384	126,393	150,387	169,911	186,581	235,065	294,107	361,627
North Atlantic	North America	4,723	5,534	6,937	7,333	8,023	9,208	10,123	10,602	11,659	12,994	14,763
North Atlantic	South America	164,292	240,453	400,315	422,818	444,580	550,078	623,158	698,506	888,000	1,131,526	1,443,885
North Atlantic	Caribbean	1,021	9,949	12,525	12,410	12,504	12,035	11,828	11,475	10,956	10,488	10,240
South Atlantic	Africa	5,797	9,243	15,213	16,386	18,012	24,951	29,277	33,381	42,871	54,012	66,818
South Atlantic	Asia	220,133	430,055	710,878	755,975	829,105	1,221,612	1,542,346	1,915,202	2,966,816	4,570,277	6,917,139
South Atlantic	Europe	205,044	407,832	524,347	542,852	581,355	763,578	879,344	992,016	1,288,131	1,688,606	2,206,690
South Atlantic	Mideast	15,925	32,770	50,510	55,122	60,747	78,162	91,504	106,527	146,940	204,201	281,078
South Atlantic	North America	7,265	16,545	18,583	19,732	21,291	27,651	32,341	36,714	47,134	60,339	76,600
South Atlantic	South America	132,332	200,084	569,805	556,169	560,250	581,596	587,770	626,195	716,089	824,392	962,235
South Atlantic	Caribbean	59,934	121,929	123,687	127,146	133,191	154,926	175,691	197,435	251,235	315,676	391,137
Gulf Coast	Africa	2,447	5,811	6,450	6,723	7,110	8,383	9,146	9,714	11,228	12,934	14,730
Gulf Coast	Asia	25,334	39,966	62,190	64,956	70,919	98,873	119,449	141,266	200,782	288,968	416,172
Gulf Coast	Europe	145,607	229,732	265,590	281,892	306,531	388,929	444,375	498,260	644,944	851,369	1,123,321
Gulf Coast	Mideast	5,268	11,698	12,347	13,247	14,493	18,661	21,950	25,410	34,338	46,383	61,823
Gulf Coast	North America	22,689	32,759	74,179	72,515	73,434	79,001	83,913	91,095	108,420	129,995	156,400
Gulf Coast	South America	65,112	126,092	280,180	293,364	313,620	404,758	462,070	519,113	655,793	825,635	1,031,793
Gulf Coast	Caribbean	23,721	50,512	76,817	81,079	86,964	106,406	122,476	138,405	178,256	227,218	285,282
South Pacific	Africa	985	1,031	1,735	1,919	2,140	2,894	3,468	4,029	5,429	7,138	9,144
South Pacific	Asia	2,255,308	4,192,316	5,320,205	5,536,300	5,951,187	8,040,545	9,466,661	10,930,426	14,536,355	19,020,344	24,289,703
South Pacific	Europe	124,866	198,292	215,344	231,866	254,751	309,726	347,005	385,419	486,003	619,920	789,830
South Pacific	Mideast	3,315	8,455	13,234	14,778	16,601	23,563	29,518	36,165	54,183	80,484	117,929
South Pacific	North America	8,776	19,028	61,193	61,377	67,018	74,446	75,840	77,834	86,216	101,300	124,325
South Pacific	South America	24,477	39,291	166,133	182,725	200,870	255,808	282,265	309,398	387,313	505,827	678,924
South Pacific	Caribbean	4,334	17,218	39,952	41,995	43,700	42,912	45,621	47,170	51,368	57,379	65,595
North Pacific	Africa	29	69	155	175	196	270	319	368	479	606	747
North Pacific	Asia	613,173	844,940	1,005,197	1,049,753	1,129,448	1,523,159	1,795,250	2,071,793	2,755,112	3,603,644	4,600,024
North Pacific	Europe	3,892	8,138	10,709	11,483	12,642	16,439	19,276	22,172	29,057	37,479	48,043
North Pacific	Mideast	11	134	1,379	1,469	1,574	2,216	2,912	3,634	5,268	7,522	11,131
North Pacific	North America	12,036	3,973	7,060	7,680	8,568	10,774	11,778	12,798	14,962	17,340	19,973
North Pacific	South America	7,863	5,876	118,027	133,621	150,178	191,281	196,415	198,323	201,721	205,155	208,413
North Pacific	Caribbean	480	1,300	1,560	1,538	1,533	1,386	1,326	1,242	1,090	989	951
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	1,040	70	167	186	212	304	365	419	549	714	916
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**5,201,196**	**9,020,491**	**12,478,837**	**13,010,881**	**13,966,686**	**18,299,496**	**21,222,241**	**24,256,710**	**31,977,228**	**42,010,373**	**54,506,215**
Average Annual Growth Rate			**11.64%**	**11.42%**	**4.26%**	**7.35%**	**5.55%**	**3.01%**	**2.71%**	**2.80%**	**2.77%**	**2.64%**

U.S. containerized exports and imports measured in TEUs grew at sharply different rates between 1995 and 2003 (see tables 2-11 and 2-12). U.S. exports of TEUs increased approximately 25 percent, from 5.083 million in 1995 to 6.438 million in 2003. During the same time, U.S. imports of TEUs increased 140 percent, from 5.201 million to 12.478 million. U.S. imports of TEUs in 2003 (12.478 million) consisted of five large markets, which in descending order of volume (TEUs) were as follows: (1) imports from Asia to South Pacific – 5.320 million TEUs; (2) imports from Europe to North Atlantic – 1.180 million TEUs; (3) Imports from Asia to North Pacific – 1.005 million TEUs; (4) imports from Asia to North Atlantic – 0.978 million TEUs; and (5) imports from Asia to South Atlantic – 0.710 million TEUs. These five markets comprise a total of 9.193 million TEUs, or nearly three-quarters of total U.S. imports of TEUs.

U.S. imports of TEUs have grown rapidly, with an average annual compound rate of 11.64 percent between 1995 and 2000 and 11.42 percent between 2000 and 2003. However, the projections indicate that growth will be slower (see Table 2-12). Growth in total U.S. imported TEUs will be 4.26 percent in 2004, 7.35 percent in 2005, and 5.55 percent annually between 2005 and 2010. After 2010, TEU imports are projected to slow. The average growth will be 3.01 percent between 2010 and 2015, 2.71 percent between 2015 and 2020, 2.80 percent between 2020 and 2030, 2.77 percent between 2030 and 2040, and 2.64 percent between 2040 and 2050.

Asia will remain a dominant source of U.S. TEU imports, with Europe having a lower growth rate. For example, imports from Asia to the North Atlantic are projected to increase 50 percent, from 0.978 million TEUs in 2003 to 1.467 million in 2010. Asia imports through the South Atlantic are projected to increase nearly 72 percent, from 0.710 million TEUs in 2003 to 1.221 million in 2010. Imports of TEUs from Asia through the South Pacific will increase nearly 50 percent, from 5.320 million in 2003 to 8.040 million in 2010. Asia TEU imports through the North Pacific will increase from 1.005 million in 2003 to 1.523 million in 2010.

U.S. TEU exports (see Table 2-11) are projected to have slow growth for most of the forecast, at average annual rates about two percent or less for the period 2005 through 2015. Thereafter, U.S. TEU exports are projected to have an average annual increase of 2.44 percent between 2015 and 2020, exceeding 3.0 percent between 2020 and 2030, nearly 4.0 percent between 2030 and 2040, and nearly 5.0 percent between 2040 and 2050.

Asia will remain the dominant market for U.S. TEU exports. In 2003, the U.S. exported 6.438 million TEUs. The largest markets were 1.991 million TEUs from South Pacific to Asia, 0.822 million TEUs from North Pacific to Asia, 0.558 million TEUs from North Atlantic to Asia, and 0.464 million TEUs from South Atlantic to Asia. Collectively, the Asia export trade from these major markets constituted 3.835 million TEUs, or 60 percent of total domestic U.S. export TEUs.

The average annual growth rates of U.S. waterborne trade for exports and imports for the 10 aggregated commodity groups are contained in tables 2-13 through 2-18 for all commodities (metric tonnes), containerized commodities (metric tonnes), and TEUs, respectively. Tables 2-13 and 2-14 pertain to all commodities (metric tonnes) for exports and imports, respectively. Tables 2-15 and 2-16 pertain to containerized commodities (metric tonnes) for

Table 2-13. Growth Rate of Outbound U.S. Commodity Forecast, by Major Commodity, 1995-2050 (Percent Change Per Period)

Major Commodity	1995-2000	2000-03	2003-04	2004-05	2005-10	2010-15	2015-20	2020-30	2030-40	2040-50
Agriculture	-2.46%	1.29%	5.24%	2.51%	2.52%	1.34%	0.91%	0.94%	-0.22%	0.98%
Capital Equipment	-3.88%	0.52%	5.54%	3.85%	4.17%	3.20%	2.89%	3.16%	3.59%	4.00%
Chemicals	2.25%	2.30%	4.78%	1.10%	1.95%	2.07%	2.33%	2.89%	3.72%	4.50%
Consumer Goods	4.38%	-3.33%	4.93%	4.09%	3.57%	3.49%	3.95%	4.76%	5.68%	6.28%
Extractive	-10.12%	-0.08%	1.11%	2.04%	0.45%	0.28%	0.44%	0.59%	0.74%	0.88%
Food	-0.81%	-4.11%	6.25%	4.38%	3.15%	1.46%	1.75%	1.72%	1.69%	1.43%
Fuels	2.14%	-0.80%	1.46%	-0.56%	-0.52%	-0.54%	0.12%	0.14%	0.28%	0.46%
High-tech Products	2.00%	-1.26%	6.16%	5.97%	6.18%	5.70%	6.24%	6.81%	7.38%	7.72%
Intermediate Manufactured Products	-12.91%	11.36%	4.38%	4.30%	4.20%	4.07%	3.30%	3.49%	3.97%	4.42%
Materials	-1.77%	3.88%	1.73%	-2.27%	-2.55%	-0.96%	1.11%	2.11%	3.46%	4.52%
All Commodities	**-4.14%**	**0.53%**	**3.37%**	**1.69%**	**1.31%**	**1.02%**	**1.28%**	**1.60%**	**1.93%**	**2.78%**

Table 2-14. Growth Rate of Inbound U.S. Commodity Forecast, by Major Commodity, 1995-2050 (Percent Change Per Period)

Major Commodity	1995-2000	2000-03	2003-04	2004-05	2005-10	2010-15	2015-20	2020-30	2030-40	2040-50
Agriculture	5.52%	6.82%	4.99%	5.54%	2.32%	1.79%	0.95%	1.53%	1.53%	1.45%
Capital Equipment	6.99%	5.27%	10.84%	10.93%	8.45%	4.13%	3.43%	3.24%	2.99%	2.71%
Chemicals	3.28%	-0.25%	-1.86%	3.82%	2.16%	0.85%	-0.04%	0.37%	0.95%	1.31%
Consumer Goods	13.18%	11.37%	5.40%	8.99%	7.20%	3.30%	3.12%	3.05%	2.89%	2.68%
Extractive	4.07%	4.48%	10.15%	5.61%	2.85%	0.95%	0.39%	0.53%	0.65%	0.73%
Food	5.03%	7.32%	3.24%	7.08%	3.07%	1.11%	1.09%	1.03%	0.92%	0.82%
Fuels	10.89%	4.61%	13.39%	4.91%	2.98%	2.49%	2.05%	2.10%	2.18%	2.29%
High-tech Products	11.16%	2.51%	5.50%	9.09%	9.35%	5.79%	4.84%	4.27%	3.69%	3.19%
Intermediate Manufactured Products	13.26%	-7.51%	10.26%	11.91%	6.75%	4.38%	3.54%	3.46%	3.36%	3.22%
Materials	8.24%	8.75%	0.67%	3.09%	2.57%	1.17%	1.04%	1.36%	1.55%	1.53%
All Commodities	**6.54%**	**3.00%**	**9.38%**	**6.44%**	**3.74%**	**1.97%**	**1.49%**	**1.68%**	**1.86%**	**1.96%**

Table 2-15. Growth Rate in Metric Tonnes of Outbound U.S. Containerized Commodity Forecast, by Major Commodity, 1995-2050 (Percent Change Per Period)

Major Commodity	1995-2000	2000-03	2003-04	2004-05	2005-10	2010-15	2015-20	2020-30	2030-40	2040-50
Agriculture	-3.98%	5.96%	7.07%	1.93%	2.66%	1.62%	1.45%	1.55%	1.57%	1.87%
Capital Equipment	-1.65%	-1.28%	6.09%	4.04%	4.11%	3.53%	3.19%	3.45%	3.89%	4.35%
Chemicals	2.02%	3.59%	1.94%	1.27%	2.86%	2.84%	3.16%	3.84%	4.79%	5.54%
Consumer Goods	4.73%	-4.38%	4.95%	4.03%	3.47%	3.43%	3.88%	4.69%	5.61%	6.22%
Extractive	1.59%	7.29%	6.08%	1.60%	1.44%	0.67%	0.83%	1.03%	1.01%	1.07%
Food	2.14%	1.39%	3.84%	3.75%	3.49%	1.41%	1.58%	1.53%	1.49%	1.08%
Fuels	8.83%	26.63%	-0.25%	-0.43%	-1.31%	-0.78%	-0.04%	0.70%	1.81%	2.75%
High-tech Products	1.79%	-3.56%	6.26%	5.82%	6.08%	5.52%	5.96%	6.52%	7.12%	7.51%
Intermediate Manufactured Products	-6.46%	8.13%	4.58%	3.87%	3.92%	3.87%	3.31%	3.73%	4.46%	5.00%
Materials	-1.53%	8.26%	1.69%	-2.05%	-1.91%	-0.46%	1.46%	2.47%	3.78%	4.74%
All Commodities	**-0.24%**	**4.73%**	**3.47%**	**1.25%**	**1.78%**	**1.64%**	**2.18%**	**2.73%**	**3.55%**	**4.32%**

Table 2-16. Growth Rate in Metric Tonnes of Inbound U.S. Containerized Commodity Forecast, by Major Commodity, 1995-2050 (Percent Change Per Period)

Major Commodity	1995-2000	2000-03	2003-04	2004-05	2005-10	2010-15	2015-20	2020-30	2030-40	2040-50
Agriculture	11.98%	7.57%	0.82%	2.78%	0.85%	0.62%	-0.62%	0.68%	0.83%	0.90%
Capital Equipment	4.76%	5.04%	9.38%	9.04%	7.47%	3.92%	3.29%	3.14%	2.92%	2.65%
Chemicals	8.32%	5.15%	1.44%	5.55%	3.99%	1.65%	0.77%	1.34%	1.92%	2.15%
Consumer Goods	12.90%	7.22%	5.30%	8.56%	6.93%	3.20%	3.02%	2.97%	2.81%	2.60%
Extractive	3.74%	-0.78%	0.69%	0.45%	1.77%	0.10%	-0.05%	0.29%	0.63%	0.83%
Food	7.22%	6.87%	3.09%	8.00%	2.88%	1.02%	1.03%	0.99%	0.90%	0.80%
Fuels	11.61%	172.77%	14.38%	5.63%	3.26%	2.62%	2.13%	2.09%	2.15%	2.32%
High-tech Products	10.45%	-0.31%	5.39%	8.77%	9.14%	5.67%	4.77%	4.22%	3.64%	3.15%
Intermediate Manufactured Products	11.68%	4.02%	6.94%	9.97%	6.02%	4.07%	3.38%	3.35%	3.29%	3.22%
Materials	13.52%	9.24%	-0.68%	2.21%	2.35%	1.07%	1.03%	1.44%	1.65%	1.63%
All Commodities	**9.97%**	**6.02%**	**4.52%**	**7.44%**	**5.24%**	**2.94%**	**2.56%**	**2.68%**	**2.69%**	**2.60%**

exports and imports, respectively. Tables 2-17 and 2-18 pertain to TEUs for exports and imports, respectively.

Several of the export commodity groups had negative trade growth, reflecting decreased volume between 1995-2000 and 2000-2003. Overall, export U.S. trade is projected to have very low annual rates of growth after 2004, ranging from 1.69 percent in 2004-2005 to 2.78 percent in 2040-2050 (refer to Table 2-13). The U.S. growth of exports of containerized cargo (metric tonnes) and TEUs is not substantially larger than for all commodities until after 2010 (refer to tables 2-15 and 2-17). For example, the increases in TEUs exported is 1.54 percent in 2004-2005, 2.08 percent annually between 2005-2010, and thereafter nearly double the growth of all commodities in the ensuing time periods (refer to Table 2-17).

For imports, U.S. trade growth for all commodities (refer to Table 2-14) is expect to peak between 2003-2004 and decline thereafter to an average of 6.44 percent between 2004-2005 and 3.74 percent between 2005 and 2010. After 2010, U.S. import growth for all commodities is expected to be less than 2.0 percent on an annual average. U.S. import growth expressed in TEUs (refer to Table 2-18) is expected to decline after 2003, growing 4.94 percent between 2003-2004, 5.21 percent between 2004-2005, and 4.99 percent between 2005 and 2010. Average annual expected growth of TEU imports will decline after 2010 to 3.54 percent between 2010-2015, then increase over the duration of the forecast to 3.91 percent between 2015-2020, 4.50 percent between 2020-2030, 5.27 percent between 2030-2040, and 5.74 percent between 2040-2050.

Table 2-17. Growth Rate in TEUs of Outbound U.S. Containerized Commodity Forecast, By Major Commodity, 1995-2050 (Percent Change Per Period)

Major Commodity	1995-2000	2000-03	2003-04	2004-05	2005-10	2010-15	2015-20	2020-30	2030-40	2040-50
Agriculture	-3.67%	7.10%	6.36%	1.04%	2.15%	1.33%	1.32%	1.44%	1.58%	1.79%
Capital Equipment	1.01%	4.89%	5.37%	3.25%	3.99%	2.90%	2.67%	2.97%	3.46%	4.08%
Chemicals	2.04%	5.59%	1.37%	1.76%	2.83%	2.70%	3.04%	3.65%	4.52%	5.23%
Consumer Goods	2.61%	-2.19%	4.84%	3.38%	2.90%	2.98%	3.64%	4.43%	5.46%	6.23%
Extractive	2.29%	6.54%	4.12%	1.25%	0.55%	0.27%	0.58%	0.82%	1.01%	1.32%
Food	1.69%	6.65%	4.21%	3.95%	3.79%	1.48%	1.63%	1.54%	1.48%	1.21%
Fuels	5.11%	23.50%	-0.24%	-0.74%	-1.56%	-1.24%	-0.77%	-0.48%	-0.02%	0.59%
High-tech Products	2.10%	0.40%	5.54%	5.51%	5.40%	5.09%	5.57%	6.24%	6.89%	7.30%
Intermediate Manufactured Products	-2.78%	7.93%	4.29%	4.19%	4.09%	4.12%	3.54%	3.97%	4.68%	5.14%
Materials	-0.14%	12.73%	1.74%	-1.95%	-1.52%	0.30%	2.23%	3.52%	4.94%	5.71%
All Commodities	**0.37%**	**7.53%**	**3.41%**	**1.54%**	**2.08%**	**1.93%**	**2.44%**	**3.04%**	**3.92%**	**4.68%**

Table 2-18. Growth Rate in TEUs of Inbound U.S. Containerized Commodity Forecast, by Major Commodity, 1995-2050 (Percent Change Per Period)

Major Commodity	1995-2000	2000-03	2003-04	2004-05	2005-10	2010-15	2015-20	2020-30	2030-40	2040-50
Agriculture	5.06%	4.14%	3.73%	2.35%	2.82%	1.75%	1.73%	2.29%	2.86%	3.29%
Capital Equipment	6.58%	6.12%	8.36%	8.89%	7.71%	4.87%	4.78%	5.13%	5.66%	5.14%
Chemicals	9.05%	5.91%	5.79%	5.82%	5.52%	4.42%	4.76%	5.47%	6.32%	6.82%
Consumer Goods	11.90%	7.51%	4.48%	5.51%	5.74%	2.98%	3.21%	3.51%	3.82%	4.22%
Extractive	5.03%	3.12%	3.39%	2.86%	1.83%	0.34%	1.19%	1.98%	3.12%	4.37%
Food	5.21%	4.75%	3.62%	3.87%	2.96%	1.46%	1.80%	2.10%	2.58%	3.09%
Fuels	4.37%	7.31%	1.74%	3.09%	2.85%	2.74%	3.19%	3.99%	4.99%	5.74%
High-tech Products	10.86%	1.12%	9.09%	9.17%	9.14%	6.19%	5.87%	5.83%	5.99%	6.03%
Intermediate Manufactured Products	8.18%	7.07%	6.52%	7.46%	6.08%	4.68%	4.74%	5.16%	5.77%	6.23%
Materials	7.53%	8.15%	1.98%	1.50%	2.46%	2.29%	3.50%	4.45%	5.59%	6.42%
All Commodities	**7.74%**	**6.15%**	**4.94%**	**5.21%**	**4.99%**	**3.54%**	**3.91%**	**4.50%**	**5.27%**	**5.74%**

VII. SUMMARY AND CONCLUSIONS

In summation:

- U.S. import demand will decline rapidly from the 12 percent attained in 1995-2000 to a more modest 7 percent for the period 2000-2010, then fall back to around 3 percent after 2010 in line with U.S. output growth. The U.S. market will likely reach saturation at this point, with most of the substitution of traded products for domestically produced products having already taken place.

- U.S. export growth will accelerate slightly, reaching 5 percent by 2040-2050, with much of the growth induced by the continued strength of Chinese demand (growing at around 7 percent during that period).

- The problem for the U.S., at least in the short-term, is that many of the products produced in the U.S. are not the type in greatest demand as the nations of Asia develop. This is especially true in terms of TEU volumes. As more industrial activity is shifted from U.S. to Asian sources (for U.S. imports), the ability to produce for export is degraded, which leads to a growing imbalance in trade. For example, exports of waste paper (a very low-value product shipped primarily to fill containers going back empty) in 1995 totaled over 400,000 TEUs, which is about one-tenth of total U.S. exports of containerized products. The U.S. share of this trade in 1995 was 80 percent. By 2005, the waste paper share will fall to 70 percent, but by 2050 it will be only 11 percent, while total trade in wastepaper is forecast to grow from 2 million TEUs (1995) to over 200 million TEUs. This is a direct result of the demand for paper and printed products throughout the emerging world. The U.S. share of this trade will probably be significantly less.

- A collapse of China and India as a result of environmental or other disasters would reduce world trade growth substantially, probably by about 2 percent per year after 2030. As a result, the expected stronger growth in U.S. exports would fall back to around 3 percent per year from the 5 percent expected for the last decade.

Appendix A

WORLD COMMODITY FORECAST 1995-2050

World Commodity by Origin (Metric Tonnes)

WORLD Commodity Forecast For AGRICULTURE COMMODITIES
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	1,151,809	1,462,550	1,569,733	1,588,828	1,606,592	1,709,890	1,774,694	1,932,164	2,438,244	3,418,773	5,503,300
Africa	Asia	2,207,259	2,756,579	2,917,645	2,946,439	2,970,572	3,238,494	3,473,631	3,771,337	4,714,518	6,488,816	9,517,490
Africa	Europe	2,282,754	2,967,974	3,319,931	3,410,322	3,505,238	4,097,279	4,384,592	4,592,803	5,063,816	5,626,733	6,344,288
Africa	Mideast	974,161	1,213,225	1,313,256	1,383,856	1,445,843	1,746,948	1,957,310	2,255,148	2,940,339	3,887,751	5,153,758
Africa	North America	78,632	101,091	111,908	108,861	108,283	110,835	114,002	116,113	118,899	120,793	122,837
Africa	South America	120,435	14,445	16,568	16,756	17,175	19,422	20,841	22,640	25,283	27,758	30,153
Africa	Caribbean	6,670	24,066	25,388	27,872	29,820	39,143	45,836	53,105	75,487	117,144	194,943
Asia	Africa	1,524,693	4,499,293	4,325,264	4,518,007	4,683,008	5,437,195	6,045,089	6,710,195	8,379,873	10,775,009	14,937,941
Asia	Asia	41,384,355	56,203,139	56,813,511	60,359,947	62,484,841	71,104,073	79,586,432	86,020,968	109,584,371	137,578,994	175,283,426
Asia	Europe	3,485,467	5,479,429	5,889,771	6,107,888	6,212,505	6,278,324	6,398,420	6,632,165	7,139,831	7,795,516	8,578,974
Asia	Mideast	5,533,158	10,586,734	10,150,998	10,799,449	11,409,861	13,185,681	14,872,121	16,715,940	20,545,273	24,760,794	29,513,588
Asia	North America	1,178,317	2,004,287	1,903,843	1,903,717	1,981,244	2,189,492	2,317,954	2,257,658	2,571,994	2,948,424	3,337,902
Asia	South America	216,056	185,074	217,889	230,109	236,757	276,345	296,965	320,909	364,473	413,553	487,659
Asia	Caribbean	110,007	302,334	336,859	357,369	375,390	436,001	472,677	500,799	556,734	634,786	759,996
Europe	Africa	7,858,568	12,471,114	12,237,684	13,126,691	13,843,393	17,271,287	20,127,368	23,572,753	33,036,152	49,693,167	84,664,450
Europe	Asia	6,409,503	11,816,919	12,756,088	14,147,683	15,288,994	18,921,453	22,172,322	25,750,745	34,499,252	46,299,663	61,019,504
Europe	Europe	24,610,415	36,356,724	39,742,838	41,388,604	43,296,900	53,547,727	58,570,582	62,552,427	70,255,044	78,814,101	89,046,083
Europe	Mideast	5,146,410	13,733,169	13,940,912	14,659,882	15,342,457	17,321,812	18,932,240	20,580,870	24,241,675	28,353,538	32,691,801
Europe	North America	444,220	1,225,107	2,117,593	2,167,001	2,208,680	2,574,373	2,790,007	2,872,706	3,197,771	3,587,386	3,940,734
Europe	South America	262,046	547,947	638,522	666,230	694,248	832,641	921,867	1,010,315	1,169,484	1,345,475	1,507,642
Europe	Caribbean	836,621	919,252	875,472	927,451	973,337	1,138,447	1,225,070	1,282,334	1,371,641	1,446,993	1,517,262
Mideast	Africa	490,768	808,679	849,000	891,746	929,901	1,103,520	1,227,234	1,359,821	1,632,360	1,920,183	2,247,645
Mideast	Asia	608,985	1,278,604	1,353,494	1,417,926	1,464,582	1,723,381	1,893,068	2,083,271	2,565,757	3,172,619	3,949,463
Mideast	Europe	1,334,526	1,682,930	1,771,516	1,863,015	1,911,193	2,131,690	2,268,225	2,379,155	2,619,520	2,916,366	3,278,385
Mideast	Mideast	1,975,686	2,590,989	2,785,460	2,945,040	3,113,615	3,932,291	4,440,179	5,022,094	6,281,233	7,771,553	9,532,706
Mideast	North America	35,210	36,099	40,020	42,423	44,653	51,577	56,109	56,479	62,735	70,154	78,827
Mideast	South America	15,398	25,110	31,491	32,117	33,154	38,634	40,405	42,072	45,160	48,313	53,207
Mideast	Caribbean	5,661	5,235	5,579	5,742	5,853	6,248	6,330	6,386	6,506	6,618	6,732
North America	Africa	3,567,324	4,033,635	4,665,911	4,900,037	5,073,142	5,865,264	6,391,052	7,245,532	8,528,984	9,775,340	10,970,400
North America	Asia	35,448,094	29,288,969	30,395,454	32,334,756	33,086,661	37,414,663	39,757,617	41,454,531	45,783,294	45,458,125	51,369,262
North America	Europe	11,295,725	8,531,282	7,549,229	8,103,860	8,379,737	9,179,333	9,873,190	10,389,896	11,409,196	12,502,565	13,704,859
North America	Mideast	2,864,364	1,783,847	1,867,557	2,008,032	2,114,141	2,751,781	3,065,786	3,361,797	3,999,807	4,704,523	5,462,697
North America	North America	3,947,999	4,940,566	4,674,367	5,140,777	5,599,657	6,877,790	7,975,955	8,956,637	11,082,495	12,064,107	14,437,684
North America	South America	7,615,993	8,694,861	10,716,338	11,043,036	11,408,129	13,124,034	14,452,080	15,525,050	17,512,772	19,395,582	21,240,003
North America	Caribbean	1,598,696	2,766,504	3,223,683	3,375,249	3,512,982	3,900,576	4,149,576	4,342,519	4,667,010	4,941,790	5,174,677
South America	Africa	1,544,464	4,161,438	4,113,744	4,273,301	4,401,147	5,063,313	5,707,473	6,297,962	7,571,863	9,097,979	11,360,761
South America	Asia	7,392,665	8,872,123	10,144,121	10,230,053	10,327,852	11,017,426	11,597,108	12,124,412	13,522,928	13,395,191	15,113,957
South America	Europe	9,645,469	13,380,712	14,999,786	15,941,535	16,490,230	19,683,860	21,282,998	20,923,352	23,276,711	25,873,292	28,611,495
South America	Mideast	1,837,564	3,058,401	3,076,152	3,331,417	3,582,529	4,332,475	4,973,176	5,760,045	7,810,105	10,698,724	14,363,639
South America	North America	2,081,837	2,582,732	3,283,465	3,284,086	3,372,195	3,652,924	3,837,440	3,955,761	4,374,404	4,849,344	5,359,271
South America	South America	2,252,982	3,507,227	4,051,561	4,202,954	4,424,384	5,597,113	6,441,216	7,256,134	8,972,118	10,912,357	13,260,374
South America	Caribbean	591,109	820,045	807,111	868,390	917,838	1,154,034	1,318,640	1,494,359	1,999,922	2,946,676	4,913,420
Caribbean	Africa	69,876	103,116	103,491	114,129	126,106	215,176	374,327	682,660	1,988,730	5,228,771	11,863,614
Caribbean	Asia	271,412	336,525	340,995	369,767	377,252	426,896	445,607	469,309	533,970	620,689	732,291
Caribbean	Europe	1,740,948	1,974,593	2,155,267	2,301,758	2,367,381	2,542,931	2,700,045	2,844,818	3,151,268	3,521,596	3,987,236
Caribbean	Mideast	96,511	244,142	253,883	263,244	270,876	306,113	330,742	357,246	405,592	457,818	514,190
Caribbean	North America	276,957	541,198	636,208	652,745	661,657	575,131	555,848	513,709	425,430	349,837	292,739
Caribbean	South America	171,603	261,340	278,862	284,844	291,345	327,376	360,580	386,562	431,773	478,468	527,868
Caribbean	Caribbean	458,565	1,408,126	1,385,655	1,474,813	1,566,393	2,055,167	2,626,692	3,419,941	6,176,226	11,650,883	22,836,979
Total		**205,057,543**	**272,589,480**	**286,681,071**	**302,539,755**	**314,539,721**	**366,527,577**	**404,798,720**	**438,235,702**	**529,128,023**	**638,964,630**	**809,398,111**
Average Annual Growth Rate			**5.86%**	**1.69%**	**5.53%**	**3.97%**	**3.11%**	**2.01%**	**1.60%**	**1.90%**	**1.90%**	**2.39%**

WORLD Commodity Forecast For CAPITAL EQUIPMENT
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	161,996	171,143	143,765	156,658	172,368	249,514	278,246	311,052	397,457	532,759	761,526
Africa	Asia	20,529	59,321	57,483	64,114	72,490	127,501	196,591	313,427	765,066	1,813,227	4,233,979
Africa	Europe	117,988	312,646	469,310	524,821	586,062	921,620	1,315,422	1,287,664	1,658,346	2,077,814	2,548,999
Africa	Mideast	17,188	28,405	27,684	30,068	32,742	43,606	49,624	57,718	80,480	116,167	171,503
Africa	North America	31,127	72,528	123,398	139,942	160,079	262,656	330,602	398,165	560,293	762,361	1,004,273
Africa	South America	5,731	5,572	6,080	6,912	7,730	11,934	14,847	16,599	22,066	28,956	37,381
Africa	Caribbean	740	7,159	7,239	7,827	8,503	10,126	10,523	10,794	11,475	12,318	13,298
Asia	Africa	529,590	806,498	819,925	859,376	914,778	1,322,308	1,824,917	2,580,522	5,406,283	11,661,906	25,509,852
Asia	Asia	11,312,619	14,840,723	17,446,774	18,653,133	20,008,661	27,360,500	35,589,097	47,544,888	89,750,206	177,550,154	301,744,360
Asia	Europe	3,287,065	7,407,714	9,988,884	10,578,984	11,240,297	15,253,875	17,840,828	20,693,008	28,209,222	38,900,382	53,935,350
Asia	Mideast	1,410,389	3,042,963	3,306,815	3,506,936	3,773,399	4,757,588	5,640,423	6,913,476	10,815,419	17,727,465	30,714,676
Asia	North America	7,656,896	10,745,400	12,601,766	13,951,419	15,466,920	23,365,483	28,939,554	34,420,704	47,630,016	64,274,717	84,347,223
Asia	South America	9,109,923	9,575,849	10,510,249	11,043,467	11,578,490	12,737,562	13,783,373	14,276,595	15,374,184	18,143,550	23,391,406
Asia	Caribbean	431,524	1,690,484	1,820,142	1,937,581	2,071,711	2,187,317	2,268,953	2,393,901	2,964,923	4,231,244	6,532,748
Europe	Africa	1,375,019	1,940,417	1,829,042	2,028,674	2,289,360	3,866,000	5,616,396	6,116,708	8,923,166	12,852,288	18,289,874
Europe	Asia	3,982,642	3,751,586	3,957,194	4,387,790	4,929,544	8,012,178	11,171,965	16,084,446	33,926,381	72,930,359	152,722,056
Europe	Europe	4,654,445	7,637,673	9,304,964	10,190,266	11,282,407	16,427,533	20,288,003	24,236,843	33,552,681	45,394,876	60,539,750
Europe	Mideast	1,855,531	2,981,854	3,139,500	3,533,723	3,996,492	6,219,977	7,710,455	9,501,456	14,539,120	22,224,039	33,450,688
Europe	North America	2,817,452	4,527,557	5,073,960	5,650,024	6,374,237	10,018,305	12,685,234	15,381,472	21,834,537	29,951,325	39,788,040
Europe	South America	1,254,877	1,413,769	1,639,884	1,866,937	2,111,611	3,412,808	4,097,672	4,691,339	6,127,117	7,987,116	10,357,237
Europe	Caribbean	574,028	685,488	682,982	745,105	815,531	993,018	1,029,821	1,058,976	1,136,848	1,242,716	1,364,812
Mideast	Africa	63,713	113,123	102,782	112,197	123,147	192,236	277,794	407,069	892,344	1,968,030	4,431,710
Mideast	Asia	81,414	148,155	136,890	148,603	162,142	227,836	291,629	372,993	621,803	1,063,654	1,823,090
Mideast	Europe	222,492	630,883	794,675	853,900	905,359	1,241,697	1,448,713	1,662,972	2,190,866	2,879,467	3,759,989
Mideast	Mideast	151,635	457,136	505,284	558,382	618,020	839,372	1,038,214	1,313,365	2,197,004	3,878,482	7,345,064
Mideast	North America	31,343	55,570	70,845	73,798	80,751	125,231	155,958	184,917	255,793	347,302	461,199
Mideast	South America	8,219	16,417	17,085	18,335	19,629	24,637	26,701	28,737	34,554	43,265	55,380
Mideast	Caribbean	16,765	47,920	48,319	51,066	56,390	52,893	52,873	52,595	67,488	116,968	244,464
North America	Africa	89,866	67,043	114,137	119,060	127,147	155,502	181,771	218,474	354,891	602,972	958,054
North America	Asia	2,049,633	1,463,362	1,551,670	1,666,238	1,755,066	2,225,315	2,771,244	3,431,358	5,404,238	8,987,508	15,690,654
North America	Europe	1,220,028	1,461,157	1,839,942	1,940,285	2,062,194	2,764,727	3,231,560	3,654,847	4,657,488	6,006,763	7,752,956
North America	Mideast	113,052	89,648	73,586	76,944	81,651	100,829	113,692	125,375	150,305	178,341	211,528
North America	North America	167,445	518,723	344,194	387,226	431,542	630,983	750,351	862,079	1,118,610	1,422,455	1,772,628
North America	South America	1,227,644	949,648	756,215	814,995	841,934	1,040,594	1,176,910	1,284,285	1,537,291	1,844,669	2,204,509
North America	Caribbean	143,276	139,433	147,358	153,034	160,124	190,018	193,993	198,133	213,346	236,754	265,289
South America	Africa	33,099	38,860	41,792	44,166	48,560	78,159	99,664	121,216	177,029	259,310	389,761
South America	Asia	578,947	357,106	444,359	456,708	475,342	549,121	631,300	752,639	1,162,169	2,020,864	3,734,004
South America	Europe	214,907	398,055	593,775	640,845	681,866	900,722	1,072,078	1,235,821	1,615,533	2,079,632	2,637,883
South America	Mideast	43,132	38,064	40,409	43,258	46,503	62,764	78,231	98,417	160,995	268,863	452,998
South America	North America	608,476	907,405	1,259,091	1,412,305	1,509,690	2,192,683	2,787,311	3,361,939	4,750,567	6,502,421	8,648,907
South America	South America	457,967	464,161	636,028	717,913	802,057	1,325,803	1,619,383	1,877,524	2,499,113	3,294,734	4,287,674
South America	Caribbean	49,668	76,467	73,714	81,924	91,210	138,773	162,001	191,812	290,782	493,000	949,677
Caribbean	Africa	928	3,955	4,111	4,464	4,921	7,198	8,192	9,183	11,824	15,418	19,992
Caribbean	Asia	78,989	13,473	16,625	16,865	17,332	19,424	21,408	23,939	31,816	47,074	77,732
Caribbean	Europe	145,780	250,038	414,372	426,340	416,970	346,798	266,378	225,252	201,806	232,418	285,805
Caribbean	Mideast	950	30,841	33,674	36,052	38,742	39,186	38,793	39,726	45,887	57,841	76,927
Caribbean	North America	810	2,764	3,367	3,862	4,400	6,952	8,883	10,798	15,574	21,923	30,113
Caribbean	South America	14,812	26,146	32,734	36,221	40,722	64,130	76,111	85,207	105,096	128,136	154,941
Caribbean	Caribbean	18,221	33,827	32,983	36,217	39,766	53,775	58,597	62,738	71,419	81,174	91,938
Total		**58,440,512**	**80,304,127**	**93,087,056**	**100,794,958**	**109,536,628**	**153,158,768**	**188,521,681**	**230,183,164**	**354,520,919**	**575,497,177**	**920,273,895**
Average Annual Growth Rate			**6.56%**	**5.05%**	**8.28%**	**8.67%**	**6.93%**	**4.24%**	**4.07%**	**4.41%**	**4.96%**	**4.81%**

WORLD Commodity Forecast For CHEMICALS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	1,072,620	1,278,171	1,829,433	1,907,928	1,976,994	2,358,499	2,729,662	3,285,737	5,137,234	9,108,467	18,507,277
Africa	Asia	3,379,405	3,546,666	5,767,401	6,177,074	6,627,957	9,039,653	11,481,412	13,982,876	20,593,091	30,868,862	47,953,515
Africa	Europe	4,759,273	5,760,443	6,374,231	6,372,285	6,391,234	6,600,724	6,793,971	6,879,392	7,004,939	7,169,495	7,443,691
Africa	Mideast	938,105	1,672,674	1,716,322	1,779,178	1,823,515	2,184,994	2,483,904	2,834,999	3,785,033	5,311,212	8,040,143
Africa	North America	87,839	281,144	281,004	287,170	309,761	369,354	429,057	467,589	552,442	649,080	761,215
Africa	South America	483,887	578,970	738,602	782,860	817,190	993,394	1,092,264	1,175,370	1,352,318	1,540,170	1,743,504
Africa	Caribbean	130,006	119,649	121,651	125,295	128,524	143,099	152,079	158,481	165,099	165,587	163,125
Asia	Africa	548,803	1,124,637	1,203,225	1,253,299	1,314,817	1,878,496	2,737,804	4,233,722	10,100,122	24,031,613	57,497,293
Asia	Asia	46,625,519	79,143,690	96,292,037	102,478,170	109,614,281	145,011,803	185,383,819	243,967,815	452,370,999	898,622,109	1,839,475,577
Asia	Europe	3,712,133	6,507,224	8,482,707	8,614,081	8,637,803	10,144,161	11,358,089	12,533,718	15,981,002	22,191,277	34,183,617
Asia	Mideast	977,191	1,957,231	2,085,017	2,257,309	2,391,329	3,138,150	3,866,724	5,062,294	9,178,539	17,877,834	37,834,681
Asia	North America	5,804,352	7,988,644	7,008,046	7,006,004	7,323,822	8,696,722	9,685,664	10,369,247	12,134,994	14,679,101	18,076,791
Asia	South America	516,530	1,019,903	1,322,829	1,445,845	1,534,213	1,971,761	2,281,424	2,707,018	4,015,749	6,550,949	12,080,701
Asia	Caribbean	65,045	211,205	223,844	243,536	262,049	377,051	548,649	790,385	1,688,152	3,599,808	7,405,235
Europe	Africa	3,702,308	5,135,538	5,336,546	5,637,931	5,920,387	7,881,042	9,365,144	10,907,322	14,267,116	18,366,348	23,935,271
Europe	Asia	21,796,027	20,876,086	22,681,138	23,361,950	24,641,969	32,844,355	40,088,393	49,072,923	76,403,799	128,756,902	234,525,167
Europe	Europe	38,165,184	47,680,059	55,099,033	55,658,950	56,127,097	59,447,127	61,622,245	63,203,243	67,632,848	74,567,418	84,692,715
Europe	Mideast	4,390,014	6,360,200	7,165,463	7,739,832	8,277,944	11,309,052	13,268,520	15,717,187	21,891,337	29,829,075	39,854,667
Europe	North America	8,101,059	9,528,897	11,612,514	11,357,022	11,638,296	13,129,500	13,603,082	13,537,352	14,171,663	15,912,194	18,459,275
Europe	South America	5,342,108	8,098,419	10,467,803	11,076,467	11,736,116	15,186,085	16,791,391	18,120,942	20,758,950	23,502,411	26,299,849
Europe	Caribbean	910,792	1,387,539	1,447,851	1,530,564	1,605,353	1,961,318	2,138,460	2,315,675	2,742,584	3,471,016	5,005,320
Mideast	Africa	697,033	1,435,969	1,463,978	1,570,622	1,677,546	2,452,509	3,601,988	5,674,195	14,182,568	34,697,027	79,976,235
Mideast	Asia	11,073,648	16,766,176	17,869,998	18,664,374	19,410,762	22,836,460	26,892,342	31,375,675	44,624,125	67,373,555	105,734,587
Mideast	Europe	4,019,210	5,859,571	6,487,137	6,666,348	6,687,618	7,410,357	8,157,431	8,737,041	10,136,860	12,338,314	16,474,481
Mideast	Mideast	1,198,040	2,142,852	2,221,814	2,334,698	2,436,260	3,201,274	3,986,077	5,212,319	9,683,345	18,962,832	33,918,658
Mideast	North America	276,370	629,543	707,779	707,416	716,700	777,984	828,563	856,939	940,053	1,068,486	1,240,597
Mideast	South America	551,989	1,270,016	1,718,086	1,779,868	1,859,992	2,314,026	2,541,520	2,707,834	3,030,719	3,370,089	3,781,650
Mideast	Caribbean	11,955	60,411	61,783	63,618	65,414	75,285	85,545	97,366	133,765	198,297	308,507
North America	Africa	442,587	347,405	286,282	284,792	286,402	333,093	388,695	471,573	763,728	1,406,409	2,931,098
North America	Asia	19,096,719	17,495,081	20,263,469	21,130,585	21,567,642	22,630,318	24,255,789	26,682,646	34,952,374	51,210,133	83,418,648
North America	Europe	5,246,390	6,834,574	7,069,542	7,027,373	6,932,728	7,680,435	8,432,491	9,134,022	10,991,447	13,870,828	18,782,756
North America	Mideast	464,872	483,189	526,916	538,664	545,703	596,138	649,036	718,869	892,770	1,119,595	1,411,911
North America	North America	6,792,527	6,603,564	5,899,728	6,116,716	6,282,099	6,909,134	7,517,092	8,052,387	9,412,191	11,178,963	13,222,603
North America	South America	6,753,547	8,306,295	8,995,084	9,618,048	9,750,978	10,826,183	11,954,620	13,276,279	17,379,206	24,662,661	36,048,736
North America	Caribbean	868,945	858,257	930,649	971,381	1,009,271	1,187,516	1,356,692	1,508,605	1,845,096	2,224,985	2,629,197
South America	Africa	125,001	218,134	232,811	239,607	248,279	322,120	383,145	425,669	533,909	645,040	782,038
South America	Asia	848,279	1,192,211	1,279,976	1,357,433	1,470,951	2,110,346	2,513,553	3,002,142	4,501,020	7,316,562	12,798,232
South America	Europe	1,423,274	3,478,959	4,073,383	4,118,368	4,167,337	4,846,323	5,428,140	5,879,311	6,839,944	7,922,344	9,148,091
South America	Mideast	79,483	194,699	202,402	211,491	220,032	269,991	305,178	363,163	472,713	616,619	803,211
South America	North America	1,811,000	4,350,613	4,726,917	4,715,492	4,972,213	5,501,349	5,916,765	6,002,907	6,223,095	6,524,579	6,912,418
South America	South America	3,358,231	4,861,989	5,798,566	6,193,545	6,555,995	8,300,720	9,405,339	10,554,753	13,267,358	16,607,925	20,593,660
South America	Caribbean	246,229	473,469	460,948	489,532	517,063	670,377	830,472	1,025,857	1,662,751	2,861,339	5,074,259
Caribbean	Africa	32,770	105,526	101,273	102,807	104,516	116,530	126,500	138,426	158,263	183,497	214,866
Caribbean	Asia	11,801	70,059	87,799	95,931	102,948	147,827	205,254	280,880	527,083	1,013,754	2,005,808
Caribbean	Europe	3,174,256	3,834,014	4,502,817	4,481,459	4,545,960	5,049,464	5,371,035	5,532,249	5,868,101	6,246,364	6,686,683
Caribbean	Mideast	6,725	22,224	25,269	25,887	26,790	30,958	33,593	36,444	43,885	53,932	67,293
Caribbean	North America	524,792	731,174	794,977	819,610	844,722	1,005,408	1,186,689	1,304,771	1,567,948	1,861,555	2,179,104
Caribbean	South America	372,793	438,153	509,500	527,512	553,432	655,806	732,333	790,896	921,144	1,073,053	1,256,070
Caribbean	Caribbean	309,416	497,544	466,731	479,947	494,359	607,637	792,883	1,102,700	2,290,800	4,769,350	9,907,911
Total		**221,326,082**	**302,318,060**	**345,022,315**	**358,365,875**	**373,154,357**	**453,531,887**	**531,780,428**	**632,267,207**	**965,774,220**	**1,638,149,014**	**3,002,247,934**
Average Annual Growth Rate			**6.44%**	**4.50%**	**3.87%**	**4.13%**	**3.98%**	**3.23%**	**3.52%**	**4.33%**	**5.43%**	**6.25%**

WORLD Commodity Forecast For CONSUMER GOODS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	128,699	144,713	151,317	160,666	168,817	203,346	219,413	241,862	303,276	399,540	548,568
Africa	Asia	5,984	9,277	10,042	10,882	11,883	18,423	24,071	31,194	51,747	85,605	142,808
Africa	Europe	313,985	510,147	639,599	640,662	632,861	574,776	573,184	578,017	648,508	774,796	943,941
Africa	Mideast	25,293	41,423	43,278	47,663	52,361	73,142	88,101	108,186	163,143	245,626	369,204
Africa	North America	19,992	43,711	106,743	113,082	121,382	161,101	189,674	217,255	279,892	352,281	433,604
Africa	South America	402	1,054	1,333	1,472	1,624	2,493	2,971	3,427	4,602	6,239	8,657
Africa	Caribbean	829	1,407	1,408	1,662	1,845	2,727	3,009	3,365	4,543	6,836	11,067
Asia	Africa	168,891	312,505	328,522	339,861	361,568	518,899	714,258	1,047,959	2,333,644	5,318,886	12,479,496
Asia	Asia	5,000,127	8,181,832	9,653,752	10,158,775	10,538,680	14,283,920	16,920,975	20,563,753	31,237,614	48,654,419	78,096,814
Asia	Europe	3,195,004	5,859,006	7,305,006	7,408,548	7,537,142	8,568,448	9,225,271	10,217,190	13,237,072	18,457,396	28,062,743
Asia	Mideast	540,319	779,385	808,310	844,344	894,650	1,179,691	1,458,823	1,900,764	3,426,064	6,461,855	12,810,303
Asia	North America	5,922,533	10,742,114	15,045,575	15,785,876	17,252,062	24,968,510	29,435,559	34,403,118	46,657,353	62,203,753	81,161,958
Asia	South America	337,791	437,356	524,940	566,703	612,596	869,771	1,010,807	1,168,787	1,630,834	2,408,688	3,786,856
Asia	Caribbean	52,317	82,767	84,577	92,172	99,926	147,227	214,126	313,479	683,333	1,487,321	3,219,614
Europe	Africa	302,300	450,360	462,473	498,129	543,064	814,853	993,576	1,197,714	1,749,548	2,633,228	4,217,638
Europe	Asia	606,821	899,541	1,019,341	1,088,335	1,170,411	1,715,195	2,180,460	2,778,645	4,648,433	7,982,285	14,019,248
Europe	Europe	1,689,538	2,988,532	3,453,364	3,646,459	3,861,988	4,928,250	5,611,011	6,424,253	8,612,027	11,782,624	16,453,499
Europe	Mideast	536,360	846,590	925,011	1,030,007	1,155,425	1,756,161	2,152,882	2,660,885	4,062,131	6,229,585	9,753,258
Europe	North America	647,774	1,185,413	1,372,292	1,480,470	1,605,594	2,034,343	2,373,100	2,693,515	3,502,525	4,616,824	6,033,092
Europe	South America	167,808	287,798	350,575	388,833	428,483	644,525	768,711	892,257	1,193,540	1,599,540	2,177,609
Europe	Caribbean	103,903	94,068	94,335	104,350	114,258	161,119	176,327	191,951	231,895	293,369	395,677
Mideast	Africa	42,928	99,595	104,467	112,099	120,256	165,058	201,502	246,824	378,682	597,997	971,776
Mideast	Asia	19,048	39,582	43,131	47,504	52,464	80,790	104,908	134,975	219,918	356,508	578,719
Mideast	Europe	220,923	413,106	497,410	543,696	594,536	789,420	907,138	1,026,579	1,320,874	1,706,326	2,195,278
Mideast	Mideast	139,475	223,915	237,443	247,268	256,980	300,358	339,197	387,087	498,524	646,360	851,783
Mideast	North America	73,799	117,759	164,588	186,689	210,178	248,614	282,863	328,482	440,887	578,392	731,820
Mideast	South America	1,894	4,724	5,711	6,192	6,646	8,831	10,101	11,330	14,245	18,229	24,265
Mideast	Caribbean	739	1,072	1,112	1,187	1,263	1,650	1,986	2,399	3,705	6,139	10,624
North America	Africa	11,560	13,862	13,182	12,584	13,188	16,131	18,825	21,901	31,547	50,252	84,037
North America	Asia	531,457	526,548	554,493	594,271	629,983	798,235	1,013,003	1,313,338	2,352,924	4,441,032	8,569,591
North America	Europe	269,000	336,902	383,250	393,298	406,631	470,488	526,168	608,394	883,318	1,426,684	2,528,720
North America	Mideast	17,631	24,035	21,986	23,240	25,050	33,541	41,026	49,504	73,081	111,047	173,814
North America	North America	12,586	120,413	156,251	165,030	171,937	224,990	262,959	304,727	401,479	522,731	673,933
North America	South America	281,572	366,057	313,383	336,052	354,906	450,897	514,909	574,169	716,570	898,227	1,124,269
North America	Caribbean	158,776	402,408	285,149	298,872	311,534	362,306	392,547	421,728	481,700	547,791	617,398
South America	Africa	2,442	5,101	5,549	5,639	6,074	9,075	10,595	12,138	15,795	20,552	26,798
South America	Asia	23,028	29,773	34,019	36,570	38,695	53,930	67,375	85,029	137,628	227,531	386,480
South America	Europe	100,768	171,215	223,464	237,633	252,581	342,748	363,090	413,717	543,206	707,368	911,651
South America	Mideast	2,109	3,189	3,584	3,965	4,419	6,795	8,411	10,424	16,074	24,989	39,464
South America	North America	179,807	282,241	387,544	418,257	428,049	595,239	678,943	791,772	1,072,606	1,431,160	1,872,342
South America	South America	148,980	231,899	275,645	301,529	327,778	478,789	566,760	663,243	900,313	1,222,157	1,685,069
South America	Caribbean	48,591	119,769	122,824	132,164	140,917	184,872	222,840	274,535	451,388	788,926	1,377,356
Caribbean	Africa	248	468	499	507	523	627	701	781	969	1,202	1,472
Caribbean	Asia	1,092	1,531	1,569	1,602	1,683	2,256	2,669	3,091	4,395	6,674	10,411
Caribbean	Europe	8,570	17,190	19,999	20,450	21,138	25,397	28,238	31,217	38,191	46,453	56,166
Caribbean	Mideast	341	1,541	1,624	1,707	1,797	2,276	2,617	2,991	4,254	7,208	14,254
Caribbean	North America	162,434	538,460	666,780	684,472	716,422	847,807	975,545	1,108,860	1,435,721	1,816,190	2,242,829
Caribbean	South America	38,971	78,946	90,374	95,103	100,385	127,621	139,732	147,986	164,077	186,320	223,046
Caribbean	Caribbean	114,852	258,228	268,438	294,747	318,281	423,391	494,191	568,625	746,151	978,831	1,264,491
Total		**22,379,295**	**38,328,528**	**47,267,351**	**49,611,298**	**52,680,916**	**70,679,252**	**82,515,158**	**97,183,423**	**138,009,949**	**201,373,971**	**304,393,505**
Average Annual Growth Rate			**11.36%**	**7.24%**	**4.96%**	**6.19%**	**6.05%**	**3.15%**	**3.33%**	**3.57%**	**3.85%**	**4.22%**

WORLD Commodity Forecast For EXTRACTIVE COMMODITIES
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	4,909,245	6,983,257	6,862,747	7,095,687	7,285,815	8,898,467	10,630,368	13,203,275	21,810,133	35,543,917	53,612,615
Africa	Asia	37,424,595	69,228,805	62,261,319	65,583,257	70,820,080	84,820,029	94,698,476	108,413,461	151,686,145	228,174,384	357,051,692
Africa	Europe	143,811,247	174,452,355	203,423,647	209,109,944	211,116,343	222,109,318	215,875,031	216,787,792	225,143,934	239,201,426	256,747,568
Africa	Mideast	11,714,745	22,145,617	22,364,591	23,070,900	24,399,731	32,651,156	34,020,283	36,809,873	44,957,263	55,782,280	68,972,763
Africa	North America	19,839,704	24,649,473	29,120,472	33,672,751	36,830,505	48,623,734	51,529,834	53,306,458	57,711,265	63,029,053	69,113,106
Africa	South America	3,454,551	4,631,931	5,559,347	5,581,885	6,029,701	7,184,785	7,322,997	7,568,455	8,291,192	9,137,582	10,045,334
Africa	Caribbean	150,435	334,986	329,556	318,064	308,373	273,409	248,994	231,344	206,306	188,818	174,442
Asia	Africa	891,567	1,275,994	1,335,789	1,375,861	1,427,477	1,807,056	2,001,903	2,198,975	2,594,952	3,067,372	3,771,045
Asia	Asia	484,638,741	664,044,367	682,313,427	729,062,027	773,554,874	900,915,482	949,404,371	1,045,909,382	1,342,162,698	1,847,113,263	2,731,835,883
Asia	Europe	59,159,508	76,292,062	84,790,105	88,578,736	94,377,896	99,359,718	97,458,724	97,598,011	99,913,536	104,330,228	110,177,895
Asia	Mideast	6,844,444	7,322,152	7,389,304	7,468,303	7,633,890	8,585,274	9,075,312	9,782,754	11,621,005	13,996,173	17,044,413
Asia	North America	12,251,584	15,905,056	13,945,227	14,602,571	15,383,462	17,137,925	17,430,669	17,421,071	17,756,030	18,366,353	19,240,694
Asia	South America	6,187,704	11,419,772	12,948,799	13,357,813	14,242,268	16,701,967	17,400,358	18,287,364	20,544,683	23,077,432	25,734,552
Asia	Caribbean	4,255	18,315	19,543	20,070	20,481	22,894	25,672	28,740	35,290	47,443	73,331
Europe	Africa	6,188,804	8,564,961	8,417,685	8,927,649	9,474,332	13,301,155	19,510,667	30,707,750	75,606,446	185,236,284	459,304,209
Europe	Asia	14,626,860	25,327,754	27,033,503	28,920,676	30,175,482	36,598,729	41,431,885	48,073,309	66,747,542	95,038,471	139,679,511
Europe	Europe	217,260,567	280,496,179	311,077,069	319,394,366	326,652,203	357,839,404	349,060,130	348,489,620	358,571,252	382,872,899	419,750,948
Europe	Mideast	12,020,075	25,440,152	26,510,475	27,715,324	28,602,846	32,205,981	35,149,372	40,473,714	57,176,453	87,042,863	144,913,623
Europe	North America	15,345,837	20,785,512	30,213,936	33,403,398	35,448,172	42,696,279	44,229,442	45,176,690	47,789,428	51,306,032	55,459,246
Europe	South America	1,556,175	2,106,661	2,346,274	2,406,557	2,443,700	2,552,689	2,554,088	2,580,297	2,659,501	2,741,734	2,828,825
Europe	Caribbean	9,598,908	28,747,648	29,281,886	33,162,181	34,834,326	39,736,074	44,325,729	48,473,232	52,371,055	53,745,433	54,217,470
Mideast	Africa	18,903,450	31,506,216	31,088,292	31,626,005	31,624,703	32,023,244	32,618,271	35,143,812	40,129,108	45,049,338	49,813,880
Mideast	Asia	471,282,271	524,849,168	491,701,415	515,109,379	505,745,327	492,725,097	458,469,948	476,215,595	568,964,624	752,211,534	1,073,753,746
Mideast	Europe	150,621,908	166,540,398	204,290,432	208,684,527	211,932,155	234,136,018	229,023,935	230,489,651	238,846,797	251,966,748	267,807,830
Mideast	Mideast	27,314,129	35,204,497	35,937,491	36,459,415	36,307,700	34,767,326	32,135,342	32,792,894	35,419,669	39,602,717	44,884,189
Mideast	North America	3,830,013	5,898,144	7,552,235	8,419,048	8,902,778	10,581,662	10,996,385	11,348,545	12,198,622	13,225,095	14,370,696
Mideast	South America	12,980,883	8,937,016	11,015,656	9,713,466	9,543,587	8,422,850	7,594,605	7,549,877	7,817,107	8,358,036	9,008,189
Mideast	Caribbean	549,043	499,976	502,145	543,327	559,183	594,000	631,961	679,659	731,435	761,284	782,576
North America	Africa	2,681,264	1,304,538	1,000,212	1,057,073	1,075,113	1,195,332	1,278,714	1,370,975	1,484,596	1,564,006	1,675,833
North America	Asia	66,673,837	51,001,041	50,562,057	51,728,444	52,332,436	54,196,318	53,335,819	53,703,571	56,271,870	60,664,093	67,727,232
North America	Europe	70,111,997	53,168,382	48,964,789	49,759,595	52,138,191	55,995,595	53,817,498	53,310,767	53,430,524	54,887,280	57,172,456
North America	Mideast	4,303,233	2,678,385	2,815,711	2,819,989	2,969,148	3,275,181	3,468,838	3,742,515	4,453,256	5,329,104	6,407,329
North America	North America	102,744,451	131,222,309	161,101,587	175,085,729	182,331,600	207,814,146	219,826,894	227,032,576	245,710,387	269,334,953	297,676,690
North America	South America	10,237,979	9,007,655	8,377,838	8,650,651	9,048,727	10,163,451	10,562,004	11,007,297	12,130,333	13,371,787	14,682,342
North America	Caribbean	2,647,174	4,066,475	4,316,085	3,940,656	3,608,055	2,508,979	1,986,056	1,740,777	1,624,955	1,637,540	1,675,121
South America	Africa	2,039,908	3,959,757	3,728,463	3,790,951	4,007,365	4,583,976	5,125,521	5,696,993	6,733,090	7,727,670	8,756,043
South America	Asia	64,941,079	81,748,226	88,949,913	101,366,958	112,495,893	135,036,288	152,749,585	178,079,901	256,365,649	396,929,805	648,615,251
South America	Europe	85,760,009	111,093,066	122,027,038	115,318,229	116,432,762	130,514,934	128,722,375	129,436,586	133,867,513	139,886,022	148,080,950
South America	Mideast	6,957,790	13,281,046	13,512,189	13,295,637	13,397,283	14,497,124	14,415,464	14,962,013	16,960,289	19,941,398	23,684,874
South America	North America	104,903,867	129,836,931	142,396,162	155,739,959	165,646,564	189,472,747	198,969,032	203,499,359	215,435,971	230,721,715	248,900,818
South America	South America	24,875,446	34,174,772	38,066,645	37,918,360	39,597,730	43,788,185	45,220,501	47,074,042	51,551,765	57,471,568	66,405,209
South America	Caribbean	14,580,901	44,127,752	43,602,724	45,924,970	48,530,022	67,968,397	105,898,634	183,521,389	549,129,574	1,465,075,961	3,733,257,897
Caribbean	Africa	798	26,254	27,398	28,932	30,039	34,311	37,097	40,260	45,997	51,513	57,136
Caribbean	Asia	42,289	75,115	80,319	82,954	85,118	87,955	90,790	95,510	108,272	127,136	156,759
Caribbean	Europe	990,962	1,602,963	1,755,658	1,836,490	1,842,185	1,979,101	1,916,715	1,937,421	2,051,454	2,199,478	2,363,559
Caribbean	Mideast	2,254	6,714	7,416	8,102	8,260	7,973	7,577	8,256	9,823	11,559	13,298
Caribbean	North America	937,701	1,467,806	1,672,686	1,842,641	1,963,194	2,319,096	2,456,917	2,533,291	2,730,914	2,972,991	3,252,939
Caribbean	South America	985,974	1,920,445	2,014,707	2,055,844	2,092,151	2,171,900	2,152,241	2,121,738	2,050,169	1,982,492	1,915,366
Caribbean	Caribbean	609,458	1,456,000	1,373,496	1,469,729	1,516,978	1,744,314	2,103,193	2,708,311	4,731,265	8,036,615	12,913,002
Total		**2,320,449,617**	**2,911,834,115**	**3,085,985,491**	**3,237,105,078**	**3,346,826,000**	**3,716,667,005**	**3,818,996,215**	**4,109,380,151**	**5,185,841,137**	**7,350,138,855**	**11,805,560,374**
Average Annual Growth Rate			**4.65%**	**1.96%**	**4.90%**	**3.39%**	**2.12%**	**0.54%**	**1.48%**	**2.35%**	**3.55%**	**4.85%**

WORLD Commodity Forecast For FOOD
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	1,444,036	1,836,018	1,982,030	2,007,389	2,022,574	2,141,178	2,314,657	2,748,399	4,613,991	9,075,971	19,998,910
Africa	Asia	898,671	1,339,900	1,450,546	1,505,910	1,623,476	2,156,322	2,389,876	2,665,409	3,298,302	4,009,918	4,797,362
Africa	Europe	2,884,846	3,425,522	4,074,153	4,294,747	4,523,489	5,450,533	5,763,695	6,074,264	6,697,973	7,326,211	7,951,664
Africa	Mideast	174,715	542,469	585,505	642,856	701,337	1,018,372	1,189,098	1,394,032	1,874,368	2,441,124	3,078,051
Africa	North America	197,700	305,520	240,230	264,366	296,146	407,354	450,227	490,096	570,414	651,602	732,600
Africa	South America	320,916	33,360	40,009	41,482	42,921	53,871	58,989	63,551	75,263	88,626	102,306
Africa	Caribbean	17,751	45,900	48,563	51,065	52,550	60,080	68,492	80,020	115,254	167,880	244,592
Asia	Africa	1,543,538	2,447,131	2,716,092	2,656,375	2,590,698	2,516,402	2,497,027	2,593,948	3,059,980	4,026,364	6,058,246
Asia	Asia	30,673,403	40,307,863	41,979,414	43,736,818	45,516,986	56,360,087	64,975,793	75,635,374	102,984,222	141,406,907	195,443,037
Asia	Europe	13,373,965	17,271,356	20,646,594	21,992,413	22,136,161	23,078,650	23,585,303	24,325,400	26,116,724	28,946,399	33,121,894
Asia	Mideast	2,948,575	3,514,177	3,826,342	4,088,794	4,315,842	5,420,512	6,195,510	7,132,396	9,328,944	11,965,618	15,029,301
Asia	North America	4,864,343	5,553,752	7,057,964	6,969,835	7,309,396	8,625,236	9,111,152	9,634,443	10,727,176	11,910,770	13,164,794
Asia	South America	338,775	312,813	373,838	396,391	408,678	475,815	519,839	561,940	649,541	744,264	845,187
Asia	Caribbean	194,365	160,664	177,181	172,129	166,556	141,102	129,170	129,731	156,762	235,481	404,229
Europe	Africa	5,746,707	6,386,845	6,810,647	7,222,858	7,446,957	8,547,378	9,222,804	9,990,319	11,760,190	13,870,166	16,550,736
Europe	Asia	5,536,222	7,521,131	8,486,191	8,727,038	9,095,935	11,424,718	12,624,879	13,985,874	17,447,603	21,552,191	25,835,478
Europe	Europe	16,752,435	18,647,378	21,412,442	22,442,022	23,350,102	26,816,108	27,908,621	29,645,369	33,685,287	39,216,839	48,191,059
Europe	Mideast	4,796,276	5,940,596	6,569,771	7,144,917	7,687,723	10,721,470	12,485,586	14,616,508	19,686,500	25,818,504	33,046,991
Europe	North America	3,828,494	5,689,273	6,379,173	6,784,854	7,445,444	8,508,636	9,008,872	9,502,114	10,519,733	11,490,812	12,367,037
Europe	South America	1,642,305	1,299,837	1,545,056	1,645,863	1,754,350	2,327,465	2,592,109	2,841,862	3,365,807	3,915,001	4,479,727
Europe	Caribbean	1,126,723	1,028,889	1,099,372	1,153,398	1,194,435	1,333,546	1,355,513	1,383,982	1,424,714	1,460,902	1,500,368
Mideast	Africa	399,882	380,674	420,604	398,252	376,121	309,576	287,869	288,172	329,549	441,580	699,068
Mideast	Asia	355,383	1,024,772	1,139,807	1,184,993	1,245,764	1,504,534	1,690,659	1,920,087	2,487,180	3,244,272	4,067,602
Mideast	Europe	1,449,553	1,786,788	1,969,335	2,016,454	2,106,277	2,202,961	2,275,766	2,362,684	2,601,471	2,952,899	3,467,608
Mideast	Mideast	1,360,396	2,272,742	2,524,443	2,696,173	2,875,811	3,677,677	4,219,033	4,898,776	6,559,258	8,714,283	11,654,835
Mideast	North America	226,677	181,462	234,894	259,405	290,895	349,862	382,828	412,558	475,491	539,932	604,872
Mideast	South America	34,113	31,848	40,490	43,014	45,360	57,582	64,104	70,699	85,901	105,650	135,763
Mideast	Caribbean	5,292	13,089	14,441	14,260	13,999	13,000	13,334	15,315	25,406	50,139	109,000
North America	Africa	259,111	375,957	409,554	410,741	405,605	415,080	410,605	423,002	456,300	497,732	545,731
North America	Asia	13,300,182	14,812,064	14,343,572	15,107,257	15,767,628	19,354,825	21,368,978	23,745,656	29,049,996	35,297,325	41,209,420
North America	Europe	14,221,808	11,527,616	9,320,142	10,219,637	10,610,487	10,445,393	10,435,552	10,858,295	11,942,907	13,361,570	14,997,421
North America	Mideast	544,327	1,067,321	913,454	1,000,293	1,047,602	1,650,787	1,947,318	2,254,647	2,933,632	3,676,733	4,448,610
North America	North America	596,635	963,215	1,636,669	1,746,165	1,873,346	2,693,261	3,075,848	3,438,608	4,192,942	4,975,276	5,762,421
North America	South America	2,492,814	2,247,877	2,119,773	2,216,066	2,347,464	3,296,664	3,728,976	4,154,314	5,056,100	6,020,955	7,027,790
North America	Caribbean	732,711	1,115,094	1,196,481	1,299,194	1,375,936	1,614,504	1,711,154	1,825,579	2,144,662	2,654,941	3,435,972
South America	Africa	2,936,909	5,409,153	5,536,743	5,894,718	6,149,976	7,902,162	9,018,071	10,184,969	12,760,108	15,673,985	19,026,319
South America	Asia	7,229,314	10,738,577	12,148,429	13,185,727	14,185,597	20,516,583	25,401,373	31,495,792	48,275,577	74,994,342	122,260,826
South America	Europe	19,698,571	26,986,669	31,704,411	33,901,597	36,473,999	51,817,298	56,856,550	61,370,633	70,643,390	80,998,210	93,570,948
South America	Mideast	3,192,628	5,992,643	6,090,056	6,759,530	7,497,670	11,523,140	13,616,303	16,028,217	21,635,248	28,218,335	35,520,810
South America	North America	2,482,465	3,396,466	4,442,779	4,668,151	4,910,115	6,233,442	6,804,829	7,329,640	8,381,568	9,430,792	10,479,904
South America	South America	3,075,318	4,817,591	5,913,424	6,198,116	6,630,800	9,310,873	10,616,099	11,988,111	15,123,502	18,873,766	23,304,238
South America	Caribbean	951,544	1,687,170	1,702,611	1,819,892	1,903,880	2,286,111	2,611,833	3,050,083	4,604,069	7,808,383	13,976,990
Caribbean	Africa	328,300	286,985	288,282	304,272	319,124	410,432	474,180	544,722	727,576	1,005,673	1,457,861
Caribbean	Asia	870,483	1,105,490	1,298,051	1,367,537	1,502,605	2,275,176	2,754,196	3,274,521	4,442,190	5,751,242	7,197,680
Caribbean	Europe	2,460,054	3,600,733	6,099,307	6,709,837	7,270,761	10,149,709	11,527,197	12,794,354	15,404,495	18,152,406	21,041,270
Caribbean	Mideast	144,074	188,673	201,568	211,152	221,418	272,266	303,410	349,022	464,528	614,282	799,271
Caribbean	North America	899,026	1,111,757	1,439,386	1,462,709	1,519,459	1,867,508	2,033,415	2,174,612	2,445,062	2,711,253	2,979,360
Caribbean	South America	892,033	800,711	971,028	997,661	1,012,219	1,299,351	1,447,200	1,601,149	1,927,800	2,277,295	2,644,525
Caribbean	Caribbean	591,760	1,393,764	1,372,320	1,440,020	1,499,835	1,863,238	2,395,144	3,315,166	7,087,870	15,356,236	31,369,933
Total		**181,016,126**	**230,927,592**	**253,283,162**	**267,474,346**	**281,161,511**	**352,597,868**	**391,919,049**	**437,662,416**	**550,422,525**	**704,721,041**	**926,739,626**
Average Annual Growth Rate			**4.99%**	**3.13%**	**5.60%**	**5.12%**	**4.63%**	**2.14%**	**2.23%**	**2.32%**	**2.50%**	**2.78%**

WORLD Commodity Forecast For FUELS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	3,573,989	2,947,811	2,896,253	2,922,071	2,935,004	3,063,408	3,167,121	3,318,005	3,655,412	4,027,605	4,470,176
Africa	Asia	2,397,150	1,912,151	1,972,745	2,033,405	2,124,364	2,362,301	2,637,055	3,000,669	4,038,457	5,649,101	8,189,437
Africa	Europe	17,507,453	18,020,472	20,093,644	20,656,309	21,519,161	24,686,690	26,748,245	28,377,518	31,754,362	35,358,260	39,315,773
Africa	Mideast	1,233,319	1,332,923	1,515,252	1,520,820	1,524,355	1,578,341	1,631,413	1,707,638	1,903,497	2,149,781	2,439,402
Africa	North America	727,671	1,017,227	794,591	899,341	936,080	1,056,389	1,159,662	1,246,558	1,444,428	1,709,447	2,108,707
Africa	South America	2,753,171	6,982,913	9,213,670	9,868,321	10,144,837	11,833,420	13,299,581	14,337,439	16,517,193	19,045,408	22,060,810
Africa	Caribbean	81,967	49,922	51,626	51,986	52,349	55,051	56,678	58,103	60,044	61,791	63,729
Asia	Africa	72,370	182,477	181,954	189,037	195,569	234,651	273,475	312,982	395,472	486,441	590,741
Asia	Asia	96,951,754	107,255,638	115,200,129	121,272,031	128,682,943	169,074,773	215,436,126	277,261,830	485,225,486	890,633,015	1,668,084,422
Asia	Europe	2,097,625	622,531	646,510	680,661	712,449	890,736	1,045,896	1,198,815	1,574,200	2,059,205	2,693,723
Asia	Mideast	161,026	3,046,994	3,116,714	3,217,530	3,300,899	3,765,059	4,246,770	4,807,597	6,130,169	7,790,396	9,834,910
Asia	North America	4,658,939	6,909,147	4,010,709	4,601,848	4,886,463	6,026,064	7,069,614	8,099,874	10,526,632	13,535,114	17,293,567
Asia	South America	165,305	4,796,452	4,820,182	5,011,237	5,145,057	5,819,170	6,466,028	6,960,779	7,514,324	7,963,580	8,393,980
Asia	Caribbean	42,346	1,282,975	1,260,786	1,290,395	1,319,459	1,502,395	1,633,271	1,733,888	1,859,142	1,941,836	2,008,845
Europe	Africa	4,354,374	5,927,317	5,988,298	6,199,523	6,414,914	7,806,374	9,335,727	10,996,667	14,658,982	19,095,524	24,576,824
Europe	Asia	5,100,055	6,037,679	6,461,234	7,077,906	7,782,855	11,731,034	16,787,384	24,064,664	51,009,731	110,443,641	235,778,961
Europe	Europe	82,178,059	88,520,990	96,296,653	94,011,463	96,104,014	105,627,806	113,237,656	121,064,350	140,120,093	163,273,752	190,987,257
Europe	Mideast	12,089,356	20,431,377	22,242,266	23,001,270	23,681,578	28,274,149	32,416,948	37,173,255	48,849,644	63,869,671	82,692,649
Europe	North America	7,476,076	24,916,235	30,870,439	34,570,232	35,889,777	40,998,062	46,198,241	51,264,261	64,311,627	81,468,822	103,158,674
Europe	South America	3,238,831	2,097,338	2,375,727	2,561,331	2,668,561	3,292,837	3,821,734	4,280,392	5,238,563	6,351,145	7,691,971
Europe	Caribbean	2,826,860	4,769,558	4,775,290	4,873,054	4,983,276	5,683,114	6,178,228	6,564,868	7,057,140	7,393,512	7,678,378
Mideast	Africa	3,004,476	8,551,513	8,848,872	8,990,372	9,074,384	9,843,950	10,544,095	11,330,147	13,079,488	15,026,838	17,324,190
Mideast	Asia	64,284,627	114,182,208	117,578,849	122,000,581	125,185,480	138,976,494	156,075,282	177,989,307	237,285,251	326,906,553	465,790,811
Mideast	Europe	7,642,822	11,994,841	14,139,596	13,774,548	14,275,692	17,189,735	19,267,880	21,335,222	26,108,070	31,903,009	38,877,480
Mideast	Mideast	2,519,716	4,053,358	4,458,160	4,577,108	4,666,671	5,212,681	5,707,007	6,324,021	7,829,980	9,720,659	12,006,314
Mideast	North America	50,227	1,111,875	1,244,038	1,407,187	1,495,443	1,917,605	2,310,755	2,699,003	3,599,555	4,711,819	6,076,630
Mideast	South America	1,122,612	1,234,257	1,584,290	1,699,398	1,750,007	2,058,512	2,319,458	2,510,531	2,919,072	3,392,335	3,963,429
Mideast	Caribbean	31,084	175,348	181,994	187,448	194,235	227,464	251,569	278,676	337,742	405,080	481,024
North America	Africa	25,469	19,949	35,930	35,732	36,529	33,197	30,777	30,715	30,836	30,772	30,197
North America	Asia	8,652,955	4,018,585	4,854,713	4,752,919	4,691,923	3,993,911	3,417,948	3,053,069	2,500,595	2,172,065	2,140,929
North America	Europe	2,589,410	2,145,830	1,020,616	1,042,772	1,056,912	1,066,826	1,080,196	1,103,455	1,198,023	1,326,429	1,513,953
North America	Mideast	618,853	380,296	453,669	438,454	447,306	431,987	418,616	424,770	435,635	439,915	433,913
North America	North America	13,675,044	25,146,496	28,636,954	31,517,529	32,481,870	35,418,325	37,884,540	40,329,984	48,971,299	53,669,138	65,233,856
North America	South America	3,836,935	2,874,727	4,920,176	5,103,023	5,187,089	5,688,171	6,181,018	6,582,022	7,207,604	7,764,063	8,318,874
North America	Caribbean	1,638,169	1,195,861	2,545,762	2,558,789	2,562,713	2,605,313	2,634,112	2,649,138	2,653,968	2,642,711	2,618,155
South America	Africa	44,212	3,244	3,186	3,266	3,357	3,966	4,636	5,345	6,889	8,732	11,000
South America	Asia	84,541	371,764	477,986	509,134	540,592	663,931	815,061	1,037,463	1,757,838	3,026,656	5,381,239
South America	Europe	1,928,105	1,805,349	1,879,580	1,824,200	1,925,681	2,244,377	2,401,009	2,539,800	2,961,461	3,375,107	3,996,286
South America	Mideast	150,603	105,396	113,761	116,473	116,887	120,933	124,976	130,521	145,585	163,101	181,447
South America	North America	21,545,438	28,439,298	24,347,035	27,927,803	29,639,988	35,812,667	41,650,078	47,234,094	60,182,417	76,449,104	97,330,203
South America	South America	7,054,072	10,237,068	11,385,080	12,221,408	12,622,116	15,067,173	17,184,711	18,997,486	22,958,510	27,636,897	33,264,829
South America	Caribbean	5,560,868	2,826,436	2,775,771	2,773,600	2,789,804	2,928,461	3,019,898	3,095,002	3,194,737	3,269,731	3,334,604
Caribbean	Africa	122	567	575	583	591	658	717	779	940	1,102	1,319
Caribbean	Asia	412,252	210,476	244,192	275,754	280,277	434,244	591,668	856,291	1,528,382	2,790,067	4,817,862
Caribbean	Europe	1,671,061	1,620,681	1,657,255	1,625,328	1,694,990	1,969,416	2,134,120	2,253,334	2,503,932	2,775,709	3,076,662
Caribbean	Mideast	3,877	27,361	28,896	29,796	30,126	32,261	33,765	36,305	43,407	53,068	65,636
Caribbean	North America	149,457	332,158	341,576	371,687	384,016	454,103	516,870	569,981	689,974	841,939	1,044,496
Caribbean	South America	1,334,441	1,270,855	1,367,732	1,493,931	1,573,733	1,882,584	2,085,392	2,252,937	2,591,168	2,962,924	3,392,062
Caribbean	Caribbean	5,192,323	4,217,843	4,156,053	4,235,048	4,318,571	4,820,929	5,297,924	5,560,969	6,172,559	6,760,861	7,368,235
Total		**404,511,464**	**537,613,463**	**574,968,918**	**598,003,663**	**620,030,948**	**726,461,698**	**836,740,934**	**969,040,522**	**1,359,739,518**	**2,034,533,432**	**3,228,188,574**
Average Annual Growth Rate			**5.85%**	**2.26%**	**4.01%**	**3.68%**	**3.22%**	**2.87%**	**2.98%**	**3.45%**	**4.11%**	**4.72%**

WORLD Commodity Forecast For HI-TECH PRODUCTS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	8,316	14,356	12,431	13,748	15,215	22,464	23,934	26,027	31,530	40,905	56,450
Africa	Asia	324	1,815	1,547	1,736	1,972	3,371	5,008	7,516	16,967	38,714	87,099
Africa	Europe	7,737	17,852	21,401	23,203	25,562	39,522	49,709	60,131	84,935	116,547	156,762
Africa	Mideast	2,590	4,365	4,012	4,508	5,096	7,567	9,134	11,193	16,940	25,897	40,566
Africa	North America	313	376	723	827	947	1,547	2,030	2,565	3,900	5,706	8,110
Africa	South America	44	87	72	81	91	148	186	227	337	502	769
Africa	Caribbean	10	22	20	23	25	40	45	48	56	64	73
Asia	Africa	56,726	92,939	84,294	88,018	94,502	142,861	200,626	279,302	535,241	1,034,572	2,035,025
Asia	Asia	2,400,133	3,974,068	3,727,706	4,179,157	4,633,015	7,499,252	10,614,126	15,153,023	31,465,563	66,433,516	134,755,419
Asia	Europe	1,259,731	2,291,207	2,455,820	2,632,068	2,774,212	3,962,186	5,133,175	6,433,628	9,702,202	14,198,567	20,428,550
Asia	Mideast	155,745	209,720	188,065	202,639	221,952	332,234	453,585	618,560	1,132,855	2,060,976	3,767,117
Asia	North America	2,145,623	3,740,660	3,998,227	4,228,725	4,615,947	7,276,775	9,766,428	12,478,574	19,188,395	27,858,663	38,573,566
Asia	South America	185,996	234,026	235,265	260,499	287,989	451,671	591,513	742,512	1,158,785	1,827,625	2,998,629
Asia	Caribbean	18,494	14,364	12,885	13,766	14,841	22,057	29,914	41,355	82,614	169,525	340,824
Europe	Africa	110,991	147,818	136,072	154,025	175,141	300,812	401,721	523,588	884,647	1,552,030	2,888,577
Europe	Asia	189,449	258,100	280,094	314,724	355,187	577,945	809,413	1,195,707	2,590,154	5,625,308	12,322,028
Europe	Europe	436,575	990,779	1,139,179	1,238,270	1,380,946	2,187,851	2,948,169	3,845,024	6,299,934	10,068,541	15,805,010
Europe	Mideast	91,508	206,345	211,840	243,080	279,510	480,271	669,952	916,680	1,667,817	2,944,753	5,019,365
Europe	North America	106,623	123,684	151,010	161,559	180,275	282,629	363,220	449,224	661,854	946,505	1,323,006
Europe	South America	37,159	62,838	70,641	80,424	91,737	152,629	187,494	221,682	303,646	410,191	549,693
Europe	Caribbean	18,827	17,521	16,022	17,962	20,079	32,011	39,363	49,210	83,370	153,476	273,751
Mideast	Africa	4,697	11,396	10,460	11,287	12,338	19,407	27,956	38,190	65,980	114,352	202,398
Mideast	Asia	3,981	9,243	8,643	9,597	10,602	17,044	24,413	34,732	68,741	135,569	268,254
Mideast	Europe	23,536	106,892	135,586	144,382	157,420	251,953	341,944	442,855	699,086	1,057,944	1,560,991
Mideast	Mideast	11,848	25,128	23,546	26,560	30,091	47,889	63,733	83,922	143,397	243,964	422,109
Mideast	North America	1,948	5,385	4,549	5,064	5,646	8,666	10,741	12,871	17,863	24,071	31,749
Mideast	South America	849	1,679	1,470	1,651	1,796	2,706	3,390	4,052	5,598	7,523	9,945
Mideast	Caribbean	139	456	430	459	521	780	921	1,021	1,304	1,622	1,949
North America	Africa	3,705	4,108	3,609	3,750	3,887	5,183	6,531	8,234	13,715	24,706	49,364
North America	Asia	228,517	221,769	240,582	261,521	282,951	404,959	557,254	787,517	1,621,894	3,433,461	7,361,014
North America	Europe	102,112	151,256	166,986	172,702	182,307	241,432	288,225	344,425	500,693	750,609	1,168,325
North America	Mideast	5,103	8,958	8,762	9,082	9,625	13,010	16,032	19,248	27,082	37,153	49,851
North America	North America	1,769	5,953	6,769	7,588	8,335	12,406	16,366	20,626	31,678	47,010	68,018
North America	South America	127,093	175,875	129,924	141,790	152,018	216,025	281,458	358,192	594,702	1,036,997	1,936,368
North America	Caribbean	12,742	21,312	23,408	25,651	28,139	44,056	65,256	100,683	239,189	562,723	1,265,117
South America	Africa	156	1,473	1,360	1,571	1,806	3,234	4,389	5,611	8,670	12,799	18,242
South America	Asia	1,307	8,253	8,494	9,726	11,130	19,431	29,362	47,495	116,658	275,285	638,202
South America	Europe	6,141	15,687	17,629	19,225	21,370	35,839	50,857	68,906	116,413	185,426	281,758
South America	Mideast	228	250	257	288	325	530	720	948	1,513	2,311	3,417
South America	North America	6,658	26,365	36,689	41,464	47,548	79,094	113,442	152,202	254,432	402,990	613,162
South America	South America	18,155	47,959	57,409	63,791	71,019	108,972	131,068	153,181	205,448	273,124	362,828
South America	Caribbean	7,360	16,077	15,272	16,468	17,871	25,626	29,559	33,806	44,001	58,049	79,579
Caribbean	Africa	72	210	227	237	255	390	464	541	719	950	1,222
Caribbean	Asia	501	317	327	370	418	692	989	1,432	2,908	5,821	11,506
Caribbean	Europe	2,037	1,373	1,488	1,592	1,741	2,679	3,333	4,041	5,825	8,315	11,817
Caribbean	Mideast	88	87	83	94	107	187	284	457	1,129	2,700	6,504
Caribbean	North America	112	490	880	974	1,093	1,666	2,050	2,460	3,370	4,465	5,794
Caribbean	South America	2,820	4,658	5,478	5,865	6,296	8,557	10,146	11,797	15,647	20,473	26,398
Caribbean	Caribbean	7,218	7,571	7,707	7,691	7,704	8,046	8,635	9,851	14,801	25,178	46,985
Total		**7,813,807**	**13,283,103**	**13,665,356**	**14,849,482**	**16,248,602**	**25,356,299**	**34,388,259**	**45,805,064**	**80,734,199**	**144,269,573**	**257,933,258**
Average Annual Growth Rate			**11.20%**	**0.95%**	**8.67%**	**9.42%**	**9.31%**	**6.28%**	**5.90%**	**5.83%**	**5.98%**	**5.98%**

WORLD Commodity Forecast For INTERMEDIATE MANUFACTURED PRODUCTS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	3,352,582	2,794,890	2,797,420	2,859,820	2,903,207	3,216,737	3,572,904	4,071,553	5,463,519	7,812,323	12,157,590
Africa	Asia	2,747,322	3,965,656	4,348,732	4,809,164	5,410,781	6,751,948	8,790,036	11,391,182	18,575,007	29,568,632	46,487,705
Africa	Europe	2,505,337	4,547,877	5,943,542	6,582,207	6,858,754	7,600,502	8,560,636	9,415,695	11,455,349	14,134,184	17,603,561
Africa	Mideast	806,663	858,832	880,007	989,885	1,063,231	1,343,244	1,714,283	2,274,493	4,063,374	7,623,805	15,342,810
Africa	North America	977,037	1,776,944	1,448,615	1,638,647	1,736,483	1,588,173	1,542,131	1,495,950	1,559,861	1,742,388	2,025,298
Africa	South America	148,528	102,674	120,875	141,979	151,442	187,544	221,399	249,684	300,614	351,281	410,268
Africa	Caribbean	27,779	32,016	32,145	33,986	35,018	37,846	38,563	38,700	38,523	38,806	40,085
Asia	Africa	1,012,108	4,451,323	4,676,441	5,085,660	5,469,232	8,087,873	10,521,714	13,515,882	22,476,233	38,752,786	69,460,555
Asia	Asia	87,633,368	107,245,037	127,481,705	137,733,143	150,437,679	207,291,341	269,987,966	357,076,859	644,360,188	1,215,790,672	2,357,680,932
Asia	Europe	5,318,220	14,045,304	18,983,777	19,894,449	20,900,593	27,769,082	33,555,845	39,221,589	52,588,795	70,376,836	95,595,888
Asia	Mideast	4,076,320	7,113,299	7,332,657	7,922,753	8,452,273	10,987,863	13,442,237	16,838,204	26,621,414	43,285,935	71,575,762
Asia	North America	11,505,675	33,806,879	28,471,211	31,027,617	34,401,205	50,235,615	63,996,375	77,460,492	110,585,312	154,665,075	212,674,718
Asia	South America	710,289	1,540,389	1,845,732	1,994,125	2,130,339	2,854,360	3,502,958	4,342,705	6,943,824	11,950,732	22,000,821
Asia	Caribbean	141,569	662,089	708,282	764,475	810,040	1,043,485	1,329,717	1,720,771	3,145,145	6,258,243	12,780,293
Europe	Africa	9,114,319	10,407,734	11,076,861	12,171,364	13,035,244	18,457,390	23,967,795	30,205,566	45,978,571	68,348,077	99,171,390
Europe	Asia	30,871,207	34,534,728	39,203,233	40,370,708	43,614,583	66,793,020	99,377,157	148,087,505	335,318,204	768,606,859	1,709,136,221
Europe	Europe	35,740,945	45,820,023	56,489,521	59,600,756	63,100,134	86,370,862	109,322,438	131,614,415	182,622,839	247,943,882	332,469,633
Europe	Mideast	12,615,998	14,478,144	16,432,920	17,833,952	19,104,280	26,423,915	33,278,183	42,123,911	66,051,109	101,701,146	153,044,072
Europe	North America	18,629,485	27,050,467	18,550,882	20,409,897	22,729,665	33,083,188	42,730,942	52,040,606	74,698,249	104,437,276	143,003,204
Europe	South America	2,015,264	2,841,369	3,482,186	3,845,182	4,173,508	5,752,434	6,848,937	8,040,771	11,011,816	15,200,952	21,462,192
Europe	Caribbean	1,370,040	1,510,418	1,594,023	1,721,647	1,813,611	2,185,529	2,396,501	2,569,262	2,882,856	3,207,334	3,567,157
Mideast	Africa	1,145,989	2,557,362	2,585,420	2,852,928	3,067,910	4,379,955	5,583,952	6,906,326	10,063,786	14,298,264	20,143,015
Mideast	Asia	3,712,506	3,383,145	3,688,764	3,958,779	4,220,398	5,676,200	7,752,157	10,874,014	21,760,970	44,030,974	86,917,877
Mideast	Europe	3,181,511	10,112,694	15,181,200	14,370,982	15,412,891	20,536,804	24,649,365	28,720,107	37,941,290	49,472,545	64,393,886
Mideast	Mideast	7,278,053	9,026,771	9,162,141	9,874,768	10,491,086	13,125,870	15,000,612	17,650,856	24,733,997	35,296,500	50,639,360
Mideast	North America	961,003	2,959,298	3,280,116	3,735,141	4,233,485	5,597,724	6,856,180	8,066,043	11,019,159	14,866,880	19,793,727
Mideast	South America	45,460	122,462	131,951	144,728	155,626	210,801	267,495	327,728	469,137	659,057	918,634
Mideast	Caribbean	91,226	306,100	305,449	324,507	334,948	352,858	361,352	361,845	354,864	349,266	350,387
North America	Africa	73,110	48,465	55,120	53,999	52,743	60,484	67,170	73,502	87,189	102,895	121,362
North America	Asia	5,654,334	2,557,837	3,351,442	3,540,535	3,685,937	4,499,866	5,614,804	6,970,136	11,373,616	19,656,238	34,756,908
North America	Europe	2,793,020	2,187,288	3,219,098	3,360,316	3,520,304	4,272,109	5,208,469	6,068,942	8,013,888	10,516,814	13,920,484
North America	Mideast	209,779	118,106	124,506	129,136	129,107	159,307	184,755	209,931	271,769	355,604	468,684
North America	North America	4,307,976	4,783,540	5,190,590	5,803,712	6,465,984	8,354,750	10,319,972	12,233,368	17,033,586	23,515,529	32,101,488
North America	South America	1,608,725	1,332,442	1,247,641	1,341,095	1,400,864	1,740,705	2,027,858	2,303,881	2,939,674	3,741,159	4,764,834
North America	Caribbean	2,293,464	1,114,606	1,076,786	1,138,591	1,181,936	1,399,431	1,552,466	1,709,356	2,191,064	3,157,412	4,766,734
South America	Africa	149,525	254,830	269,214	290,199	306,184	397,919	511,064	649,798	1,042,371	1,714,439	2,933,475
South America	Asia	6,755,492	6,025,884	6,024,444	5,981,717	6,020,660	6,658,631	7,642,803	9,139,524	15,498,590	30,912,906	64,654,571
South America	Europe	2,797,733	6,147,438	7,704,657	8,224,646	8,549,475	10,443,098	13,009,997	15,328,931	20,232,799	25,831,409	32,538,219
South America	Mideast	407,663	273,480	294,684	312,028	326,255	380,157	442,397	543,259	877,781	1,513,383	2,737,639
South America	North America	9,607,850	16,692,612	16,949,232	18,887,834	21,215,379	29,436,805	38,210,709	46,913,084	68,633,435	97,556,941	135,316,281
South America	South America	4,093,776	3,906,782	4,647,686	4,896,053	5,115,070	6,375,808	7,425,453	8,610,896	11,711,040	16,450,138	24,137,278
South America	Caribbean	1,760,574	3,416,075	3,693,129	3,892,580	4,020,453	4,733,742	5,287,691	6,157,246	9,397,154	16,856,977	33,710,292
Caribbean	Africa	1,080	17,126	18,560	19,771	20,911	30,164	39,404	50,418	80,118	127,045	210,898
Caribbean	Asia	43,726	30,431	30,028	32,554	34,685	43,925	58,081	78,448	144,992	266,364	469,196
Caribbean	Europe	97,315	153,859	198,541	207,597	211,029	250,655	301,906	346,230	441,337	552,428	684,194
Caribbean	Mideast	5,859	9,422	10,520	11,355	12,120	14,729	17,758	21,543	32,104	48,657	73,399
Caribbean	North America	369,835	615,468	722,826	815,042	893,070	1,381,722	2,035,216	2,694,742	4,394,570	6,682,058	9,636,907
Caribbean	South America	340,807	436,591	528,003	572,627	614,708	816,173	953,324	1,093,349	1,415,243	1,831,201	2,392,806
Caribbean	Caribbean	894,976	2,041,998	2,213,539	2,360,516	2,452,108	2,909,278	3,296,035	3,835,977	5,761,112	9,832,051	19,078,170
Total		**292,002,432**	**400,218,205**	**441,806,056**	**474,565,154**	**512,476,629**	**702,301,619**	**903,377,158**	**1,152,635,278**	**1,914,597,437**	**3,341,992,359**	**6,060,320,860**
Average Annual Growth Rate			**6.51%**	**3.35%**	**7.41%**	**7.99%**	**6.50%**	**5.16%**	**4.99%**	**5.21%**	**5.73%**	**6.13%**

WORLD Commodity Forecast For MATERIALS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	316,523	437,153	460,543	460,797	461,661	466,139	490,006	548,653	790,211	1,367,128	2,742,213
Africa	Asia	544,982	746,851	849,162	865,214	886,503	986,296	1,112,566	1,331,941	2,047,888	3,586,004	7,105,279
Africa	Europe	597,163	903,459	1,139,351	1,178,230	1,180,347	1,002,852	940,794	958,366	1,014,207	1,098,961	1,230,065
Africa	Mideast	77,706	153,793	161,329	167,890	176,076	186,723	200,101	223,268	286,175	381,355	534,251
Africa	North America	96,835	46,317	62,413	58,287	56,727	59,344	62,382	66,047	76,143	89,719	106,581
Africa	South America	64,443	53,414	65,848	67,769	69,147	79,801	87,433	94,434	107,401	124,218	154,360
Africa	Caribbean	2,604	9,911	10,669	11,220	11,523	12,513	13,327	13,988	15,157	16,656	18,965
Asia	Africa	633,172	1,017,261	1,086,720	1,100,702	1,127,409	1,412,298	1,837,697	2,608,972	5,682,651	12,804,064	29,138,549
Asia	Asia	23,492,851	37,178,215	43,328,164	45,208,638	47,089,493	58,874,721	70,813,885	91,129,072	158,655,626	293,538,238	563,817,743
Asia	Europe	3,578,283	5,670,470	7,351,493	7,388,923	7,435,553	8,344,543	9,147,444	10,307,271	14,138,586	21,608,082	37,381,857
Asia	Mideast	1,927,791	2,805,979	3,032,137	3,198,246	3,308,395	3,979,545	4,705,142	5,867,778	10,078,910	19,550,930	41,716,238
Asia	North America	3,280,434	5,913,761	7,555,241	7,603,646	7,838,762	8,997,671	9,724,736	10,333,738	12,048,621	14,268,166	16,764,818
Asia	South America	355,773	585,991	709,720	747,529	784,607	1,027,808	1,143,993	1,307,799	1,907,226	3,327,940	6,755,690
Asia	Caribbean	142,497	292,765	287,446	293,386	302,380	387,944	555,431	796,373	1,694,987	3,586,742	7,451,077
Europe	Africa	1,636,867	2,198,689	2,326,337	2,392,808	2,449,946	2,902,444	3,299,068	3,694,832	4,596,172	5,776,101	7,315,136
Europe	Asia	5,239,026	9,739,538	11,824,774	12,104,337	12,437,969	14,291,023	16,792,278	20,968,229	35,771,153	69,285,133	146,253,925
Europe	Europe	17,083,821	23,071,511	27,295,278	27,076,729	26,361,159	24,017,527	22,614,808	23,531,474	25,611,659	27,326,203	29,321,355
Europe	Mideast	2,296,135	3,282,231	3,834,378	4,032,696	4,246,434	5,299,242	6,133,726	7,175,260	9,807,110	13,420,976	18,549,737
Europe	North America	2,366,517	3,671,841	4,741,032	4,717,512	4,820,840	5,156,037	5,379,931	5,672,574	6,526,288	7,642,908	8,965,088
Europe	South America	723,103	1,063,215	1,430,550	1,505,202	1,579,469	1,982,056	2,270,982	2,549,712	3,155,012	3,890,386	4,797,458
Europe	Caribbean	170,413	200,277	206,283	213,932	219,114	234,865	251,522	269,336	303,601	344,379	399,638
Mideast	Africa	90,491	198,995	203,079	206,862	209,655	234,159	258,601	286,249	368,929	548,805	922,868
Mideast	Asia	196,289	435,089	431,991	436,311	441,006	502,017	608,543	816,481	1,663,356	3,722,327	8,757,166
Mideast	Europe	371,078	698,069	838,092	889,002	936,442	994,924	1,068,659	1,157,056	1,402,519	1,799,987	2,488,859
Mideast	Mideast	346,806	537,633	556,245	579,888	599,919	656,706	727,706	817,390	1,053,720	1,416,375	1,949,133
Mideast	North America	44,369	144,958	191,243	203,943	217,873	261,185	281,522	306,184	370,587	455,868	564,190
Mideast	South America	9,553	8,578	10,547	11,321	11,899	16,503	17,980	19,136	21,578	29,577	53,195
Mideast	Caribbean	1,343	3,523	3,588	3,635	3,666	3,662	3,757	3,843	4,021	4,448	5,562
North America	Africa	232,714	136,940	153,960	160,223	164,200	215,078	319,995	536,253	1,436,645	3,661,852	9,254,988
North America	Asia	16,429,106	16,308,008	19,795,843	19,888,338	19,273,490	16,256,891	14,219,513	13,790,712	13,305,438	13,261,405	13,806,778
North America	Europe	8,510,150	8,013,173	8,532,267	8,892,263	8,817,173	6,166,026	5,002,603	4,838,454	4,806,202	5,144,609	5,957,244
North America	Mideast	643,403	507,484	509,714	515,520	518,629	512,273	509,215	526,400	568,697	623,351	695,875
North America	North America	1,332,161	1,309,437	1,291,110	1,390,357	1,459,255	1,659,309	1,793,278	1,901,415	2,167,317	2,512,293	2,944,168
North America	South America	2,820,106	2,563,384	2,475,730	2,480,941	2,465,801	2,495,850	2,531,674	2,635,632	2,914,850	3,286,032	3,756,173
North America	Caribbean	589,248	694,661	1,043,446	1,109,584	1,182,761	1,681,174	2,517,681	3,634,980	7,631,705	15,632,048	30,820,278
South America	Africa	107,609	109,933	106,385	100,708	96,375	83,652	81,405	89,098	124,089	202,383	384,541
South America	Asia	1,660,746	2,592,068	3,731,878	3,734,073	3,721,199	3,549,361	3,390,493	3,587,025	4,048,700	4,871,761	7,009,508
South America	Europe	2,306,286	3,314,622	4,926,438	5,148,852	5,186,606	4,570,718	4,157,658	4,195,760	4,372,649	4,739,129	5,386,952
South America	Mideast	202,630	157,869	173,358	175,814	179,242	182,293	187,523	200,355	235,907	286,314	355,116
South America	North America	1,509,243	2,227,848	3,258,901	3,258,718	3,346,910	4,091,425	4,335,406	4,553,774	5,079,774	5,761,636	6,613,660
South America	South America	853,117	1,322,695	1,631,296	1,671,804	1,720,333	2,002,638	2,301,624	2,756,056	4,258,363	7,234,710	13,191,919
South America	Caribbean	193,727	405,669	373,060	388,057	402,780	476,755	598,027	767,870	1,366,422	2,545,227	4,728,198
Caribbean	Africa	636	2,388	2,298	2,291	2,300	2,386	2,390	2,398	2,443	2,544	2,707
Caribbean	Asia	15,577	22,968	29,895	29,135	29,045	36,076	40,396	46,682	64,268	90,217	128,465
Caribbean	Europe	28,553	50,857	70,537	71,582	72,635	78,251	80,971	85,073	97,324	116,363	144,168
Caribbean	Mideast	964	1,687	2,017	2,067	2,169	2,322	2,373	2,863	3,621	4,572	5,565
Caribbean	North America	60,068	70,076	100,072	95,607	95,781	104,309	112,678	120,168	135,550	153,479	175,601
Caribbean	South America	102,312	121,781	142,334	140,457	138,937	139,180	141,203	147,526	158,517	169,703	182,650
Caribbean	Caribbean	119,811	216,409	201,676	207,163	212,386	246,359	301,689	392,677	758,156	1,469,794	2,540,793
Total		**103,385,039**	**141,219,441**	**168,547,871**	**172,188,208**	**174,351,979**	**186,922,873**	**203,172,014**	**237,666,623**	**352,736,133**	**582,771,096**	**1,053,346,341**
Average Annual Growth Rate			**6.44%**	**6.07%**	**2.16%**	**1.26%**	**1.40%**	**1.68%**	**3.19%**	**4.03%**	**5.15%**	**6.10%**

WORLD Commodity Forecast For ALL COMMODITIES
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	16,119,815	18,570,062	18,705,672	19,173,593	19,548,245	22,329,642	25,201,003	29,686,727	44,641,008	71,327,388	118,358,623
Africa	Asia	49,626,221	76,567,021	79,636,623	83,997,195	90,550,075	109,504,337	124,808,720	144,909,012	205,787,188	310,283,263	485,566,365
Africa	Europe	174,787,782	210,918,747	246,398,810	252,792,731	256,339,051	273,083,816	270,805,279	275,011,643	290,526,369	312,884,425	340,286,312
Africa	Mideast	15,964,486	27,993,726	28,611,237	29,657,624	31,224,288	40,834,093	43,343,251	47,676,548	60,070,612	77,964,999	104,142,452
Africa	North America	22,056,850	28,294,330	32,290,099	37,183,274	40,556,192	52,640,486	55,809,602	57,806,795	62,877,536	69,112,430	76,416,329
Africa	South America	7,352,106	12,404,419	15,762,403	16,509,515	17,281,858	20,366,812	22,121,008	23,531,827	26,696,272	30,350,741	34,593,543
Africa	Caribbean	418,792	625,039	628,356	629,000	628,529	634,016	637,546	647,949	691,945	775,900	924,319
Asia	Africa	6,980,958	16,210,057	16,758,227	17,466,196	18,179,117	23,358,079	28,654,512	36,082,458	60,964,451	111,959,012	221,478,744
Asia	Asia	830,112,869	1,118,373,970	1,194,236,621	1,272,841,839	1,352,561,453	1,657,775,953	1,898,712,592	2,260,262,964	3,447,796,973	5,717,323,287	10,046,217,613
Asia	Europe	98,467,002	141,446,301	166,540,668	173,876,750	181,964,611	203,689,723	214,748,996	229,160,795	268,601,172	328,863,887	424,160,492
Asia	Mideast	24,574,957	40,378,634	41,236,358	43,506,302	45,702,488	55,331,596	63,956,647	75,639,772	108,878,592	165,477,976	269,840,988
Asia	North America	59,268,697	103,309,700	101,597,810	107,681,260	116,459,281	157,519,494	187,477,705	216,878,919	289,826,523	384,710,137	504,636,031
Asia	South America	18,104,142	30,107,624	33,509,443	35,053,719	36,960,995	43,186,230	46,997,256	50,676,408	60,103,623	76,408,315	106,475,481
Asia	Caribbean	1,202,419	4,717,962	4,931,544	5,184,879	5,442,832	6,267,474	7,207,580	8,449,421	12,867,081	22,192,430	40,976,192
Europe	Africa	40,390,256	53,630,793	54,621,647	58,359,651	61,592,738	81,148,734	101,240,266	127,913,219	211,460,989	377,423,214	740,914,107
Europe	Asia	94,357,313	120,763,061	135,702,791	140,501,149	149,492,927	202,909,651	263,436,137	350,962,048	658,362,252	1,326,520,812	2,731,292,100
Europe	Europe	488,571,984	552,209,847	621,310,371	634,647,887	651,516,950	736,910,196	771,183,663	814,607,020	926,963,664	1,081,261,133	1,287,257,309
Europe	Mideast	55,837,663	93,700,659	100,972,535	106,934,682	112,374,690	140,012,009	162,197,863	190,939,726	267,972,895	381,434,152	553,016,850
Europe	North America	59,763,537	98,703,985	111,082,832	120,701,969	128,340,979	158,481,350	179,362,071	198,590,515	247,213,675	311,360,084	392,517,396
Europe	South America	16,239,675	19,819,191	24,347,217	26,043,025	27,681,782	36,136,170	40,854,986	45,220,569	54,983,435	66,943,951	82,152,203
Europe	Caribbean	17,587,114	39,360,656	40,073,516	44,449,646	46,573,321	53,459,040	59,116,537	64,158,825	69,605,705	72,759,131	75,919,833
Mideast	Africa	24,843,427	45,663,523	45,676,956	46,772,370	47,215,961	50,723,615	54,629,261	61,680,805	81,122,794	114,652,414	176,732,786
Mideast	Asia	551,618,152	662,116,141	633,952,983	662,978,048	657,938,526	664,269,853	653,802,950	701,817,129	880,261,725	1,202,217,564	1,751,641,316
Mideast	Europe	169,087,559	199,826,171	244,104,981	249,746,854	254,919,623	286,885,558	289,409,056	298,313,322	323,867,353	358,993,605	404,304,785
Mideast	Mideast	42,295,785	56,535,021	58,412,028	60,299,301	61,396,153	65,761,444	67,657,100	74,502,725	94,400,128	126,253,725	173,204,151
Mideast	North America	5,530,958	11,140,093	13,490,306	15,040,114	16,198,402	19,920,109	22,161,903	24,272,021	29,380,744	35,887,998	43,954,308
Mideast	South America	14,770,972	11,652,107	14,556,779	13,450,090	13,427,695	13,155,081	12,885,760	13,271,997	14,443,072	16,032,074	18,003,658
Mideast	Caribbean	713,247	1,113,130	1,124,840	1,195,249	1,235,473	1,327,840	1,409,629	1,499,104	1,666,235	1,899,862	2,300,824
North America	Africa	7,366,710	6,351,903	6,737,899	7,037,992	7,237,956	8,294,344	9,294,045	10,400,161	13,188,430	17,716,936	26,621,064
North America	Asia	168,064,835	137,693,263	145,913,294	151,004,865	153,073,719	161,775,300	166,311,968	174,932,536	202,616,239	244,581,385	326,050,436
North America	Europe	116,359,650	94,357,459	88,265,861	90,912,101	94,106,603	98,282,364	97,895,952	100,317,496	107,833,688	119,793,550	137,499,173
North America	Mideast	9,784,617	7,141,269	7,315,863	7,559,351	7,887,963	9,524,833	10,414,314	11,433,056	13,896,034	16,575,365	19,764,212
North America	North America	133,578,195	175,414,217	208,938,211	227,360,830	237,075,625	270,595,095	289,423,256	303,132,407	337,121,983	379,242,435	433,893,490
North America	South America	37,002,408	36,518,821	40,054,102	41,745,697	42,957,909	49,042,574	53,411,507	57,701,122	67,989,103	82,022,131	101,103,903
North America	Caribbean	10,683,203	12,374,610	14,790,806	14,871,001	14,933,453	15,494,072	16,559,534	18,140,498	23,692,694	34,238,695	53,267,937
South America	Africa	6,983,325	14,161,923	14,039,247	14,644,126	15,269,125	18,447,577	20,945,965	23,488,798	28,973,814	35,362,891	43,688,978
South America	Asia	89,515,396	111,935,984	123,243,619	136,868,118	149,287,911	180,175,047	204,838,012	239,349,423	345,386,758	533,970,901	880,592,267
South America	Europe	123,881,263	166,791,773	188,140,161	185,375,151	190,181,906	225,399,917	233,294,751	241,392,817	263,969,619	291,597,938	325,164,234
South America	Mideast	12,873,829	23,105,036	23,508,853	24,249,901	25,371,146	31,376,200	34,152,380	38,097,357	48,316,209	61,784,037	78,142,615
South America	North America	144,736,642	188,742,510	201,087,815	220,354,069	235,088,652	277,068,374	303,303,956	323,794,532	374,388,270	439,630,681	522,046,966
South America	South America	46,188,044	63,572,443	72,463,289	74,385,473	77,867,282	92,356,073	100,912,055	109,931,425	131,447,530	159,977,375	200,493,079
South America	Caribbean	23,990,571	53,968,628	53,627,164	56,387,578	59,331,838	80,567,147	119,979,603	199,611,959	572,140,801	1,502,706,269	3,801,402,272
Caribbean	Africa	434,831	546,595	546,714	577,993	609,287	817,871	1,063,973	1,468,168	3,017,578	6,617,716	13,831,087
Caribbean	Asia	1,748,122	1,866,386	2,129,800	2,272,467	2,431,359	3,474,472	4,211,059	5,130,192	7,388,277	10,719,037	15,607,710
Caribbean	Europe	10,319,536	15,106,302	16,875,241	17,682,432	18,444,789	22,394,400	24,329,931	26,053,989	29,763,734	33,851,531	38,337,559
Caribbean	Mideast	261,644	532,693	564,951	589,456	612,345	708,272	771,122	854,853	1,054,180	1,311,639	1,636,337
Caribbean	North America	3,381,194	5,411,351	6,378,759	6,749,349	7,083,814	8,563,701	9,884,111	11,033,392	13,844,113	17,415,689	21,839,882
Caribbean	South America	4,256,565	5,359,606	5,940,751	6,210,064	6,423,929	7,492,678	8,098,262	8,639,149	9,780,636	11,110,065	12,715,732
Caribbean	Caribbean	8,376,600	11,531,370	11,478,597	12,005,891	12,426,382	14,732,134	17,284,982	20,976,955	33,750,358	58,960,972	107,418,436
Total		**3,816,381,917**	**4,928,636,115**	**5,310,314,649**	**5,575,497,817**	**5,801,007,291**	**6,754,204,846**	**7,396,209,616**	**8,350,059,549**	**11,431,504,060**	**17,212,411,148**	**28,368,402,479**
Average Annual Growth Rate			**5.25%**	**2.52%**	**4.99%**	**4.04%**	**3.09%**	**1.83%**	**2.46%**	**3.19%**	**4.18%**	**5.12%**

World Commodity by Destination (Metric Tonnes)

WORLD Commodity Forecast For AGRICULTURE COMMODITIES
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	1,151,809	1,462,550	1,569,733	1,588,828	1,606,592	1,709,890	1,774,694	1,932,164	2,438,244	3,418,773	5,503,300
Africa	Asia	1,524,693	4,499,293	4,325,264	4,518,007	4,683,008	5,437,195	6,045,089	6,710,195	8,379,873	10,775,009	14,937,941
Africa	Europe	7,858,568	12,471,114	12,247,684	13,126,691	13,843,393	17,271,287	20,127,368	23,572,753	33,036,152	49,693,167	84,664,450
Africa	Mideast	490,768	808,679	849,000	891,746	929,901	1,103,520	1,227,234	1,359,821	1,652,360	1,920,183	2,247,645
Africa	North America	3,567,324	4,033,635	4,665,911	4,900,037	5,073,142	5,865,264	6,591,052	7,245,532	8,528,984	9,775,340	10,970,400
Africa	South America	1,544,464	4,161,438	4,113,744	4,273,301	4,401,147	5,063,313	5,707,473	6,297,962	7,571,863	9,097,979	11,360,761
Africa	Caribbean	69,876	103,116	103,491	114,129	126,106	215,176	374,327	682,660	1,988,730	5,228,771	11,863,614
Asia	Africa	2,207,259	2,756,579	2,917,645	2,946,439	2,970,572	3,238,494	3,473,631	3,771,337	4,714,518	6,488,816	9,517,490
Asia	Asia	41,384,355	56,203,139	56,813,511	60,359,947	62,484,841	71,104,073	79,586,432	86,020,968	109,584,371	137,578,994	175,283,426
Asia	Europe	6,409,503	11,816,919	12,756,088	14,147,683	15,288,994	18,921,453	22,172,322	25,750,745	34,499,252	46,299,663	61,019,504
Asia	Mideast	608,985	1,278,604	1,353,494	1,417,926	1,464,582	1,723,381	1,893,068	2,083,271	2,565,757	3,172,619	3,949,463
Asia	North America	35,448,094	29,288,969	30,395,454	32,334,756	33,086,661	37,414,663	39,757,617	41,454,531	45,783,294	45,458,125	51,369,262
Asia	South America	7,392,665	8,872,123	10,144,121	10,230,053	10,327,852	11,017,426	11,597,108	12,124,412	13,522,928	13,395,191	15,113,957
Asia	Caribbean	271,412	336,525	340,995	369,767	377,252	426,896	445,697	469,399	533,970	620,689	732,291
Europe	Africa	2,282,754	2,967,974	3,319,931	3,410,322	3,505,238	4,097,279	4,384,592	4,592,803	5,063,816	5,626,733	6,344,288
Europe	Asia	3,485,467	5,479,429	5,889,771	6,107,888	6,212,505	6,278,324	6,398,420	6,632,165	7,139,831	7,795,516	8,578,974
Europe	Europe	24,610,415	36,356,724	39,742,838	41,388,604	43,296,900	53,547,727	58,570,582	62,552,427	70,255,044	78,814,101	89,046,083
Europe	Mideast	1,334,526	1,682,930	1,771,516	1,863,015	1,911,193	2,131,690	2,268,225	2,379,155	2,619,520	2,916,366	3,278,385
Europe	North America	11,295,725	8,531,282	7,549,229	8,103,860	8,379,737	9,179,333	9,873,190	10,389,896	11,409,196	12,502,565	13,704,859
Europe	South America	9,645,469	13,380,712	14,899,786	15,941,535	16,490,230	19,683,860	21,232,998	20,923,352	23,276,711	25,873,292	28,611,495
Europe	Caribbean	1,740,948	1,974,593	2,155,267	2,301,758	2,367,381	2,542,931	2,700,045	2,844,818	3,151,268	3,521,596	3,987,236
Mideast	Africa	974,161	1,213,225	1,313,256	1,383,856	1,445,843	1,746,948	1,957,310	2,255,148	2,940,339	3,887,751	5,153,758
Mideast	Asia	5,533,158	10,586,734	10,150,998	10,799,449	11,409,861	13,185,681	14,872,121	16,715,949	20,545,273	24,760,794	29,513,588
Mideast	Europe	5,146,410	13,733,169	13,940,912	14,659,882	15,342,457	17,321,812	18,932,240	20,580,870	24,241,675	28,353,538	32,691,801
Mideast	Mideast	1,975,686	2,590,989	2,785,460	2,945,040	3,113,615	3,932,291	4,440,179	5,022,094	6,281,233	7,771,553	9,532,706
Mideast	North America	2,864,364	1,783,847	1,867,557	2,008,032	2,114,141	2,751,781	3,065,786	3,361,797	3,999,807	4,704,523	5,462,697
Mideast	South America	1,837,564	3,058,401	3,076,152	3,331,417	3,582,529	4,332,475	4,973,176	5,760,045	7,810,105	10,698,724	14,363,639
Mideast	Caribbean	96,511	244,142	253,883	263,244	270,876	306,113	330,742	357,246	405,592	457,818	514,190
North America	Africa	78,632	101,091	111,908	108,861	108,283	110,835	114,002	116,113	118,899	120,793	122,837
North America	Asia	1,178,317	2,004,287	1,903,843	1,903,717	1,981,244	2,189,492	2,317,954	2,257,658	2,571,994	2,948,424	3,337,902
North America	Europe	444,220	1,225,107	2,117,593	2,167,001	2,208,680	2,574,373	2,790,007	2,872,706	3,197,771	3,587,386	3,940,734
North America	Mideast	35,210	36,099	40,020	42,423	44,653	51,577	56,100	56,479	62,735	70,154	78,827
North America	North America	3,947,599	4,940,566	4,674,367	5,140,777	5,569,657	6,877,790	7,975,955	8,956,637	11,082,495	12,064,107	14,437,684
North America	South America	2,081,837	2,582,732	3,283,465	3,284,086	3,372,195	3,652,924	3,837,440	3,955,761	4,374,404	4,849,344	5,359,271
North America	Caribbean	276,957	341,198	636,208	652,745	661,657	575,131	555,848	513,709	425,430	349,837	292,739
South America	Africa	120,435	14,445	16,568	16,756	17,175	19,422	20,841	22,640	25,283	27,758	30,153
South America	Asia	216,056	185,074	217,889	230,109	236,757	276,345	296,965	320,909	364,473	413,553	487,659
South America	Europe	262,046	547,947	638,522	666,230	694,248	832,641	921,867	1,010,315	1,169,484	1,345,475	1,507,642
South America	Mideast	15,398	25,110	31,491	32,117	33,154	38,634	40,405	42,072	45,160	48,313	53,207
South America	North America	7,615,993	8,694,861	10,716,338	11,043,036	11,408,129	13,124,034	14,452,080	15,525,050	17,512,772	19,395,582	21,240,003
South America	South America	2,252,982	3,507,227	4,051,561	4,202,954	4,424,384	5,597,113	6,441,216	7,256,134	8,972,118	10,912,357	13,260,374
South America	Caribbean	171,603	261,340	278,862	284,844	291,345	327,376	360,580	386,562	431,773	478,468	527,868
Caribbean	Africa	6,670	24,066	25,388	27,872	29,820	39,143	45,836	53,105	75,487	117,144	194,943
Caribbean	Asia	110,007	302,334	336,859	357,369	375,390	436,001	472,677	500,799	556,734	634,786	759,996
Caribbean	Europe	836,621	919,252	875,472	927,451	973,337	1,138,447	1,225,070	1,282,334	1,371,641	1,446,993	1,517,262
Caribbean	Mideast	5,661	5,235	5,579	5,742	5,853	6,248	6,330	6,386	6,506	6,618	6,732
Caribbean	North America	1,598,696	2,766,504	3,223,683	3,375,249	3,512,982	3,900,576	4,149,576	4,342,519	4,667,010	4,941,790	5,174,677
Caribbean	South America	591,109	820,045	807,111	868,390	917,838	1,154,034	1,318,640	1,494,359	1,999,922	2,946,676	4,913,420
Caribbean	Caribbean	458,565	1,408,126	1,385,655	1,474,813	1,566,393	2,055,167	2,626,692	3,419,941	6,176,226	11,650,883	22,836,979
Total		**205,057,543**	**272,589,480**	**286,681,071**	**302,539,755**	**314,539,721**	**366,527,577**	**404,798,720**	**438,235,702**	**529,128,023**	**638,964,630**	**809,398,111**
Average Annual Growth Rate			**5.86%**	**1.69%**	**5.53%**	**3.97%**	**3.11%**	**2.01%**	**1.60%**	**1.90%**	**1.90%**	**2.39%**

WORLD Commodity Forecast For CAPITAL EQUIPMENT
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	161,996	171,143	143,765	156,658	172,368	249,514	278,246	311,052	397,457	532,759	761,526
Africa	Asia	529,590	806,498	819,925	859,376	914,778	1,322,308	1,824,917	2,580,522	5,406,283	11,661,906	25,509,852
Africa	Europe	1,375,019	1,940,417	1,829,042	2,028,674	2,289,360	3,866,000	5,016,396	6,116,708	8,923,166	12,852,288	18,289,874
Africa	Mideast	63,713	113,123	102,782	112,197	123,147	192,236	277,794	407,069	892,344	1,968,030	4,431,710
Africa	North America	89,866	67,043	114,137	119,060	127,147	155,502	181,771	218,474	354,891	602,972	938,054
Africa	South America	33,099	38,860	41,792	44,166	48,560	78,159	99,664	121,216	177,029	259,310	389,761
Africa	Caribbean	928	3,955	4,111	4,464	4,921	7,198	8,192	9,183	11,824	15,418	19,992
Asia	Africa	20,529	59,321	57,483	64,114	72,490	127,501	196,591	313,427	765,066	1,813,227	4,233,979
Asia	Asia	11,312,619	14,840,723	17,446,774	18,653,133	20,008,661	27,360,500	35,589,097	47,544,888	89,750,206	177,550,154	301,744,360
Asia	Europe	3,982,642	3,751,586	3,957,194	4,387,790	4,929,544	8,012,178	11,171,965	16,084,446	33,926,381	72,930,359	152,722,056
Asia	Mideast	81,414	148,155	136,890	148,603	162,142	227,836	291,629	372,993	621,803	1,063,654	1,823,090
Asia	North America	2,049,633	1,463,362	1,551,670	1,666,238	1,755,066	2,225,315	2,771,244	3,431,358	5,404,238	8,987,508	15,690,654
Asia	South America	578,947	357,106	444,359	456,708	475,342	549,121	631,300	752,639	1,162,169	2,020,864	3,734,004
Asia	Caribbean	78,989	13,473	16,625	16,865	17,332	19,424	21,408	23,939	31,816	47,074	77,732
Europe	Africa	117,988	312,646	469,310	524,821	586,062	921,620	1,115,422	1,287,664	1,658,346	2,077,814	2,548,999
Europe	Asia	3,287,065	7,407,714	9,988,884	10,578,984	11,240,297	15,253,875	17,840,828	20,693,008	28,209,222	38,900,382	53,935,350
Europe	Europe	4,654,445	7,637,673	9,304,964	10,190,266	11,282,407	16,427,533	20,288,003	24,236,843	33,552,681	45,394,876	60,539,750
Europe	Mideast	222,492	630,883	794,675	853,900	905,399	1,241,697	1,448,713	1,662,972	2,190,866	2,879,467	3,759,989
Europe	North America	1,220,028	1,461,157	1,839,942	1,940,285	2,062,194	2,764,727	3,231,560	3,654,847	4,657,488	6,006,763	7,752,956
Europe	South America	214,907	398,055	593,775	640,845	681,866	900,722	1,072,078	1,235,821	1,615,533	2,079,632	2,637,883
Europe	Caribbean	145,780	250,038	414,372	426,340	416,970	346,798	266,378	225,252	201,806	232,418	285,805
Mideast	Africa	17,188	28,405	27,684	30,068	32,742	43,696	49,624	57,718	80,480	116,167	171,503
Mideast	Asia	1,410,389	3,042,963	3,306,815	3,506,936	3,773,399	4,757,588	5,640,423	6,943,476	10,815,419	17,727,465	30,714,676
Mideast	Europe	1,855,531	2,981,854	3,139,500	3,533,723	3,996,492	6,219,977	7,710,455	9,501,456	14,539,120	22,224,039	33,450,688
Mideast	Mideast	151,635	457,136	505,284	558,382	618,020	839,372	1,038,214	1,313,365	2,197,004	3,878,482	7,345,064
Mideast	North America	113,052	89,648	73,586	76,944	81,651	100,829	113,692	125,375	150,305	178,341	211,528
Mideast	South America	43,132	38,064	40,409	43,258	46,503	62,764	78,231	98,417	160,995	268,863	452,998
Mideast	Caribbean	950	30,841	33,674	36,052	38,742	39,186	38,793	39,726	45,887	57,841	76,927
North America	Africa	31,127	72,528	123,398	139,942	160,079	262,656	330,692	398,165	560,293	762,361	1,004,273
North America	Asia	7,656,896	10,745,400	12,601,766	13,951,419	15,466,920	23,365,483	28,939,554	34,420,704	47,680,016	64,274,717	84,347,223
North America	Europe	2,817,452	4,527,557	5,073,960	5,650,024	6,374,237	10,018,305	12,685,234	15,381,472	21,834,537	29,951,325	39,788,040
North America	Mideast	31,343	55,570	70,845	73,798	80,751	125,231	155,958	184,917	255,793	347,302	461,199
North America	North America	167,445	318,723	344,194	387,226	431,542	630,983	750,351	862,079	1,118,610	1,422,455	1,772,628
North America	South America	608,476	907,405	1,259,091	1,412,305	1,509,690	2,192,683	2,787,311	3,361,939	4,750,567	6,502,421	8,648,907
North America	Caribbean	810	2,764	3,367	3,862	4,400	6,952	8,883	10,798	15,574	21,923	30,115
South America	Africa	5,731	5,572	6,080	6,912	7,730	11,934	14,347	16,599	22,066	28,956	37,381
South America	Asia	9,169,923	9,575,849	10,510,249	11,043,467	11,578,490	12,737,562	13,783,373	14,276,595	15,374,184	18,143,550	23,391,406
South America	Europe	1,254,877	1,413,769	1,639,884	1,869,937	2,111,611	3,412,808	4,097,672	4,691,339	6,127,117	7,987,116	10,357,237
South America	Mideast	8,219	16,417	17,085	18,335	19,629	24,637	26,701	28,737	34,554	43,265	55,380
South America	North America	1,227,644	949,648	756,215	814,995	841,934	1,040,594	1,176,910	1,284,285	1,537,291	1,844,669	2,204,509
South America	South America	457,967	464,161	636,028	717,913	802,057	1,325,803	1,619,283	1,877,524	2,499,113	3,294,734	4,287,674
South America	Caribbean	14,812	26,146	32,734	36,221	40,722	64,130	76,111	85,207	105,096	128,136	154,941
Caribbean	Africa	740	7,159	7,239	7,827	8,503	10,126	10,523	10,794	11,475	12,318	13,298
Caribbean	Asia	431,524	1,690,484	1,820,142	1,937,581	2,071,711	2,187,317	2,268,953	2,393,901	2,964,925	4,231,244	6,532,748
Caribbean	Europe	574,028	685,488	682,982	745,105	815,531	993,018	1,029,821	1,058,976	1,136,848	1,242,716	1,364,812
Caribbean	Mideast	16,765	47,920	48,319	51,066	56,390	52,893	52,873	52,595	67,488	116,968	244,464
Caribbean	North America	143,276	139,433	147,358	153,034	160,124	190,018	193,593	198,133	213,346	236,754	265,289
Caribbean	South America	49,668	76,467	73,714	81,924	91,210	138,773	162,001	191,812	290,782	495,000	949,677
Caribbean	Caribbean	18,221	33,827	32,983	36,217	39,766	53,775	58,597	62,738	71,419	81,174	91,938
Total		**58,440,512**	**80,304,127**	**93,087,056**	**100,794,958**	**109,536,628**	**153,158,768**	**188,521,681**	**230,183,164**	**354,520,919**	**575,497,177**	**920,273,895**
Average Annual Growth Rate			**6.56%**	**5.05%**	**8.28%**	**8.67%**	**6.93%**	**4.24%**	**4.07%**	**4.41%**	**4.96%**	**4.81%**

WORLD Commodity Forecast For CHEMICALS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	1,072,620	1,778,171	1,829,433	1,907,928	1,976,994	2,358,499	2,729,662	3,285,737	5,137,234	9,108,467	18,507,277
Africa	Asia	548,803	1,124,637	1,203,225	1,253,299	1,314,817	1,878,496	2,737,804	4,233,722	10,100,122	24,031,613	57,497,293
Africa	Europe	3,702,308	5,135,538	5,336,546	5,637,931	5,920,387	7,881,042	9,365,144	10,907,322	14,267,116	18,366,348	23,935,271
Africa	Mideast	697,033	1,435,969	1,463,978	1,570,622	1,677,546	2,452,509	3,601,988	5,674,195	14,182,568	34,697,027	79,976,235
Africa	North America	442,587	347,405	286,282	284,792	286,402	333,693	388,605	471,573	763,728	1,406,409	2,931,098
Africa	South America	125,001	218,134	232,811	239,607	248,279	322,120	383,145	425,669	533,909	645,040	782,038
Africa	Caribbean	32,770	105,526	101,273	102,807	104,516	116,530	126,500	136,426	158,263	183,497	214,866
Asia	Africa	3,379,405	5,546,666	5,767,401	6,177,074	6,627,957	9,039,653	11,481,412	13,982,876	20,593,091	30,868,862	47,953,513
Asia	Asia	46,625,519	79,143,090	96,292,037	102,478,170	109,614,281	145,011,803	185,383,819	243,967,815	452,370,999	898,622,109	1,839,475,577
Asia	Europe	21,796,027	20,876,086	22,681,138	23,361,950	24,641,969	32,844,355	40,088,395	49,072,923	76,403,799	128,756,902	234,525,167
Asia	Mideast	11,073,648	16,766,176	17,869,998	18,664,374	19,410,762	22,836,460	26,892,342	31,375,675	44,624,125	67,373,555	105,734,587
Asia	North America	19,096,719	17,495,081	20,263,469	21,130,585	21,567,642	22,630,318	24,255,789	26,682,646	34,952,374	51,210,133	83,418,648
Asia	South America	848,279	1,192,211	1,279,976	1,357,433	1,470,951	2,110,346	2,513,553	3,002,142	4,501,020	7,316,562	12,798,232
Asia	Caribbean	11,801	70,059	87,799	95,931	102,944	147,827	205,254	280,880	527,083	1,013,754	2,005,808
Europe	Africa	4,759,273	5,760,443	6,374,231	6,372,285	6,391,234	6,600,724	6,793,971	6,879,392	7,004,939	7,169,495	7,443,691
Europe	Asia	3,712,153	6,507,224	8,482,707	8,614,081	8,637,803	10,144,161	11,358,089	12,533,718	15,981,002	22,191,277	34,183,617
Europe	Europe	38,165,184	47,680,059	55,099,033	55,658,950	56,127,097	59,447,127	61,622,245	63,203,243	67,632,848	74,567,418	84,692,715
Europe	Mideast	4,019,210	5,859,571	6,487,137	6,606,348	6,687,618	7,410,357	8,157,431	8,737,041	10,136,860	12,338,314	16,474,481
Europe	North America	5,246,390	6,834,574	7,069,542	7,027,373	6,932,728	7,680,435	8,432,491	9,134,022	10,991,447	13,870,828	18,782,756
Europe	South America	1,423,274	3,478,959	4,073,383	4,118,368	4,167,337	4,846,323	5,428,140	5,879,311	6,839,944	7,922,344	9,148,091
Europe	Caribbean	3,174,256	3,834,014	4,502,817	4,481,459	4,545,960	5,049,464	5,371,035	5,532,249	5,868,101	6,246,364	6,686,683
Mideast	Africa	938,105	1,672,674	1,716,322	1,779,178	1,823,515	2,184,594	2,483,904	2,834,999	3,785,033	5,311,212	8,040,143
Mideast	Asia	977,191	1,957,231	2,085,017	2,257,309	2,391,329	3,138,150	3,866,724	5,062,294	9,178,539	17,877,834	37,834,681
Mideast	Europe	4,390,014	6,360,200	7,165,463	7,739,832	8,277,944	11,309,032	13,268,520	15,717,187	21,891,337	29,829,075	39,854,667
Mideast	Mideast	1,198,040	2,142,852	2,221,814	2,334,698	2,436,269	3,201,274	3,986,077	5,212,319	9,683,345	18,962,832	33,918,658
Mideast	North America	464,872	483,189	526,916	538,664	545,703	596,138	649,036	718,869	892,770	1,179,595	1,411,911
Mideast	South America	79,483	194,699	202,402	211,491	220,032	269,991	305,178	363,163	472,713	616,619	803,213
Mideast	Caribbean	6,725	22,224	25,269	25,887	26,790	30,958	33,593	36,444	43,835	53,932	67,293
North America	Africa	87,839	281,144	281,004	287,170	309,761	369,354	429,057	467,589	552,442	649,080	761,215
North America	Asia	5,804,352	7,988,644	7,008,046	7,006,004	7,323,822	8,696,722	9,685,664	10,369,247	12,184,994	14,679,101	18,076,791
North America	Europe	8,101,059	9,528,897	11,612,514	11,357,022	11,638,206	13,129,500	13,603,082	13,537,352	14,171,663	15,912,194	18,459,275
North America	Mideast	276,370	629,543	707,779	707,416	716,700	777,984	828,563	856,939	940,033	1,068,486	1,240,597
North America	North America	6,792,527	6,693,564	5,899,728	6,116,716	6,282,099	6,909,134	7,517,092	8,052,387	9,412,191	11,178,963	13,222,603
North America	South America	1,811,000	4,350,613	4,726,917	4,715,492	4,972,213	5,501,349	5,916,765	6,002,907	6,223,095	6,524,579	6,912,418
North America	Caribbean	524,792	731,174	794,977	819,610	844,722	1,005,408	1,186,689	1,304,771	1,567,948	1,861,555	2,179,104
South America	Africa	483,887	578,970	738,602	782,860	817,190	993,394	1,092,264	1,175,370	1,352,318	1,540,170	1,743,504
South America	Asia	516,530	1,019,903	1,322,829	1,445,845	1,534,213	1,971,761	2,281,424	2,707,018	4,015,749	6,550,949	12,080,701
South America	Europe	5,342,108	8,098,419	10,467,803	11,076,467	11,736,116	15,186,085	16,791,391	18,120,942	20,758,950	23,502,411	26,299,849
South America	Mideast	551,989	1,270,016	1,718,086	1,779,868	1,859,992	2,314,026	2,541,520	2,707,834	3,030,719	3,370,089	3,781,650
South America	North America	6,753,547	8,306,295	8,995,084	9,618,048	9,750,978	10,826,183	11,954,620	13,276,279	17,379,206	24,662,661	36,048,736
South America	South America	3,358,231	4,861,989	5,798,566	6,193,545	6,555,995	8,300,720	9,405,339	10,554,753	13,267,358	16,607,925	20,593,660
South America	Caribbean	372,793	438,153	509,500	527,512	553,432	655,806	732,333	790,896	921,144	1,073,053	1,256,070
Caribbean	Africa	130,006	119,649	121,651	125,295	128,524	143,099	152,070	158,481	165,099	165,587	163,125
Caribbean	Asia	65,045	211,205	223,844	243,536	262,049	377,051	548,649	790,385	1,688,152	3,599,808	7,405,235
Caribbean	Europe	910,792	1,387,539	1,447,851	1,530,564	1,605,353	1,961,318	2,138,460	2,315,675	2,742,584	3,471,016	5,005,320
Caribbean	Mideast	11,955	60,411	61,783	63,618	65,414	75,285	85,545	97,366	133,765	198,297	308,507
Caribbean	North America	868,945	858,257	930,649	971,381	1,009,271	1,187,516	1,356,692	1,508,605	1,845,096	2,224,985	2,629,197
Caribbean	South America	246,229	473,469	460,948	489,532	517,063	670,377	830,472	1,025,857	1,662,751	2,861,339	5,074,259
Caribbean	Caribbean	309,416	497,544	466,731	479,947	494,359	607,637	792,883	1,102,700	2,290,800	4,769,350	9,907,911
Total		**221,326,082**	**302,318,060**	**345,022,315**	**358,365,875**	**373,154,357**	**453,531,887**	**531,780,428**	**632,267,207**	**965,774,220**	**1,638,149,014**	**3,002,247,934**
Average Annual Growth Rate			**6.44%**	**4.50%**	**3.87%**	**4.13%**	**3.98%**	**3.23%**	**3.52%**	**4.33%**	**5.43%**	**6.25%**

WORLD Commodity Forecast For CONSUMER GOODS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	128,699	144,713	151,317	160,666	168,817	203,346	279,413	241,862	303,276	399,540	548,568
Africa	Asia	168,391	312,505	328,522	339,861	361,568	518,899	714,258	1,047,959	2,333,644	5,318,886	12,479,496
Africa	Europe	302,300	450,360	462,473	498,129	543,064	814,853	993,576	1,197,714	1,749,548	2,633,228	4,217,638
Africa	Mideast	42,928	99,595	104,467	112,099	120,256	165,058	201,502	246,824	378,682	597,997	971,776
Africa	North America	11,560	13,862	13,182	12,584	13,188	16,131	18,825	21,901	31,547	50,252	84,037
Africa	South America	2,442	5,101	5,549	5,639	6,074	9,075	10,595	12,138	15,795	20,552	26,798
Africa	Caribbean	248	468	499	507	523	627	701	781	969	1,202	1,472
Asia	Africa	5,984	9,277	10,042	10,882	11,883	18,423	24,071	31,194	51,747	85,605	142,808
Asia	Asia	5,000,127	8,181,832	9,653,752	10,158,775	10,538,680	14,283,920	16,920,975	20,563,753	31,237,614	48,654,419	78,096,814
Asia	Europe	606,321	899,541	1,019,341	1,088,335	1,170,411	1,715,195	2,180,460	2,778,645	4,648,433	7,982,285	14,019,248
Asia	Mideast	19,048	39,582	43,131	47,504	52,464	80,790	104,908	134,975	219,918	356,508	578,719
Asia	North America	531,457	526,548	554,493	594,271	629,983	798,285	1,013,003	1,313,338	2,352,924	4,441,032	8,569,591
Asia	South America	23,028	29,773	34,019	36,570	38,695	53,930	67,375	85,029	137,628	227,531	386,480
Asia	Caribbean	1,092	1,531	1,569	1,602	1,683	2,256	2,669	3,091	4,395	6,674	10,417
Europe	Africa	313,985	510,147	639,599	640,662	632,861	574,776	573,184	578,017	648,508	774,796	943,941
Europe	Asia	3,195,004	5,859,006	7,305,006	7,408,548	7,537,142	8,568,448	9,225,271	10,217,190	13,237,072	18,457,396	28,062,743
Europe	Europe	1,689,538	2,988,532	3,453,364	3,646,459	3,861,988	4,928,250	5,611,011	6,424,253	8,612,027	11,782,624	16,453,499
Europe	Mideast	220,923	413,106	497,410	543,696	594,536	789,420	907,138	1,026,579	1,320,874	1,706,326	2,195,278
Europe	North America	269,000	336,902	383,250	393,298	406,631	470,488	526,168	608,394	883,318	1,426,684	2,528,720
Europe	South America	100,768	171,215	223,464	237,653	252,581	342,748	363,090	413,717	543,206	707,368	911,651
Europe	Caribbean	8,570	17,190	19,999	20,450	21,138	25,397	28,238	31,217	38,191	46,453	56,166
Mideast	Africa	25,293	41,423	43,278	47,663	52,361	73,142	88,101	108,186	163,143	245,626	369,204
Mideast	Asia	540,319	779,385	808,310	844,344	894,650	1,179,691	1,458,823	1,900,764	3,426,064	6,461,855	12,810,303
Mideast	Europe	536,360	846,590	925,011	1,030,007	1,155,425	1,756,161	2,152,882	2,660,885	4,062,131	6,229,585	9,753,258
Mideast	Mideast	139,475	223,915	237,443	247,268	256,980	300,358	339,197	387,087	498,524	646,360	851,783
Mideast	North America	17,631	24,035	21,986	23,240	25,050	33,541	41,026	49,504	73,081	111,047	173,814
Mideast	South America	2,109	3,189	3,584	3,965	4,419	6,795	8,411	10,424	16,074	24,989	39,464
Mideast	Caribbean	341	1,541	1,624	1,707	1,797	2,276	2,617	2,991	4,254	7,208	14,254
North America	Africa	19,992	43,711	106,743	113,082	121,382	161,101	189,674	217,255	279,892	352,281	433,604
North America	Asia	5,922,533	10,742,114	15,045,575	15,785,876	17,252,062	24,968,310	29,435,559	34,403,118	46,657,353	62,203,753	81,161,958
North America	Europe	647,774	1,185,413	1,372,292	1,480,470	1,605,594	2,034,343	2,373,160	2,693,515	3,502,525	4,616,824	6,053,092
North America	Mideast	73,799	117,759	164,588	186,689	210,178	248,614	282,863	328,482	440,887	578,392	731,820
North America	North America	12,586	120,413	156,251	165,030	171,937	224,990	262,959	304,727	401,479	522,731	673,933
North America	South America	179,807	282,241	387,544	418,257	428,049	595,239	678,943	791,772	1,072,606	1,431,160	1,872,342
North America	Caribbean	162,434	538,460	666,780	684,472	716,422	847,807	975,545	1,108,860	1,435,721	1,816,190	2,242,829
South America	Africa	402	1,054	1,333	1,472	1,624	2,493	2,971	3,427	4,602	6,239	8,657
South America	Asia	337,791	437,356	524,940	566,703	612,596	869,771	1,010,807	1,168,787	1,630,834	2,408,688	3,786,856
South America	Europe	167,808	287,798	350,575	388,833	428,483	644,525	768,711	892,257	1,193,540	1,599,540	2,177,609
South America	Mideast	1,894	4,724	5,711	6,192	6,646	8,831	10,101	11,330	14,245	18,229	24,265
South America	North America	281,572	366,057	315,383	336,052	354,906	450,897	514,909	574,169	716,570	898,227	1,124,269
South America	South America	148,980	231,899	275,645	301,529	327,778	478,789	566,760	663,243	900,313	1,222,157	1,685,069
South America	Caribbean	38,971	78,946	90,374	95,103	100,385	127,621	139,732	147,986	164,077	186,320	223,046
Caribbean	Africa	829	1,407	1,498	1,662	1,845	2,727	3,009	3,365	4,543	6,836	11,067
Caribbean	Asia	52,317	82,767	84,577	92,172	99,926	147,227	214,126	313,479	683,333	1,487,321	3,219,614
Caribbean	Europe	103,903	94,068	94,335	104,350	114,258	161,119	176,327	191,951	231,895	293,369	395,677
Caribbean	Mideast	739	1,072	1,112	1,187	1,263	1,650	1,986	2,399	3,705	6,139	10,624
Caribbean	North America	158,776	402,408	285,149	298,872	311,534	362,506	392,547	421,728	481,700	547,791	617,398
Caribbean	South America	48,591	119,769	122,824	132,164	140,917	164,872	222,849	274,535	451,388	788,926	1,377,356
Caribbean	Caribbean	114,852	258,228	268,438	294,747	318,281	423,391	494,191	568,625	746,151	978,831	1,264,491
Total		**22,379,295**	**38,328,528**	**47,267,351**	**49,611,298**	**52,680,916**	**70,679,252**	**82,515,158**	**97,183,423**	**138,009,949**	**201,373,971**	**304,393,505**
Average Annual Growth Rate			**11.36%**	**7.24%**	**4.96%**	**6.19%**	**6.05%**	**3.15%**	**3.33%**	**3.57%**	**3.85%**	**4.22%**

WORLD Commodity Forecast For EXTRACTIVE COMMODITIES
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	4,909,245	6,983,257	6,862,747	7,095,687	7,285,815	8,898,467	10,630,368	13,203,275	21,810,133	35,543,917	53,612,613
Africa	Asia	891,567	1,275,994	1,335,789	1,375,861	1,427,477	1,807,036	2,001,903	2,198,975	2,594,952	3,067,372	3,771,045
Africa	Europe	6,188,804	8,564,961	8,417,685	8,927,649	9,474,332	13,301,155	19,510,667	30,707,750	75,606,446	185,236,284	459,304,209
Africa	Mideast	18,903,450	31,506,216	31,088,292	31,626,005	31,624,703	32,023,244	32,618,271	35,143,812	40,129,108	45,049,338	49,813,880
Africa	North America	2,681,264	1,304,538	1,000,212	1,057,073	1,075,113	1,195,332	1,278,714	1,370,975	1,484,596	1,564,006	1,675,833
Africa	South America	2,039,908	3,959,757	3,728,463	3,790,951	4,007,365	4,583,976	5,125,521	5,696,993	6,733,090	7,727,670	8,756,043
Africa	Caribbean	798	26,254	27,398	28,932	30,039	34,311	37,097	40,260	45,997	51,513	57,136
Asia	Africa	37,424,595	60,228,805	62,261,319	65,583,257	70,820,080	84,820,029	94,698,476	108,413,461	151,686,145	228,174,384	357,051,692
Asia	Asia	484,638,741	664,044,367	682,313,427	729,062,027	773,554,874	900,915,482	949,404,371	1,045,909,382	1,342,162,698	1,847,113,263	2,731,835,883
Asia	Europe	14,626,860	25,327,754	27,033,503	28,920,676	30,175,482	36,598,729	41,431,885	48,073,309	66,747,542	95,038,471	139,679,511
Asia	Mideast	471,282,271	524,849,168	491,701,415	515,109,379	505,745,327	492,723,097	458,469,948	476,215,595	568,964,624	752,211,534	1,073,753,746
Asia	North America	66,673,837	51,001,041	50,562,057	51,728,444	52,332,436	54,196,318	53,335,819	53,703,571	56,271,870	60,664,093	67,727,232
Asia	South America	64,941,079	81,748,226	88,949,913	101,366,958	112,495,893	135,036,288	152,749,585	178,079,901	256,365,649	396,929,805	648,615,251
Asia	Caribbean	42,289	75,115	80,319	82,954	85,118	87,955	90,790	95,510	108,272	127,136	156,759
Europe	Africa	143,811,247	174,452,355	203,423,647	209,109,944	211,116,343	222,109,318	215,875,031	216,787,792	225,143,934	239,201,426	256,747,568
Europe	Asia	59,159,508	76,202,062	84,790,105	88,578,736	94,377,896	99,399,718	97,458,724	97,598,011	99,913,536	104,330,228	110,177,895
Europe	Europe	217,260,567	280,496,179	311,077,099	319,394,366	326,652,203	357,839,404	349,060,130	348,489,620	358,571,252	382,872,899	419,750,948
Europe	Mideast	150,621,908	166,340,398	204,290,432	208,684,527	211,932,155	234,136,018	229,023,935	230,489,651	238,846,797	251,966,748	267,807,830
Europe	North America	70,111,997	53,168,382	48,964,789	49,759,595	52,138,191	55,995,595	53,817,498	53,316,767	53,430,524	54,887,280	57,172,456
Europe	South America	85,760,009	111,093,066	122,027,038	115,318,229	116,432,762	130,514,934	128,722,375	129,436,586	133,367,513	139,886,022	148,080,950
Europe	Caribbean	990,962	1,602,903	1,755,658	1,836,490	1,842,185	1,979,101	1,916,715	1,937,421	2,051,454	2,199,478	2,363,559
Mideast	Africa	11,714,745	22,145,617	22,364,591	23,070,900	24,399,731	32,651,156	34,020,283	36,809,873	44,957,263	55,782,280	68,972,763
Mideast	Asia	6,844,444	7,322,152	7,389,304	7,468,303	7,633,890	8,585,274	9,075,312	9,782,754	11,621,005	13,996,173	17,044,413
Mideast	Europe	12,020,075	25,440,132	26,510,475	27,715,324	28,602,846	32,205,981	35,149,372	40,473,714	57,176,453	87,042,863	144,913,623
Mideast	Mideast	27,314,129	35,204,497	35,937,491	36,459,415	36,307,700	34,767,326	32,135,342	32,792,894	35,419,669	39,602,717	44,884,189
Mideast	North America	4,303,233	2,678,385	2,815,711	2,819,989	2,969,148	3,275,181	3,468,838	3,742,515	4,453,256	5,329,104	6,407,329
Mideast	South America	6,957,790	13,281,046	13,512,189	13,295,637	13,397,283	14,497,124	14,415,464	14,962,013	16,960,289	19,941,398	23,684,874
Mideast	Caribbean	2,254	6,714	7,416	8,102	8,260	7,973	7,577	8,256	9,823	11,559	13,298
North America	Africa	19,839,704	24,649,473	29,120,472	33,672,751	36,830,305	48,623,734	51,529,834	53,306,458	57,711,265	63,029,053	69,113,106
North America	Asia	12,251,584	15,905,056	13,945,227	14,602,571	15,383,462	17,137,925	17,430,669	17,421,071	17,756,030	18,366,353	19,240,694
North America	Europe	15,345,837	20,785,512	30,213,936	33,403,398	35,448,172	42,696,279	44,229,442	45,176,690	47,789,428	51,306,032	55,459,246
North America	Mideast	3,830,013	5,898,144	7,552,235	8,419,048	8,902,778	10,581,662	10,996,385	11,348,545	12,198,622	13,225,095	14,370,696
North America	North America	102,744,451	131,222,309	161,101,587	175,085,729	182,331,600	207,814,146	219,826,894	227,032,576	243,710,387	269,334,933	297,676,690
North America	South America	104,903,867	129,836,931	142,396,162	155,739,959	165,646,564	189,472,747	198,969,032	203,499,359	215,435,971	230,721,715	248,900,818
North America	Caribbean	937,701	1,467,806	1,672,686	1,842,641	1,963,194	2,319,096	2,456,917	2,533,291	2,730,914	2,972,991	3,252,939
South America	Africa	3,454,551	4,631,931	5,559,347	5,581,885	6,029,701	7,184,785	7,322,997	7,568,455	8,291,192	9,137,582	10,045,334
South America	Asia	6,187,704	11,419,772	12,948,799	13,357,813	14,242,268	16,701,967	17,400,358	18,287,364	20,544,683	23,077,432	25,734,552
South America	Europe	1,556,175	2,106,661	2,346,274	2,406,557	2,443,700	2,552,689	2,554,088	2,589,297	2,659,501	2,741,734	2,828,825
South America	Mideast	12,980,883	8,937,016	11,015,656	9,713,466	9,543,587	8,422,850	7,594,605	7,549,877	7,817,107	8,358,036	9,008,189
South America	North America	10,237,979	9,007,655	8,377,838	8,650,651	9,048,727	10,163,451	10,562,004	11,007,297	12,130,333	13,371,787	14,682,342
South America	South America	24,875,446	34,174,772	38,066,645	37,918,360	39,597,730	43,788,185	45,220,501	47,074,042	51,551,765	57,471,568	66,405,209
South America	Caribbean	985,974	1,920,445	2,014,707	2,055,844	2,092,151	2,171,900	2,152,241	2,121,738	2,050,169	1,982,492	1,915,366
Caribbean	Africa	150,435	334,986	329,556	318,064	308,373	273,409	248,994	231,344	206,306	188,818	174,442
Caribbean	Asia	4,255	18,315	19,543	20,070	20,481	22,894	25,672	28,740	35,290	47,443	73,331
Caribbean	Europe	9,598,908	28,747,648	29,281,886	33,162,181	34,834,326	39,736,074	44,325,729	48,473,232	52,371,055	53,745,433	54,217,470
Caribbean	Mideast	549,043	499,976	502,145	543,327	559,183	594,000	631,961	679,659	731,435	761,284	782,576
Caribbean	North America	2,647,174	4,066,475	4,316,085	3,940,656	3,608,055	2,508,979	1,986,056	1,749,777	1,624,955	1,637,540	1,675,121
Caribbean	South America	14,580,901	44,127,752	43,602,724	45,924,970	48,530,022	67,968,397	105,898,634	183,521,389	549,129,574	1,465,075,961	3,733,257,897
Caribbean	Caribbean	669,458	1,456,890	1,373,496	1,469,729	1,516,978	1,744,314	2,103,193	2,708,311	4,731,265	8,036,615	12,913,002
Total		**2,320,449,617**	**2,911,834,115**	**3,085,985,491**	**3,237,105,078**	**3,346,826,000**	**3,716,667,005**	**3,818,996,215**	**4,109,380,151**	**5,185,841,137**	**7,350,138,855**	**11,805,560,374**
Average Annual Growth Rate			**4.65%**	**1.96%**	**4.90%**	**3.39%**	**2.12%**	**0.54%**	**1.48%**	**2.35%**	**3.55%**	**4.85%**

WORLD Commodity Forecast For FOOD
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	1,444,036	1,836,018	1,982,030	2,007,389	2,022,574	2,141,178	2,314,657	2,748,399	4,613,991	9,075,971	19,998,910
Africa	Asia	1,543,538	2,447,131	2,716,092	2,656,375	2,590,698	2,516,462	2,497,027	2,593,948	3,059,980	4,026,364	6,058,246
Africa	Europe	5,746,707	6,386,845	6,810,647	7,222,858	7,446,957	8,547,378	9,222,804	9,990,319	11,760,190	13,870,166	16,550,736
Africa	Mideast	399,882	380,674	420,604	398,252	376,121	309,576	287,869	288,172	329,549	441,580	699,068
Africa	North America	239,111	375,957	409,554	410,741	405,605	415,080	410,605	423,002	456,300	497,732	545,731
Africa	South America	2,936,909	5,409,153	5,536,743	5,894,718	6,149,976	7,902,162	9,018,071	10,184,969	12,760,108	15,673,985	19,026,319
Africa	Caribbean	328,300	286,985	288,282	304,272	319,124	410,432	474,180	544,722	727,576	1,005,673	1,457,861
Asia	Africa	898,671	1,339,900	1,450,546	1,505,910	1,623,476	2,156,322	2,389,876	2,665,409	3,298,302	4,009,918	4,797,362
Asia	Asia	30,673,403	40,307,863	41,979,414	43,736,818	45,516,986	56,360,187	64,975,793	75,635,374	102,984,222	141,406,907	195,443,037
Asia	Europe	5,536,222	7,521,131	8,486,191	8,727,038	9,095,935	11,424,718	12,624,879	13,985,874	17,447,605	21,552,191	25,835,478
Asia	Mideast	355,383	1,024,772	1,139,807	1,184,993	1,245,764	1,504,534	1,690,659	1,920,087	2,487,180	3,244,272	4,067,602
Asia	North America	13,300,182	14,812,064	14,343,572	15,107,257	15,767,628	19,354,825	21,368,978	23,745,656	29,049,996	35,297,325	41,209,420
Asia	South America	7,229,314	10,738,577	12,148,429	13,185,727	14,185,597	20,516,583	25,401,373	31,493,792	48,275,577	74,994,342	122,260,826
Asia	Caribbean	870,483	1,105,490	1,298,051	1,367,537	1,502,605	2,275,176	2,754,196	3,274,521	4,442,190	5,751,242	7,197,680
Europe	Africa	2,884,846	3,425,522	4,074,153	4,294,747	4,523,489	5,450,533	5,763,695	6,074,264	6,697,973	7,326,211	7,951,664
Europe	Asia	13,373,965	17,271,356	20,646,594	21,992,413	22,136,161	23,078,650	23,585,303	24,325,400	26,116,724	28,946,399	33,121,894
Europe	Europe	16,752,435	18,647,378	21,412,442	22,442,022	23,350,102	26,516,108	27,908,621	29,645,369	33,685,287	39,216,839	48,191,059
Europe	Mideast	1,449,533	1,786,788	1,969,335	2,016,454	2,106,277	2,202,961	2,275,766	2,362,684	2,601,471	2,952,899	3,467,608
Europe	North America	14,221,808	11,527,616	9,520,142	10,219,637	10,610,487	10,445,393	10,435,552	10,858,295	11,942,907	13,361,570	14,997,421
Europe	South America	19,698,571	26,986,669	31,794,411	33,901,597	36,473,999	51,817,298	56,856,550	61,370,633	70,643,390	80,998,210	93,570,948
Europe	Caribbean	2,460,054	5,600,733	6,099,307	6,709,837	7,270,761	10,149,709	11,527,197	12,794,354	15,404,495	18,152,406	21,041,270
Mideast	Africa	174,715	542,469	585,505	642,856	701,337	1,018,372	1,189,098	1,394,032	1,874,368	2,441,124	3,078,051
Mideast	Asia	2,948,575	3,514,177	3,826,342	4,088,794	4,315,842	5,420,512	6,195,510	7,132,396	9,328,944	11,965,618	15,029,301
Mideast	Europe	4,796,276	5,940,596	6,569,771	7,144,917	7,687,723	10,721,470	12,485,586	14,616,508	19,686,500	25,818,504	33,046,991
Mideast	Mideast	1,360,396	2,272,742	2,524,443	2,696,173	2,875,811	3,677,677	4,219,033	4,898,776	6,559,258	8,714,283	11,634,835
Mideast	North America	544,327	1,067,321	913,454	1,000,293	1,047,602	1,650,787	1,947,318	2,254,647	2,933,632	3,676,733	4,448,610
Mideast	South America	3,192,628	3,992,643	4,090,056	6,759,330	7,497,670	11,323,140	13,616,303	16,028,217	21,635,248	28,218,335	35,520,810
Mideast	Caribbean	144,074	188,673	201,568	211,152	221,418	272,266	303,419	349,022	464,528	614,282	799,271
North America	Africa	197,700	305,520	240,250	264,366	296,146	407,354	450,227	490,096	570,414	651,602	732,600
North America	Asia	4,864,343	5,553,752	7,057,964	6,969,835	7,309,396	8,625,236	9,111,152	9,634,443	10,727,176	11,910,770	13,164,794
North America	Europe	3,828,494	5,689,273	6,379,173	6,784,854	7,445,444	8,508,636	9,008,872	9,302,114	10,519,733	11,490,812	12,367,037
North America	Mideast	226,677	181,462	234,894	259,405	290,895	349,862	382,828	412,558	475,491	539,932	604,872
North America	North America	596,635	963,215	1,636,660	1,746,165	1,873,346	2,693,261	3,075,848	3,438,608	4,192,942	4,975,276	5,762,421
North America	South America	2,482,465	3,396,466	4,442,779	4,668,151	4,910,115	6,233,442	6,804,829	7,329,640	8,381,568	9,430,792	10,479,904
North America	Caribbean	899,026	1,111,757	1,439,386	1,462,709	1,519,459	1,867,508	2,033,415	2,174,612	2,445,062	2,711,253	2,979,360
South America	Africa	320,916	33,360	40,009	41,482	42,921	53,871	58,989	63,551	75,263	88,626	102,306
South America	Asia	338,775	312,813	373,838	396,391	408,678	475,815	519,839	561,940	649,541	744,264	845,187
South America	Europe	1,642,305	1,299,837	1,545,056	1,645,863	1,754,350	2,327,465	2,592,109	2,841,862	3,365,807	3,915,001	4,479,727
South America	Mideast	34,113	31,848	40,490	43,014	45,360	57,582	64,104	70,699	85,901	105,650	135,763
South America	North America	2,492,814	2,247,877	2,119,773	2,216,066	2,347,464	3,296,664	3,728,976	4,154,314	5,056,100	6,020,955	7,027,796
South America	South America	3,075,318	4,817,891	5,913,424	6,198,116	6,630,800	9,310,873	10,616,099	11,988,111	15,123,502	18,873,766	23,304,238
South America	Caribbean	892,033	800,711	971,028	997,661	1,012,219	1,299,331	1,447,200	1,601,149	1,927,800	2,277,295	2,644,525
Caribbean	Africa	17,751	45,900	48,563	51,065	52,550	60,660	68,492	80,020	115,254	167,880	244,592
Caribbean	Asia	194,365	160,664	177,181	172,129	166,556	141,102	129,170	129,731	156,762	235,481	404,229
Caribbean	Europe	1,126,723	1,028,889	1,099,372	1,153,398	1,194,435	1,333,546	1,355,515	1,383,982	1,424,714	1,460,902	1,500,368
Caribbean	Mideast	5,292	13,089	14,441	14,260	13,999	13,000	13,334	15,315	25,406	50,139	109,000
Caribbean	North America	732,711	1,115,094	1,196,481	1,299,194	1,375,936	1,614,504	1,711,154	1,825,579	2,144,662	2,654,941	3,435,972
Caribbean	South America	951,544	1,687,170	1,702,611	1,819,892	1,903,880	2,286,111	2,611,833	3,050,083	4,604,069	7,808,383	13,976,990
Caribbean	Caribbean	591,760	1,393,764	1,372,320	1,440,020	1,499,835	1,863,238	2,305,144	3,315,166	7,087,870	15,356,236	31,369,933
Total		**181,016,126**	**230,927,592**	**253,283,162**	**267,474,346**	**281,161,511**	**352,597,868**	**391,919,049**	**437,662,416**	**550,422,525**	**704,721,041**	**926,739,626**
Average Annual Growth Rate			**4.99%**	**3.13%**	**5.60%**	**5.12%**	**4.63%**	**2.14%**	**2.23%**	**2.32%**	**2.50%**	**2.78%**

WORLD Commodity Forecast For FUELS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	3,573,989	2,947,811	2,896,253	2,922,071	2,935,004	3,063,408	3,167,121	3,318,005	3,655,412	4,027,605	4,470,176
Africa	Asia	72,370	182,477	181,954	189,037	195,569	234,651	273,475	312,982	395,472	486,441	590,741
Africa	Europe	4,354,374	5,927,317	5,988,298	6,199,523	6,414,914	7,805,374	9,335,727	10,996,667	14,658,982	19,095,524	24,576,824
Africa	Mideast	3,004,476	8,551,513	8,848,872	8,990,372	9,074,384	9,843,950	10,544,095	11,330,147	13,079,488	15,026,838	17,324,190
Africa	North America	25,469	19,949	35,930	35,732	36,529	33,197	30,777	30,715	30,836	30,772	30,197
Africa	South America	44,272	3,244	3,186	3,266	3,357	3,966	4,636	5,345	6,889	8,732	11,000
Africa	Caribbean	122	567	575	583	591	658	717	779	940	1,102	1,319
Asia	Africa	2,397,150	1,912,151	1,972,745	2,033,405	2,124,364	2,362,301	2,637,055	3,000,669	4,038,457	5,649,101	8,189,437
Asia	Asia	96,951,754	107,255,638	115,200,129	121,272,031	128,682,943	169,074,773	215,436,126	277,261,830	485,225,486	890,633,015	1,668,084,422
Asia	Europe	3,100,055	6,037,679	6,461,234	7,077,906	7,782,855	11,731,034	16,787,384	24,064,664	51,009,731	110,443,641	235,778,961
Asia	Mideast	64,284,627	114,182,208	117,578,849	122,000,581	125,185,480	138,976,494	156,075,282	177,989,307	237,285,251	326,906,553	465,790,811
Asia	North America	8,652,955	4,018,585	4,854,713	4,752,919	4,691,923	3,993,911	3,417,948	3,053,069	2,500,595	2,172,065	2,140,929
Asia	South America	84,541	371,764	477,986	509,154	540,592	663,931	815,061	1,037,465	1,757,838	3,026,656	5,381,239
Asia	Caribbean	412,252	210,476	244,192	273,754	280,277	434,244	591,668	856,291	1,528,382	2,790,067	4,817,862
Europe	Africa	17,507,453	18,020,472	20,993,644	20,656,309	21,519,161	24,686,690	26,748,245	28,377,518	31,754,362	35,358,260	39,315,773
Europe	Asia	2,097,625	622,531	646,510	680,661	712,449	890,736	1,045,896	1,198,815	1,574,200	2,059,205	2,693,723
Europe	Europe	82,178,059	88,520,990	96,296,653	94,011,463	96,108,014	105,627,806	113,237,656	121,064,350	140,120,093	163,273,752	190,987,257
Europe	Mideast	7,642,822	11,994,841	14,139,596	13,774,548	14,275,692	17,189,735	19,267,880	21,335,222	26,108,070	31,903,009	38,877,480
Europe	North America	2,589,410	2,145,830	1,020,616	1,042,772	1,056,912	1,066,826	1,080,396	1,103,455	1,198,023	1,326,429	1,513,953
Europe	South America	1,928,105	1,805,349	1,879,580	1,824,200	1,925,681	2,244,377	2,401,009	2,539,800	2,961,461	3,375,107	3,996,286
Europe	Caribbean	1,671,061	1,620,681	1,657,255	1,625,328	1,694,990	1,969,416	2,134,120	2,253,334	2,503,932	2,775,709	3,076,662
Mideast	Africa	1,233,319	1,332,923	1,515,252	1,520,820	1,524,355	1,578,341	1,631,413	1,707,638	1,903,497	2,149,781	2,439,402
Mideast	Asia	161,026	3,046,994	3,116,714	3,217,530	3,300,899	3,765,059	4,246,770	4,807,597	6,130,169	7,790,396	9,834,910
Mideast	Europe	12,089,356	20,431,377	22,242,266	23,001,270	23,681,578	28,274,149	32,416,948	37,173,255	48,849,644	63,869,671	82,692,649
Mideast	Mideast	2,519,716	4,053,358	4,458,160	4,577,108	4,666,671	5,212,681	5,707,007	6,324,021	7,829,980	9,720,659	12,006,314
Mideast	North America	618,853	380,296	453,669	438,454	447,306	431,987	418,616	424,770	435,635	439,915	433,913
Mideast	South America	150,603	105,396	115,761	116,473	116,887	120,933	124,976	130,521	145,585	163,101	181,447
Mideast	Caribbean	3,877	27,361	28,896	29,796	30,126	32,261	33,765	36,305	43,407	53,068	65,636
North America	Africa	727,671	1,017,227	794,591	899,341	936,080	1,056,389	1,159,662	1,246,558	1,444,428	1,709,447	2,108,707
North America	Asia	4,658,939	6,909,147	4,010,709	4,601,848	4,886,463	6,026,064	7,069,614	8,099,874	10,526,632	13,535,114	17,293,567
North America	Europe	7,476,076	24,916,235	30,870,439	34,570,232	35,889,777	40,998,062	46,198,241	51,264,261	64,311,627	81,468,822	103,158,674
North America	Mideast	50,227	1,111,875	1,244,038	1,407,187	1,495,443	1,917,605	2,310,755	2,699,003	3,599,555	4,711,819	6,076,630
North America	North America	13,675,044	25,146,496	28,636,954	31,517,529	32,481,870	35,418,325	37,884,540	40,329,984	45,971,299	53,669,138	65,233,856
North America	South America	21,545,438	28,439,298	24,347,035	27,927,803	29,639,988	35,812,667	41,650,078	47,234,094	60,182,417	76,449,104	97,330,203
North America	Caribbean	140,457	332,158	341,576	371,687	384,016	454,103	516,870	569,981	689,974	841,939	1,044,496
South America	Africa	2,753,171	6,982,913	9,213,670	9,868,321	10,144,837	11,833,420	13,299,581	14,337,439	16,517,195	19,045,408	22,060,810
South America	Asia	165,305	4,706,452	4,820,182	5,011,237	5,145,057	5,819,170	6,466,028	6,960,779	7,514,324	7,963,580	8,393,980
South America	Europe	3,238,831	2,097,338	2,375,727	2,561,331	2,668,561	3,292,837	3,821,734	4,280,392	5,238,563	6,351,145	7,691,971
South America	Mideast	1,122,612	1,234,257	1,584,290	1,699,398	1,750,007	2,058,512	2,319,458	2,510,531	2,919,072	3,392,335	3,963,429
South America	North America	3,836,935	2,874,727	4,920,176	5,103,023	5,187,089	5,688,171	6,181,018	6,582,022	7,207,604	7,764,063	8,318,874
South America	South America	7,054,072	10,237,068	11,385,030	12,221,408	12,622,116	15,067,173	17,184,711	18,997,486	22,958,510	27,636,897	33,264,829
South America	Caribbean	1,334,441	1,270,855	1,367,732	1,493,931	1,573,733	1,882,584	2,085,392	2,252,937	2,591,168	2,962,924	3,392,062
Caribbean	Africa	81,967	49,922	51,626	51,986	52,349	55,051	56,678	58,103	60,044	61,791	63,729
Caribbean	Asia	42,346	1,282,975	1,260,786	1,290,395	1,319,459	1,502,395	1,633,271	1,733,888	1,859,142	1,941,836	2,008,845
Caribbean	Europe	2,826,860	4,769,558	4,775,290	4,873,054	4,983,276	5,683,114	6,178,228	6,564,868	7,057,140	7,393,512	7,678,378
Caribbean	Mideast	31,084	175,348	181,994	187,448	194,235	227,464	254,569	278,676	337,742	405,080	481,024
Caribbean	North America	1,638,169	1,195,861	2,545,762	2,558,789	2,562,713	2,605,313	2,634,112	2,649,138	2,653,968	2,642,711	2,618,155
Caribbean	South America	5,560,868	2,826,136	2,775,771	2,773,600	2,789,804	2,928,461	3,019,898	3,095,002	3,194,737	3,269,731	3,334,604
Caribbean	Caribbean	5,192,323	4,217,843	4,156,053	4,235,048	4,318,571	4,820,929	5,207,924	5,560,969	6,172,559	6,760,861	7,368,235
Total		**404,511,464**	**537,613,463**	**574,968,918**	**598,003,663**	**620,030,948**	**726,461,698**	**836,740,934**	**969,040,522**	**1,359,739,518**	**2,034,533,432**	**3,228,188,574**
Average Annual Growth Rate			**5.85%**	**2.26%**	**4.01%**	**3.68%**	**3.22%**	**2.87%**	**2.98%**	**3.45%**	**4.11%**	**4.72%**

WORLD Commodity Forecast For HI-TECH PRODUCTS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	8,316	14,356	12,431	13,748	15,215	22,464	23,934	26,027	31,530	40,905	56,450
Africa	Asia	56,726	92,939	84,294	88,018	94,502	142,861	200,626	279,302	535,241	1,034,572	2,035,025
Africa	Europe	110,991	147,818	136,072	154,025	175,141	300,812	401,721	523,588	884,647	1,552,030	2,888,577
Africa	Mideast	4,697	11,396	10,460	11,287	12,538	19,407	27,956	38,190	65,980	114,352	202,398
Africa	North America	3,705	4,108	3,609	3,750	3,887	5,183	6,531	8,234	13,715	24,706	49,364
Africa	South America	156	1,473	1,360	1,571	1,806	3,234	4,389	5,611	8,670	12,799	18,242
Africa	Caribbean	72	210	227	237	255	300	464	541	719	950	1,222
Asia	Africa	324	1,815	1,547	1,736	1,972	3,371	5,008	7,516	16,967	38,714	87,099
Asia	Asia	2,400,133	3,974,068	3,727,706	4,179,157	4,633,015	7,499,252	10,614,126	15,153,023	31,465,563	66,435,516	134,755,419
Asia	Europe	189,449	258,100	280,094	314,724	355,187	577,945	809,413	1,195,707	2,590,154	5,625,308	12,322,028
Asia	Mideast	3,981	9,243	8,643	9,597	10,602	17,044	24,413	34,732	68,741	135,569	268,254
Asia	North America	228,517	221,769	240,582	261,521	282,951	404,959	557,254	787,517	1,621,894	3,433,461	7,361,014
Asia	South America	1,307	8,253	8,494	9,726	11,130	19,431	29,362	47,495	116,658	275,285	638,202
Asia	Caribbean	501	317	327	370	418	692	989	1,432	2,908	5,821	11,506
Europe	Africa	7,737	17,852	21,401	23,203	25,562	39,522	49,709	60,131	84,935	116,547	156,762
Europe	Asia	1,259,731	2,291,207	2,455,820	2,632,068	2,774,212	3,962,186	5,133,175	6,433,628	9,702,202	14,198,567	20,428,550
Europe	Europe	436,575	990,779	1,139,179	1,238,270	1,380,946	2,187,851	2,948,169	3,845,024	6,299,934	10,068,541	15,805,010
Europe	Mideast	23,536	106,892	135,586	144,382	157,420	251,953	341,944	442,855	699,086	1,057,944	1,560,991
Europe	North America	102,112	151,256	166,986	172,702	182,307	241,432	288,225	344,425	500,693	750,009	1,168,325
Europe	South America	6,141	15,687	17,629	19,225	21,370	35,839	50,857	68,906	116,413	185,426	281,758
Europe	Caribbean	2,037	1,373	1,488	1,592	1,741	2,679	3,333	4,041	5,825	8,315	11,817
Mideast	Africa	2,590	4,365	4,012	4,508	5,096	7,567	9,134	11,193	16,940	25,897	40,566
Mideast	Asia	155,745	209,720	188,065	202,639	221,952	332,234	433,585	618,560	1,132,855	2,060,976	3,767,117
Mideast	Europe	91,508	206,345	211,840	243,080	279,510	480,271	669,952	916,680	1,667,817	2,944,753	5,019,365
Mideast	Mideast	11,848	25,128	23,546	26,560	30,091	47,889	63,733	83,922	143,397	243,964	422,109
Mideast	North America	5,103	8,958	8,762	9,082	9,625	13,010	16,032	19,248	27,082	37,153	49,851
Mideast	South America	228	250	257	288	325	530	720	943	1,513	2,311	3,417
Mideast	Caribbean	88	87	83	94	107	187	284	457	1,129	2,700	6,504
North America	Africa	313	376	723	827	947	1,547	2,030	2,565	3,900	5,796	8,110
North America	Asia	2,145,623	3,740,660	3,998,227	4,228,735	4,615,947	7,276,775	9,766,428	12,478,574	19,188,395	27,858,663	38,573,566
North America	Europe	106,623	123,684	151,010	161,559	180,275	282,629	363,220	449,224	661,854	946,505	1,323,006
North America	Mideast	1,948	5,385	4,549	5,064	5,646	8,666	10,741	12,871	17,863	24,071	31,749
North America	North America	1,769	5,953	6,769	7,588	8,335	12,406	16,366	20,626	31,678	47,010	68,018
North America	South America	6,658	26,365	36,689	41,464	47,548	79,094	113,442	152,202	254,432	402,990	613,162
North America	Caribbean	112	490	880	974	1,093	1,666	2,050	2,460	3,370	4,465	5,794
South America	Africa	44	87	72	81	91	148	186	227	337	502	769
South America	Asia	185,996	234,026	235,265	260,499	287,989	451,671	591,513	742,512	1,158,785	1,827,625	2,998,629
South America	Europe	37,159	62,838	70,641	80,424	91,737	152,629	187,494	221,682	303,646	410,191	549,693
South America	Mideast	849	1,679	1,470	1,651	1,796	2,706	3,390	4,052	5,598	7,523	9,945
South America	North America	127,093	175,875	129,924	141,790	152,018	216,025	281,458	358,192	594,702	1,036,997	1,936,468
South America	South America	18,155	47,959	57,409	63,791	71,019	108,972	131,068	153,181	205,448	273,124	362,828
South America	Caribbean	2,820	4,638	5,478	5,865	6,206	8,557	10,146	11,797	15,647	20,473	26,398
Caribbean	Africa	10	22	20	23	25	40	45	48	56	64	73
Caribbean	Asia	18,494	14,364	12,885	13,766	14,841	22,057	29,914	41,355	82,614	169,525	340,824
Caribbean	Europe	18,827	17,521	16,022	17,962	20,079	32,011	39,363	49,210	83,370	153,476	273,751
Caribbean	Mideast	139	456	430	459	521	780	921	1,021	1,304	1,622	1,949
Caribbean	North America	12,742	21,312	23,408	25,651	28,139	44,056	65,256	100,683	239,189	562,723	1,265,117
Caribbean	South America	7,360	16,077	15,272	16,468	17,871	25,626	29,559	33,806	44,601	58,049	79,579
Caribbean	Caribbean	7,218	7,571	7,707	7,691	7,704	8,046	8,635	9,851	14,801	25,178	46,985
Total		**7,813,807**	**13,283,103**	**13,665,356**	**14,849,482**	**16,248,602**	**25,356,299**	**34,388,259**	**45,805,064**	**80,734,199**	**144,269,573**	**257,933,258**
Average Annual Growth Rate			**11.20%**	**9.95%**	**8.67%**	**9.42%**	**9.31%**	**6.28%**	**5.90%**	**5.83%**	**5.98%**	**5.98%**

WORLD Commodity Forecast For INTERMEDIATE MANUFACTURED PRODUCTS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	3,352,582	2,794,890	2,797,420	2,859,820	2,903,207	3,216,737	3,572,904	4,071,553	5,463,519	7,812,323	12,157,590
Africa	Asia	1,012,108	4,451,323	4,676,441	5,085,660	5,469,232	8,087,873	10,521,714	13,515,882	22,476,233	38,752,786	69,460,555
Africa	Europe	9,114,319	10,407,734	11,076,861	12,171,364	13,035,244	18,457,390	23,967,795	30,205,566	45,978,571	68,348,077	99,171,390
Africa	Mideast	1,145,989	2,557,362	2,585,420	2,852,928	3,067,910	4,379,955	5,583,952	6,906,326	10,063,786	14,298,264	20,143,015
Africa	North America	73,110	48,465	55,120	53,999	52,743	60,484	67,170	73,502	87,189	102,895	121,362
Africa	South America	149,525	254,830	269,214	290,199	306,184	397,919	511,064	649,798	1,042,371	1,714,439	2,933,475
Africa	Caribbean	1,080	17,126	18,560	19,771	20,911	30,164	39,404	50,418	80,118	127,045	210,898
Asia	Africa	2,747,322	3,965,656	4,348,732	4,809,164	5,410,781	6,751,948	8,790,036	11,391,182	18,575,007	29,568,632	46,487,705
Asia	Asia	87,633,368	107,245,037	127,481,705	137,733,143	150,437,679	207,291,341	269,987,966	357,076,859	644,360,188	1,215,790,672	2,357,680,932
Asia	Europe	30,871,207	34,534,728	39,203,233	40,370,708	43,614,583	66,793,020	99,377,157	148,987,505	335,318,204	768,606,859	1,709,136,221
Asia	Mideast	3,712,506	3,383,145	3,688,764	3,958,779	4,220,398	5,676,200	7,752,157	10,874,014	21,760,970	44,030,974	86,917,877
Asia	North America	5,654,334	2,557,837	3,351,442	3,540,535	3,685,937	4,499,866	5,614,804	6,970,136	11,373,616	19,656,238	34,756,908
Asia	South America	6,755,492	6,025,884	6,024,444	5,981,717	6,020,660	6,658,631	7,642,803	9,139,524	15,498,590	30,912,906	64,654,571
Asia	Caribbean	43,726	30,431	30,028	32,554	34,685	43,925	58,081	78,448	144,992	266,364	469,196
Europe	Africa	2,505,337	4,547,877	5,943,542	6,582,207	6,858,754	7,600,502	8,560,636	9,415,695	11,455,349	14,134,184	17,603,561
Europe	Asia	5,318,220	14,045,304	18,983,777	19,894,449	20,900,593	27,769,082	33,555,845	39,221,589	52,588,795	70,376,836	95,595,888
Europe	Europe	35,740,945	45,820,023	56,489,521	59,600,756	63,100,134	86,370,862	109,322,438	131,614,415	182,622,839	247,943,882	332,469,633
Europe	Mideast	3,181,341	10,112,694	13,181,200	14,370,982	15,412,891	20,536,804	24,649,365	28,720,107	37,941,290	49,472,545	64,393,886
Europe	North America	2,793,029	2,187,288	3,219,098	3,360,316	3,520,304	4,272,109	5,208,469	6,068,942	8,013,888	10,516,814	13,920,484
Europe	South America	2,797,733	6,147,438	7,704,657	8,224,646	8,549,475	10,443,098	13,009,997	15,328,931	20,232,799	25,831,409	32,538,219
Europe	Caribbean	97,315	153,859	198,541	207,597	211,029	250,655	301,900	346,230	441,337	552,428	684,194
Mideast	Africa	806,663	858,832	880,007	989,885	1,063,231	1,343,244	1,714,283	2,274,493	4,063,374	7,623,805	15,342,810
Mideast	Asia	4,076,320	7,113,299	7,332,657	7,922,753	8,452,273	10,987,863	13,442,237	16,838,204	26,621,414	43,285,935	71,575,762
Mideast	Europe	12,615,998	14,478,144	16,432,920	17,833,952	19,104,280	26,423,915	33,278,185	42,123,911	66,051,109	101,701,146	153,044,072
Mideast	Mideast	7,278,053	9,026,771	9,162,141	9,874,768	10,491,086	13,125,870	15,000,612	17,650,856	24,733,997	35,296,500	50,639,360
Mideast	North America	209,779	118,106	124,506	129,136	129,107	159,307	184,755	209,931	271,769	355,604	468,684
Mideast	South America	407,663	273,480	294,684	312,028	326,255	380,157	442,397	543,259	877,781	1,513,383	2,737,639
Mideast	Caribbean	5,859	9,422	10,520	11,355	12,120	14,729	17,758	21,543	32,104	48,657	73,399
North America	Africa	977,037	1,776,944	1,448,615	1,638,647	1,736,483	1,588,173	1,542,131	1,495,950	1,559,861	1,742,388	2,025,298
North America	Asia	11,505,675	33,806,879	28,471,211	31,027,617	34,401,205	50,235,615	63,096,375	77,460,492	110,585,312	154,665,075	212,674,718
North America	Europe	18,629,485	27,050,467	18,550,882	20,409,897	22,729,665	33,083,188	42,730,942	52,040,606	74,698,249	104,437,276	143,003,204
North America	Mideast	961,003	2,959,298	3,280,116	3,735,141	4,233,485	5,597,724	6,856,180	8,066,043	11,019,159	14,866,880	19,793,727
North America	North America	4,307,976	4,783,540	5,190,590	5,803,712	6,465,984	8,354,750	10,319,972	12,233,368	17,033,586	23,515,529	32,101,488
North America	South America	9,607,850	16,692,612	16,949,232	18,887,834	21,215,379	29,436,805	38,210,709	46,913,084	68,633,435	97,556,941	135,316,281
North America	Caribbean	369,835	615,468	722,826	815,042	893,070	1,381,722	2,035,216	2,694,742	4,394,570	6,682,058	9,636,907
South America	Africa	148,528	102,674	120,875	141,979	151,442	187,544	221,399	249,684	300,614	351,281	410,268
South America	Asia	710,289	1,540,389	1,845,732	1,994,125	2,130,339	2,854,360	3,502,958	4,342,705	6,943,824	11,950,732	22,000,821
South America	Europe	2,015,264	2,841,369	3,482,186	3,545,182	4,173,508	5,752,434	6,848,937	8,040,771	11,011,816	15,200,952	21,462,192
South America	Mideast	45,460	122,462	131,951	144,728	155,626	210,801	267,495	327,728	469,137	659,057	918,634
South America	North America	1,608,725	1,332,442	1,247,641	1,341,095	1,400,864	1,740,705	2,027,858	2,303,881	2,939,674	3,741,159	4,764,834
South America	South America	4,093,776	3,906,782	4,647,686	4,896,053	5,115,070	6,375,808	7,425,453	8,610,896	11,711,040	16,450,138	24,137,278
South America	Caribbean	340,807	436,591	528,003	572,627	614,708	816,173	953,324	1,093,349	1,415,243	1,831,201	2,392,806
Caribbean	Africa	27,779	32,016	32,145	33,986	35,018	37,846	38,563	38,700	38,523	38,806	40,085
Caribbean	Asia	141,569	662,089	708,282	764,475	810,040	1,043,485	1,329,717	1,720,771	3,145,145	6,258,243	12,780,293
Caribbean	Europe	1,370,040	1,510,418	1,594,023	1,721,647	1,813,611	2,185,529	2,396,501	2,569,262	2,882,856	3,207,334	3,567,157
Caribbean	Mideast	91,226	306,100	305,449	324,507	334,948	352,858	361,352	361,845	354,864	349,266	350,387
Caribbean	North America	2,293,464	1,114,606	1,076,786	1,138,591	1,181,936	1,399,431	1,552,466	1,709,356	2,191,064	3,157,412	4,766,734
Caribbean	South America	1,760,574	3,416,075	3,693,129	3,892,580	4,020,453	4,733,742	5,287,691	6,157,246	9,397,154	16,856,977	33,710,292
Caribbean	Caribbean	894,976	2,041,998	2,213,539	2,360,516	2,452,108	2,909,278	3,296,085	3,835,977	5,701,112	9,832,051	19,078,170
Total		**292,002,432**	**400,218,205**	**441,806,056**	**474,565,154**	**512,476,629**	**702,301,619**	**903,377,158**	**1,152,635,278**	**1,914,597,437**	**3,341,992,359**	**6,060,320,860**
Average Annual Growth Rate			**6.51%**	**3.35%**	**7.41%**	**7.99%**	**6.50%**	**5.16%**	**4.99%**	**5.21%**	**5.73%**	**6.13%**

WORLD Commodity Forecast For MATERIALS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	316,523	437,153	460,543	469,797	461,661	466,139	490,006	548,653	790,211	1,367,128	2,742,213
Africa	Asia	633,172	1,017,261	1,086,720	1,100,702	1,127,469	1,412,298	1,837,697	2,608,972	5,682,651	12,804,064	29,138,549
Africa	Europe	1,636,867	2,198,689	2,326,337	2,392,808	2,449,946	2,902,444	3,299,068	3,694,832	4,596,172	5,776,101	7,315,136
Africa	Mideast	90,491	198,995	203,079	206,862	209,655	234,159	258,601	286,249	368,929	538,805	922,868
Africa	North America	232,714	136,940	153,960	160,223	164,200	215,078	319,995	536,253	1,436,645	3,661,852	9,254,988
Africa	South America	107,609	109,933	106,385	100,708	96,375	83,652	81,405	89,098	124,089	202,383	384,541
Africa	Caribbean	636	2,388	2,298	2,291	2,300	2,386	2,390	2,398	2,443	2,544	2,707
Asia	Africa	544,982	746,851	849,162	865,214	886,503	986,296	1,112,566	1,331,941	2,047,888	3,586,004	7,105,279
Asia	Asia	23,492,851	37,178,215	43,328,164	45,208,638	47,089,493	58,874,721	70,813,885	91,129,072	158,655,626	293,538,238	563,817,743
Asia	Europe	5,239,026	9,739,538	11,824,774	12,104,337	12,437,969	14,291,023	16,792,278	20,968,229	35,771,153	69,285,133	146,253,925
Asia	Mideast	196,289	435,089	431,991	436,311	441,006	502,017	608,543	816,481	1,603,356	3,722,327	8,757,166
Asia	North America	16,429,106	16,308,008	19,795,843	19,888,338	19,273,490	16,256,891	14,219,513	13,790,712	13,305,438	13,261,405	13,806,778
Asia	South America	1,660,746	2,592,068	3,731,878	3,734,073	3,721,199	3,549,361	3,390,493	3,587,025	4,048,700	4,871,761	7,009,508
Asia	Caribbean	15,577	22,968	29,895	29,135	29,045	36,076	40,396	46,682	64,268	90,217	128,465
Europe	Africa	597,163	903,459	1,139,351	1,178,230	1,180,347	1,002,852	940,794	958,366	1,014,207	1,098,961	1,230,065
Europe	Asia	3,578,283	5,670,470	7,351,493	7,388,923	7,435,553	8,344,543	9,147,444	10,307,271	14,138,586	21,608,082	37,381,857
Europe	Europe	17,083,821	23,071,511	27,295,278	27,076,729	26,361,159	24,017,527	22,614,808	23,531,474	25,611,639	27,326,203	29,321,355
Europe	Mideast	371,078	698,069	838,092	889,002	936,442	994,924	1,068,659	1,157,056	1,402,519	1,799,987	2,488,859
Europe	North America	8,510,150	8,013,173	8,532,267	8,892,263	8,817,173	6,166,026	5,002,603	4,838,454	4,806,202	5,144,609	5,957,244
Europe	South America	2,306,286	3,314,622	4,926,438	5,148,852	5,186,606	4,570,718	4,157,658	4,195,760	4,372,649	4,739,129	5,386,952
Europe	Caribbean	28,553	50,857	70,537	71,582	72,635	78,251	80,971	85,073	97,324	116,363	144,168
Mideast	Africa	77,706	153,793	161,329	167,890	176,076	186,723	200,101	223,268	286,175	381,355	534,251
Mideast	Asia	1,927,791	2,805,979	3,032,137	3,198,246	3,308,395	3,979,545	4,705,142	5,867,778	10,078,910	19,550,930	41,716,238
Mideast	Europe	2,296,135	3,282,231	3,834,378	4,032,696	4,246,434	5,299,242	6,133,726	7,175,260	9,807,110	13,420,976	18,549,737
Mideast	Mideast	346,806	537,633	556,245	579,888	599,919	656,706	727,706	817,390	1,053,720	1,416,375	1,949,133
Mideast	North America	643,403	507,484	509,714	515,520	518,629	512,273	509,215	526,400	568,697	623,351	695,875
Mideast	South America	202,630	157,869	173,358	175,814	179,242	182,293	187,523	200,355	255,907	286,314	355,116
Mideast	Caribbean	964	1,687	2,017	2,067	2,109	2,322	2,573	2,863	3,621	4,572	5,565
North America	Africa	96,835	46,317	62,413	58,287	56,727	59,344	62,382	66,047	76,143	89,719	106,581
North America	Asia	3,280,434	5,913,761	7,555,241	7,603,646	7,838,762	8,997,671	9,724,736	10,333,738	12,048,621	14,268,166	16,764,818
North America	Europe	2,366,517	3,671,841	4,741,032	4,717,512	4,820,840	5,156,037	5,379,931	5,672,574	6,526,288	7,642,908	8,965,088
North America	Mideast	44,369	144,958	191,243	203,943	217,873	261,185	281,522	306,184	370,587	455,868	564,190
North America	North America	1,332,161	1,309,437	1,291,110	1,390,357	1,459,255	1,659,309	1,793,278	1,901,415	2,167,317	2,512,293	2,944,168
North America	South America	1,509,243	2,227,848	3,258,901	3,258,718	3,346,910	4,091,425	4,335,406	4,553,774	5,079,774	5,761,636	6,613,680
North America	Caribbean	60,068	70,076	100,072	95,607	95,781	104,309	112,678	120,168	135,550	153,479	175,601
South America	Africa	64,443	53,414	65,848	67,769	69,147	79,801	87,433	94,434	107,401	124,218	154,360
South America	Asia	335,773	585,991	709,720	747,529	784,607	1,027,808	1,143,993	1,307,799	1,907,226	3,327,940	6,755,690
South America	Europe	723,103	1,063,215	1,430,550	1,505,202	1,579,469	1,982,056	2,270,982	2,540,712	3,155,012	3,890,386	4,797,458
South America	Mideast	9,555	8,578	10,547	11,321	11,899	16,503	17,980	19,136	21,578	29,577	53,195
South America	North America	2,820,106	2,563,384	2,475,730	2,480,941	2,465,801	2,495,850	2,531,674	2,635,632	2,914,850	3,286,032	3,756,173
South America	South America	853,117	1,322,695	1,631,296	1,671,804	1,720,333	2,002,638	2,301,624	2,756,056	4,258,363	7,234,710	13,191,919
South America	Caribbean	102,312	121,781	142,334	140,457	138,937	139,180	141,203	147,526	158,517	169,703	182,650
Caribbean	Africa	2,604	9,911	10,669	11,220	11,523	12,513	13,327	13,988	15,137	16,656	18,965
Caribbean	Asia	142,497	292,765	287,446	293,386	302,380	387,944	555,431	796,373	1,694,987	3,586,742	7,451,077
Caribbean	Europe	170,413	200,277	206,283	213,932	219,114	234,865	251,522	269,336	303,601	344,379	399,638
Caribbean	Mideast	1,343	3,523	3,588	3,635	3,666	3,662	3,757	3,843	4,021	4,448	5,562
Caribbean	North America	589,248	694,661	1,045,446	1,109,584	1,182,761	1,681,174	2,517,681	3,634,980	7,631,705	15,632,048	30,820,278
Caribbean	South America	193,727	405,669	373,060	388,057	402,780	476,755	598,027	767,870	1,366,422	2,545,227	4,728,198
Caribbean	Caribbean	119,811	216,409	201,676	207,163	212,386	246,359	301,689	392,677	758,156	1,469,794	2,540,793
Total		**103,385,039**	**141,219,441**	**168,547,871**	**172,188,208**	**174,351,979**	**186,922,873**	**203,172,014**	**237,666,623**	**352,736,133**	**582,771,096**	**1,053,346,341**
Average Annual Growth Rate			**6.44%**	**6.07%**	**2.16%**	**1.26%**	**1.40%**	**1.68%**	**3.19%**	**4.03%**	**5.15%**	**6.10%**

WORLD Commodity Forecast For ALL COMMODITIES
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	16,119,815	18,570,062	18,705,672	19,173,593	19,548,245	22,329,642	25,201,003	29,686,727	44,641,008	71,327,388	118,358,623
Africa	Asia	6,980,958	16,210,057	16,758,227	17,466,196	18,179,117	23,358,079	28,654,512	36,082,458	60,964,451	111,959,012	221,478,744
Africa	Europe	40,390,256	53,630,793	54,621,647	58,359,651	61,592,738	81,148,734	101,240,266	127,913,219	211,460,989	377,423,214	740,914,107
Africa	Mideast	24,843,427	45,663,523	45,676,956	46,772,370	47,215,961	50,723,615	54,629,261	61,680,805	81,122,794	114,652,414	176,732,786
Africa	North America	7,366,710	6,351,903	6,737,899	7,037,992	7,237,956	8,294,344	9,294,045	10,400,161	13,188,430	17,716,936	26,621,064
Africa	South America	6,983,325	14,161,923	14,039,247	14,644,126	15,269,125	18,447,577	20,945,965	23,488,798	28,973,814	35,362,891	43,688,978
Africa	Caribbean	434,831	546,595	546,714	577,993	609,287	817,871	1,063,973	1,468,168	3,017,578	6,617,716	13,831,087
Asia	Africa	49,626,221	76,567,021	79,636,623	83,997,195	90,550,075	109,504,337	124,808,720	144,909,012	205,787,188	310,285,263	485,566,365
Asia	Asia	830,112,869	1,118,373,970	1,194,236,621	1,272,841,839	1,352,561,453	1,657,775,953	1,898,712,592	2,260,262,964	3,447,796,975	5,717,323,287	10,046,217,613
Asia	Europe	94,357,313	120,763,061	133,702,791	140,501,149	149,492,927	202,909,651	263,436,137	350,962,048	658,362,252	1,326,520,812	2,731,292,100
Asia	Mideast	551,618,152	662,116,141	633,952,983	602,978,048	657,938,526	664,269,853	653,802,950	701,817,129	880,261,725	1,202,217,564	1,751,641,316
Asia	North America	168,064,835	137,693,263	145,913,294	151,004,865	153,073,719	161,775,300	166,311,968	174,932,536	202,616,239	244,581,385	326,050,436
Asia	South America	89,515,396	111,935,984	123,243,619	136,868,118	149,287,911	180,175,047	204,838,012	239,349,423	345,386,758	533,970,901	880,592,267
Asia	Caribbean	1,748,122	1,866,386	2,129,800	2,272,467	2,431,359	3,474,472	4,211,059	5,130,192	7,388,277	10,719,037	15,607,710
Europe	Africa	174,787,782	210,918,747	246,398,810	252,792,731	256,339,051	273,083,816	270,805,279	275,011,643	290,526,369	312,884,425	340,286,312
Europe	Asia	98,467,002	141,446,301	166,540,668	173,876,750	181,964,611	203,689,723	214,748,996	229,160,795	268,601,172	328,863,887	424,160,492
Europe	Europe	438,571,984	552,209,847	621,310,371	634,647,887	651,516,950	736,910,196	771,183,663	814,607,020	926,963,664	1,081,261,133	1,287,257,309
Europe	Mideast	169,087,559	199,826,171	244,104,981	249,746,854	254,919,623	286,885,558	289,409,036	298,313,322	323,867,353	358,993,605	404,304,785
Europe	North America	116,359,630	94,357,459	88,265,861	90,912,101	94,106,663	98,282,364	97,895,952	100,317,496	107,833,688	119,793,550	137,499,173
Europe	South America	123,881,263	166,791,773	188,140,161	185,375,151	190,181,906	225,399,917	233,294,751	241,392,817	263,969,619	291,597,938	325,164,234
Europe	Caribbean	10,319,536	15,106,302	16,875,241	17,682,432	18,444,789	22,394,400	24,329,931	26,053,989	29,763,734	33,851,531	38,337,559
Mideast	Africa	15,964,486	27,993,726	28,611,237	29,637,624	31,224,288	40,834,693	43,343,251	47,676,548	60,070,612	77,964,999	104,142,452
Mideast	Asia	24,574,957	40,378,634	41,236,358	43,506,302	45,702,488	55,331,596	63,956,647	75,639,772	108,878,592	165,477,976	269,840,988
Mideast	Europe	55,837,663	93,700,659	100,972,535	106,934,682	112,374,690	140,012,009	162,197,865	190,939,726	267,972,895	381,434,152	553,016,850
Mideast	Mideast	42,295,785	56,535,021	58,413,028	60,299,301	61,396,153	65,761,444	67,657,100	74,502,725	94,400,128	126,253,725	173,204,151
Mideast	North America	9,784,617	7,141,269	7,315,863	7,559,351	7,887,963	9,524,833	10,414,314	11,433,056	13,806,034	16,575,365	19,764,212
Mideast	South America	12,873,829	23,105,036	23,508,853	24,249,901	25,371,146	31,376,200	34,152,380	38,097,357	48,316,209	61,734,037	78,142,615
Mideast	Caribbean	261,644	532,693	564,951	589,456	612,345	708,272	771,122	854,853	1,054,180	1,311,639	1,636,337
North America	Africa	22,056,830	28,294,330	32,200,099	37,183,274	40,556,192	52,640,486	55,809,602	57,806,795	62,877,536	69,112,430	76,416,329
North America	Asia	59,268,697	103,309,700	101,597,810	107,681,260	116,459,281	157,519,494	187,477,705	216,878,919	289,826,523	384,710,137	504,636,031
North America	Europe	59,763,537	98,703,985	111,082,832	120,701,969	128,340,979	158,481,350	179,362,071	198,590,515	247,213,675	311,360,084	392,517,396
North America	Mideast	5,530,958	11,140,093	13,490,306	15,040,114	16,198,402	19,920,109	22,161,903	24,272,021	29,380,744	35,887,998	43,954,308
North America	North America	133,578,195	175,414,217	208,938,211	227,360,830	237,075,625	270,595,095	289,423,256	303,132,407	337,121,983	379,242,435	433,893,490
North America	South America	144,736,642	188,742,510	201,087,815	220,354,069	235,088,652	277,068,374	303,303,956	323,794,532	374,388,270	439,630,681	522,046,966
North America	Caribbean	3,381,194	5,411,351	6,378,759	6,749,349	7,083,814	8,563,701	9,884,111	11,033,392	13,844,113	17,415,689	21,839,882
South America	Africa	7,352,106	12,404,419	15,762,403	16,509,515	17,281,858	20,366,812	22,121,008	23,531,827	26,696,272	30,350,741	34,593,543
South America	Asia	18,104,142	30,107,624	33,509,443	35,053,719	36,960,995	43,186,230	46,997,256	50,676,408	60,103,623	76,408,315	106,475,481
South America	Europe	16,239,675	19,819,191	24,347,217	26,043,025	27,681,782	36,136,170	40,854,986	45,229,569	54,983,435	66,943,951	82,152,203
South America	Mideast	14,770,972	11,652,107	14,556,779	13,450,090	13,427,695	13,155,081	12,885,760	13,271,997	14,443,072	16,032,074	18,003,658
South America	North America	37,002,408	36,518,821	40,054,102	41,745,697	42,957,909	49,042,574	53,411,507	57,701,122	67,989,103	82,022,131	101,103,903
South America	South America	46,188,044	63,572,443	72,463,289	74,385,473	77,867,282	92,356,073	100,912,055	109,931,425	131,447,530	159,977,375	200,493,079
South America	Caribbean	4,256,565	5,359,606	5,940,751	6,210,064	6,423,929	7,492,678	8,098,262	8,630,149	9,780,636	11,110,065	12,715,732
Caribbean	Africa	418,792	625,039	628,356	629,000	628,529	634,016	637,546	647,949	691,945	775,900	924,319
Caribbean	Asia	1,202,419	4,717,962	4,931,544	5,184,879	5,442,832	6,267,474	7,207,580	8,449,421	12,867,081	22,192,430	40,976,192
Caribbean	Europe	17,537,114	39,360,656	40,073,516	44,449,646	46,573,321	53,459,040	59,116,537	64,158,825	69,605,705	72,759,131	75,919,833
Caribbean	Mideast	713,247	1,113,130	1,124,840	1,195,249	1,235,473	1,327,840	1,409,629	1,499,104	1,666,235	1,899,862	2,300,824
Caribbean	North America	10,683,203	12,374,610	14,790,806	14,871,001	14,933,453	15,494,072	16,559,534	18,140,498	23,692,694	34,238,695	53,267,937
Caribbean	South America	23,990,571	53,968,628	53,627,164	56,387,578	59,331,838	80,567,147	119,979,603	199,611,959	572,140,801	1,502,706,269	3,801,402,272
Caribbean	Caribbean	8,376,600	11,531,370	11,478,597	12,105,891	12,426,382	14,732,134	17,284,982	20,976,955	33,750,358	58,960,972	107,418,436
Total		**3,816,381,917**	**4,928,636,115**	**5,310,314,649**	**5,575,497,817**	**5,801,007,291**	**6,754,204,846**	**7,396,209,616**	**8,350,059,549**	**11,431,504,060**	**17,212,411,148**	**28,368,402,479**
Average Annual Growth Rate			**5.25%**	**2.52%**	**4.99%**	**4.04%**	**3.09%**	**1.83%**	**2.46%**	**3.19%**	**4.18%**	**5.12%**

Containerized World Commodity by Origin (Metric Tonnes)

Containerized WORLD Commodity Forecast For AGRICULTURE COMMODITIES
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	126,675	214,318	238,600	242,992	246,585	272,605	299,894	362,205	581,110	1,083,272	2,275,484
Africa	Asia	281,097	485,481	537,331	555,878	572,896	716,136	832,607	1,003,570	1,570,624	2,716,790	4,850,769
Africa	Europe	1,509,157	1,765,752	1,980,018	2,001,308	2,023,971	2,148,892	2,237,473	2,285,468	2,441,558	2,676,151	3,053,415
Africa	Mideast	525,655	659,764	725,519	754,344	781,826	902,920	988,489	1,136,983	1,431,062	1,792,077	2,207,646
Africa	North America	25,024	64,714	63,278	61,399	61,447	63,277	64,325	64,808	65,167	65,491	66,392
Africa	South America	4,447	5,450	6,682	6,653	6,715	7,149	7,233	8,041	8,880	9,720	10,569
Africa	Caribbean	1,579	4,379	4,820	5,159	5,509	7,568	10,257	13,719	25,617	49,134	94,100
Asia	Africa	206,205	363,976	373,482	384,210	391,532	439,162	523,615	634,346	1,202,951	2,577,500	5,877,924
Asia	Asia	7,327,402	10,113,987	10,581,493	10,927,473	11,050,055	12,619,069	14,213,342	16,584,564	23,381,429	34,968,500	51,818,542
Asia	Europe	1,885,286	2,846,559	3,170,060	3,154,137	3,124,979	2,863,330	2,682,623	2,630,462	2,582,533	2,636,708	2,764,746
Asia	Mideast	1,102,544	1,341,153	1,386,505	1,447,397	1,483,685	1,728,251	1,892,010	2,092,623	2,517,897	3,011,175	3,590,023
Asia	North America	705,462	1,070,191	1,282,383	1,298,141	1,357,098	1,428,141	1,487,936	1,364,408	1,540,781	1,752,132	1,990,571
Asia	South America	102,866	90,455	120,307	126,187	131,556	156,338	168,894	189,171	226,088	270,533	337,066
Asia	Caribbean	7,351	33,083	36,723	37,616	38,486	42,602	46,436	52,262	72,964	120,145	214,679
Europe	Africa	517,552	840,391	836,790	897,737	946,798	1,214,483	1,394,109	1,610,669	2,179,969	3,139,504	5,088,158
Europe	Asia	1,129,995	1,275,076	1,421,800	1,499,382	1,568,970	1,872,885	2,121,361	2,431,395	3,136,752	4,105,219	5,369,844
Europe	Europe	2,946,713	4,399,423	4,826,945	4,971,036	5,141,573	5,937,624	6,354,580	6,968,447	8,011,677	9,495,399	11,904,927
Europe	Mideast	553,370	1,052,282	1,102,309	1,155,728	1,200,707	1,433,495	1,586,612	1,732,199	2,108,948	2,552,307	3,038,968
Europe	North America	218,895	553,073	697,214	688,421	685,676	779,556	808,664	776,959	814,867	871,121	936,266
Europe	South America	165,867	233,725	296,824	312,200	329,622	405,317	436,975	480,487	545,360	612,339	674,551
Europe	Caribbean	112,727	170,302	164,920	178,057	189,497	242,204	263,138	278,422	303,938	328,051	353,311
Mideast	Africa	72,319	111,694	122,679	128,852	134,824	175,042	197,931	222,770	279,194	353,137	470,088
Mideast	Asia	219,478	536,746	585,809	616,318	653,707	837,489	969,120	1,115,637	1,464,723	1,915,132	2,486,273
Mideast	Europe	1,293,082	1,330,502	1,335,481	1,403,095	1,432,425	1,608,268	1,703,867	1,785,613	1,975,889	2,230,230	2,541,511
Mideast	Mideast	1,477,532	1,924,936	2,113,233	2,247,418	2,391,435	3,150,419	3,577,816	4,068,606	5,128,900	6,389,900	7,897,552
Mideast	North America	34,173	36,539	34,780	36,832	38,486	43,834	47,463	47,183	51,960	57,719	64,562
Mideast	South America	15,756	26,385	30,950	31,608	32,678	38,275	40,096	41,813	44,969	48,160	53,038
Mideast	Caribbean	733	1,694	1,841	2,008	2,117	2,483	2,559	2,606	2,714	2,814	2,917
North America	Africa	24,252	33,571	49,063	50,349	50,979	57,528	62,753	67,555	76,343	84,861	93,126
North America	Asia	4,755,483	3,333,091	4,346,165	4,714,314	4,831,926	5,569,045	6,047,726	6,522,683	7,694,348	9,094,313	11,162,219
North America	Europe	1,560,773	1,455,691	1,188,621	1,244,257	1,228,926	1,243,340	1,279,756	1,310,978	1,399,380	1,519,246	1,669,062
North America	Mideast	98,717	262,458	449,028	463,236	467,110	602,288	684,379	761,252	935,999	1,137,800	1,357,414
North America	North America	132,031	249,421	129,714	131,702	132,372	127,221	129,800	135,807	157,657	187,562	223,175
North America	South America	354,991	354,771	461,086	465,924	481,891	552,224	590,232	632,644	706,262	779,206	854,691
North America	Caribbean	227,374	304,989	325,898	338,054	340,045	391,157	411,323	425,877	450,437	472,047	490,717
South America	Africa	90,553	124,718	122,178	127,574	131,920	160,321	197,824	256,781	475,368	977,114	2,197,950
South America	Asia	788,642	922,175	1,018,834	1,028,835	1,014,203	1,093,852	1,120,879	1,182,803	1,341,702	1,501,904	1,788,230
South America	Europe	2,957,824	3,650,434	4,201,648	4,497,386	4,583,197	5,500,155	5,880,247	5,412,879	5,985,031	6,698,360	7,640,288
South America	Mideast	260,922	393,505	429,256	469,624	510,000	672,633	847,949	1,104,083	2,014,151	3,642,091	5,966,259
South America	North America	1,012,862	1,654,040	2,358,275	2,364,765	2,422,543	2,568,439	2,690,747	2,710,846	2,945,872	3,223,243	3,530,763
South America	South America	479,839	575,615	681,243	710,368	754,807	961,016	1,081,437	1,201,557	1,446,136	1,730,721	2,103,388
South America	Caribbean	106,532	168,767	169,022	179,572	190,195	247,214	301,943	367,483	584,034	1,010,727	1,850,461
Caribbean	Africa	6,626	7,015	7,108	7,751	8,408	13,384	21,768	37,917	105,856	273,749	617,041
Caribbean	Asia	87,397	119,620	130,272	131,644	124,528	130,966	125,454	124,907	132,439	151,076	184,672
Caribbean	Europe	750,954	716,646	850,558	912,216	944,714	991,656	1,048,348	1,082,508	1,150,362	1,257,900	1,434,548
Caribbean	Mideast	12,107	37,344	41,522	42,670	43,486	47,166	50,700	59,882	74,954	93,039	112,294
Caribbean	North America	241,944	542,049	582,908	599,311	605,441	515,070	491,660	448,053	356,126	275,200	210,403
Caribbean	South America	38,446	43,866	48,314	48,748	49,330	53,158	55,020	62,635	71,274	80,564	90,068
Caribbean	Caribbean	86,133	347,477	349,786	383,684	418,186	614,642	837,276	1,113,240	2,085,053	4,024,308	7,767,136
Total		**36,643,344**	**46,849,291**	**52,109,278**	**54,083,571**	**55,368,060**	**63,249,291**	**68,886,643**	**75,007,807**	**93,887,289**	**124,045,034**	**171,377,795**
Average Annual Growth Rate			**5.04%**	**3.61%**	**3.79%**	**2.38%**	**2.70%**	**1.72%**	**1.72%**	**2.27%**	**2.82%**	**3.29%**

Containerized WORLD Commodity Forecast For CAPITAL EQUIPMENT
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	96,105	126,665	106,472	116,666	128,880	191,366	215,757	242,462	308,061	401,612	537,918
Africa	Asia	16,204	28,037	25,718	28,236	31,784	52,318	73,223	104,385	215,051	445,570	903,582
Africa	Europe	120,459	221,349	325,170	360,472	396,181	588,916	714,549	828,508	1,079,051	1,369,691	1,703,926
Africa	Mideast	10,249	18,489	15,888	17,612	19,495	28,695	33,134	39,078	55,283	80,666	120,581
Africa	North America	30,762	67,183	92,827	104,089	118,089	189,300	236,926	283,363	393,436	529,511	692,012
Africa	South America	5,571	5,018	5,546	6,320	7,087	11,011	13,218	15,267	20,220	26,452	34,074
Africa	Caribbean	266	1,343	1,189	1,323	1,473	2,156	2,295	2,385	2,579	2,793	3,030
Asia	Africa	284,339	488,247	482,362	502,452	535,654	820,875	1,221,702	1,882,675	4,491,015	10,603,040	24,739,149
Asia	Asia	7,310,565	8,876,448	10,610,475	11,555,946	12,642,628	18,302,201	24,871,648	34,674,351	69,651,822	143,297,321	236,934,584
Asia	Europe	1,830,482	4,065,969	5,316,043	5,509,166	5,811,493	8,077,592	9,774,807	11,559,574	16,203,669	23,006,064	33,148,872
Asia	Mideast	606,910	1,037,295	1,000,748	1,064,038	1,155,974	1,622,359	2,087,160	2,797,700	5,206,759	10,112,115	20,690,737
Asia	North America	4,975,587	6,437,685	7,764,022	8,489,074	9,288,887	13,602,661	16,730,335	19,779,645	27,126,874	36,407,430	47,599,960
Asia	South America	315,412	475,552	562,150	612,370	662,405	917,441	1,100,178	1,314,008	1,968,350	3,181,959	5,567,219
Asia	Caribbean	70,556	121,797	119,942	127,520	136,290	194,061	277,963	404,298	902,348	1,994,063	4,099,854
Europe	Africa	786,132	1,197,410	1,105,007	1,232,325	1,398,401	2,406,563	3,160,001	3,893,149	5,785,932	8,488,641	12,331,757
Europe	Asia	2,766,791	2,609,570	2,726,602	3,047,573	3,440,554	5,627,254	8,017,707	11,870,943	26,181,387	58,080,326	124,166,715
Europe	Europe	2,626,645	4,288,743	5,181,418	5,587,312	6,103,459	8,758,194	10,816,445	12,858,418	17,658,846	23,936,539	32,236,215
Europe	Mideast	1,000,378	1,492,941	1,493,062	1,695,281	1,931,274	3,177,490	3,988,888	4,957,961	7,662,395	11,774,969	17,777,154
Europe	North America	1,974,685	2,761,630	2,863,522	3,140,201	3,494,169	5,251,520	6,687,576	8,162,927	11,707,986	16,209,956	21,737,246
Europe	South America	654,231	947,516	1,106,144	1,273,445	1,458,642	2,441,419	2,938,911	3,370,201	4,411,444	5,742,293	7,431,746
Europe	Caribbean	139,846	183,088	163,001	182,826	205,074	311,576	337,508	359,242	406,482	460,169	519,251
Mideast	Africa	45,073	74,401	65,742	72,733	80,868	132,504	197,174	296,124	668,849	1,502,236	3,407,571
Mideast	Asia	30,683	69,020	66,541	73,778	82,170	131,149	178,572	241,180	441,355	813,482	1,492,120
Mideast	Europe	175,484	397,435	505,442	551,673	598,240	925,526	1,146,389	1,356,468	1,841,199	2,451,879	3,235,483
Mideast	Mideast	103,974	197,405	185,347	209,475	236,778	384,661	517,589	709,886	1,371,506	2,761,233	5,886,436
Mideast	North America	32,104	47,691	55,708	59,256	66,692	108,116	137,494	165,679	233,843	320,888	428,353
Mideast	South America	8,146	11,388	12,309	13,552	14,841	19,801	21,791	23,761	29,397	37,923	49,880
Mideast	Caribbean	1,540	4,328	3,928	4,213	4,614	6,072	8,574	13,350	33,731	84,707	213,735
North America	Africa	58,762	44,742	62,823	63,128	65,829	83,904	102,726	124,928	202,474	339,553	533,912
North America	Asia	1,357,717	1,145,332	1,218,398	1,306,254	1,380,281	1,761,551	2,234,450	2,805,004	4,522,486	7,668,891	13,636,267
North America	Europe	768,153	955,791	1,057,571	1,131,524	1,214,879	1,639,257	1,938,700	2,214,529	2,873,493	3,775,659	4,967,287
North America	Mideast	58,351	66,091	55,234	57,048	59,785	73,798	84,474	92,782	109,146	125,957	144,445
North America	North America	13,061	34,254	22,211	24,844	26,546	34,602	40,590	44,997	54,407	63,737	74,222
North America	South America	748,123	696,502	567,023	615,688	637,548	792,803	900,496	980,095	1,158,618	1,366,387	1,604,028
North America	Caribbean	88,905	105,635	107,234	109,220	112,056	127,081	127,368	128,579	136,720	151,384	170,439
South America	Africa	20,484	22,893	24,054	25,501	28,126	44,531	56,762	69,554	104,150	159,177	255,543
South America	Asia	77,356	70,448	93,564	100,958	111,504	159,704	221,537	319,412	680,228	1,473,133	3,087,936
South America	Europe	149,011	260,560	381,073	414,155	446,040	614,970	758,943	888,852	1,179,983	1,532,060	1,959,422
South America	Mideast	13,157	16,305	19,168	21,234	23,841	37,775	51,296	68,376	120,530	210,706	367,608
South America	North America	569,218	833,817	1,106,305	1,236,255	1,298,508	1,799,391	2,233,727	2,650,110	3,642,338	4,860,053	6,312,527
South America	South America	154,476	191,711	239,848	268,659	299,068	470,306	558,661	639,672	835,865	1,034,025	1,424,116
South America	Caribbean	33,626	49,905	46,973	52,259	58,227	89,860	108,828	134,853	225,002	418,313	859,659
Caribbean	Africa	343	1,709	1,760	1,863	1,984	2,625	3,087	3,580	4,785	6,322	8,220
Caribbean	Asia	3,799	1,448	1,753	1,914	2,118	3,234	4,408	6,167	12,286	24,868	51,361
Caribbean	Europe	9,657	17,217	26,976	28,292	29,202	33,888	35,727	38,524	47,545	60,662	76,755
Caribbean	Mideast	227	2,230	2,459	2,695	2,961	3,832	4,303	4,943	6,763	9,434	13,186
Caribbean	North America	432	2,157	2,139	2,456	2,801	4,477	5,743	7,013	10,160	14,325	19,695
Caribbean	South America	6,443	11,075	13,396	15,111	17,164	27,768	33,195	37,521	47,085	58,415	71,858
Caribbean	Caribbean	11,121	17,907	16,434	18,131	19,966	28,671	31,878	34,684	40,381	46,622	53,542
Total		**30,161,601**	**40,801,371**	**47,028,723**	**51,136,117**	**55,890,528**	**82,116,732**	**105,044,410**	**133,501,161**	**222,073,016**	**387,583,211**	**643,380,588**
Average Annual Growth Rate			**6.23%**	**4.85%**	**8.73%**	**9.30%**	**8.00%**	**5.05%**	**4.91%**	**5.22%**	**5.73%**	**5.20%**

Containerized WORLD Commodity Forecast For CHEMICALS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	218,342	423,716	446,549	468,440	489,593	625,976	855,441	1,282,437	2,974,035	7,041,453	17,145,922
Africa	Asia	263,437	449,501	497,452	542,451	591,477	858,967	1,160,606	1,569,819	2,926,045	5,670,506	11,286,619
Africa	Europe	133,825	263,492	314,367	329,220	341,850	436,366	504,269	563,426	694,550	857,889	1,060,963
Africa	Mideast	43,133	68,741	72,763	79,115	86,048	128,270	184,991	289,367	698,127	1,668,317	3,902,797
Africa	North America	24,646	49,318	63,773	68,154	75,247	95,709	118,151	138,483	190,045	258,913	349,336
Africa	South America	25,196	21,268	27,949	30,108	31,859	40,920	45,969	50,506	60,279	71,283	83,952
Africa	Caribbean	824	5,655	5,995	6,267	6,529	7,750	8,410	9,033	10,355	11,944	13,823
Asia	Africa	345,604	668,047	716,515	747,440	784,714	1,131,122	1,660,104	2,551,891	5,966,132	13,937,902	33,149,940
Asia	Asia	23,305,153	40,863,341	49,992,415	53,664,713	57,643,427	78,052,964	100,977,500	133,118,158	244,540,114	478,631,573	969,766,814
Asia	Europe	2,159,282	4,090,160	5,323,078	5,460,164	5,475,200	6,590,401	7,473,257	8,351,369	10,881,445	15,365,906	23,771,937
Asia	Mideast	550,427	1,227,583	1,310,181	1,408,951	1,490,623	1,940,873	2,333,154	2,897,470	4,613,129	7,793,293	14,366,282
Asia	North America	1,781,920	3,272,331	3,925,475	4,000,609	4,197,473	5,028,641	5,719,212	6,272,487	7,708,280	9,732,445	12,402,904
Asia	South America	250,544	621,510	798,959	874,224	934,247	1,248,354	1,493,069	1,828,027	2,888,041	4,996,843	9,674,942
Asia	Caribbean	32,811	138,807	147,755	159,812	169,814	225,857	293,995	387,898	725,089	1,438,169	2,913,278
Europe	Africa	1,454,846	1,804,003	1,899,212	2,021,425	2,149,032	3,053,474	3,809,898	4,666,839	6,716,940	9,549,349	13,878,396
Europe	Asia	5,312,014	6,596,806	7,337,485	8,011,503	8,707,662	12,675,996	16,922,271	22,996,948	44,526,735	90,659,081	188,634,467
Europe	Europe	8,933,484	12,543,768	14,459,070	14,871,645	15,304,990	17,867,220	19,628,356	21,157,911	25,000,646	30,495,836	38,166,180
Europe	Mideast	2,074,352	3,190,173	3,648,555	3,988,353	4,317,744	6,124,186	7,197,326	8,621,878	12,334,523	17,529,091	24,712,869
Europe	North America	2,268,340	3,092,684	3,503,928	3,552,033	3,745,655	4,878,843	5,330,697	5,538,451	6,418,250	7,888,312	9,814,684
Europe	South America	871,898	1,142,874	1,393,421	1,534,458	1,661,532	2,337,325	2,674,946	3,015,554	3,797,603	4,757,209	5,953,659
Europe	Caribbean	163,427	181,358	188,176	202,719	214,952	273,051	306,684	339,672	419,607	552,272	819,334
Mideast	Africa	317,694	620,614	636,709	705,922	781,555	1,343,532	2,343,087	4,258,669	12,396,250	32,396,443	76,957,668
Mideast	Asia	1,433,451	2,245,268	2,455,043	2,586,494	2,684,333	3,240,196	4,091,712	5,258,935	9,823,745	19,408,534	35,926,091
Mideast	Europe	816,502	1,324,030	1,494,289	1,543,314	1,583,288	1,879,463	2,160,746	2,423,325	3,165,836	4,521,358	7,362,716
Mideast	Mideast	514,904	1,111,543	1,172,194	1,248,505	1,321,292	1,803,353	2,405,440	3,450,986	7,603,865	16,828,028	32,071,832
Mideast	North America	124,573	219,208	225,397	235,740	249,311	302,068	342,725	381,355	471,735	583,479	721,107
Mideast	South America	32,361	86,191	115,260	119,562	126,262	161,171	180,174	198,472	244,358	317,582	459,280
Mideast	Caribbean	2,529	8,369	8,605	9,185	9,688	12,463	15,681	19,462	30,870	49,610	78,246
North America	Africa	109,589	151,963	125,526	123,689	124,358	140,862	158,209	178,832	233,516	319,177	469,181
North America	Asia	6,495,834	5,958,462	6,971,986	7,141,491	7,372,622	8,581,454	10,076,138	12,153,505	18,956,598	32,454,894	59,886,272
North America	Europe	2,331,422	3,136,147	3,484,872	3,426,942	3,360,682	3,819,684	4,242,336	4,646,186	5,691,951	7,206,157	9,505,116
North America	Mideast	193,479	244,076	287,851	294,447	302,110	332,523	363,567	403,288	500,143	628,242	796,781
North America	North America	201,538	280,608	337,625	355,451	371,346	438,755	497,316	545,944	662,115	809,071	987,448
North America	South America	2,095,334	2,736,216	2,752,157	2,920,042	2,981,818	3,475,293	3,999,569	4,633,921	6,683,528	10,330,197	15,840,957
North America	Caribbean	361,048	451,458	510,285	533,445	552,794	651,130	749,673	852,921	1,104,301	1,396,708	1,700,082
South America	Africa	50,779	76,236	82,520	84,354	87,931	117,904	141,044	162,004	213,225	272,706	345,736
South America	Asia	243,236	283,205	300,355	319,655	342,368	476,797	622,474	820,022	1,516,264	3,013,220	6,208,460
South America	Europe	319,259	605,751	728,356	752,044	776,331	966,079	1,116,605	1,246,296	1,530,835	1,867,710	2,265,292
South America	Mideast	34,703	63,252	68,933	73,095	76,584	99,080	115,605	138,578	193,712	269,992	374,629
South America	North America	322,642	506,448	660,845	679,072	719,052	843,379	960,017	1,035,057	1,216,006	1,451,159	1,754,651
South America	South America	890,703	1,498,709	1,770,377	1,912,971	2,032,458	2,643,328	3,087,912	3,589,895	4,868,795	6,614,234	8,860,060
South America	Caribbean	113,460	212,617	215,577	233,417	250,574	350,252	463,915	608,631	1,095,436	2,029,413	3,776,158
Caribbean	Africa	1,511	3,216	2,967	2,968	3,016	3,464	3,769	4,257	5,979	9,728	17,809
Caribbean	Asia	3,629	7,516	7,578	8,210	8,943	13,385	18,662	26,985	58,005	127,419	278,756
Caribbean	Europe	58,498	61,705	76,712	80,116	86,079	105,655	119,230	132,505	163,277	201,010	247,153
Caribbean	Mideast	1,190	5,758	6,264	6,824	7,388	10,447	12,108	14,485	20,835	29,902	42,407
Caribbean	North America	4,495	28,521	19,002	20,918	23,112	31,208	38,348	45,095	61,746	83,689	112,083
Caribbean	South America	29,568	47,097	53,631	56,596	59,668	73,218	83,489	93,110	114,502	141,731	179,749
Caribbean	Caribbean	62,096	124,394	123,946	131,233	138,121	175,654	219,826	279,621	476,012	807,490	1,311,080
Total		**67,379,549**	**102,813,714**	**120,767,932**	**127,627,510**	**134,852,752**	**175,714,659**	**217,327,672**	**273,249,965**	**463,193,395**	**853,076,458**	**1,650,405,986**
Average Annual Growth Rate			**8.82%**	**5.51%**	**5.68%**	**5.66%**	**5.44%**	**4.34%**	**4.69%**	**5.42%**	**6.30%**	**6.82%**

Containerized WORLD Commodity Forecast For CONSUMER GOODS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	138,511	155,019	163,646	173,835	182,720	220,350	237,894	262,263	328,357	431,074	589,471
Africa	Asia	6,576	10,302	11,146	12,074	13,182	20,435	26,694	34,585	57,343	94,804	158,060
Africa	Europe	352,191	571,610	723,072	724,283	715,198	647,422	644,568	648,929	726,359	866,614	1,054,893
Africa	Mideast	28,346	46,795	46,531	51,221	56,238	78,425	94,402	115,881	174,687	263,024	395,595
Africa	North America	13,313	28,086	47,361	50,460	54,228	72,220	84,109	95,379	120,598	149,191	180,942
Africa	South America	429	1,125	1,434	1,583	1,746	2,677	3,189	3,678	4,933	6,673	9,221
Africa	Caribbean	872	1,483	1,594	1,768	1,963	2,898	3,196	3,571	4,807	7,201	11,605
Asia	Africa	184,917	344,519	364,047	376,558	409,638	576,054	795,526	1,171,588	2,623,256	5,999,245	14,106,031
Asia	Asia	5,565,599	9,123,885	10,738,463	11,293,463	11,701,931	15,845,173	18,745,870	22,769,433	34,579,931	53,878,050	86,557,785
Asia	Europe	3,583,802	6,558,882	8,184,969	8,298,375	8,439,371	9,573,630	10,296,358	11,396,419	14,763,235	20,612,062	31,422,301
Asia	Mideast	615,231	872,209	905,487	945,527	1,001,457	1,319,335	1,632,410	2,129,133	3,848,038	7,277,662	14,470,673
Asia	North America	6,023,510	10,716,891	13,447,034	14,085,432	15,327,510	21,940,641	25,723,418	29,905,475	40,166,833	53,056,940	68,593,701
Asia	South America	378,044	488,704	588,342	635,175	686,581	974,679	1,132,729	1,310,221	1,830,013	2,706,244	4,261,863
Asia	Caribbean	58,377	92,222	94,193	102,649	111,280	163,968	238,646	349,848	764,223	1,666,207	3,613,594
Europe	Africa	306,321	457,580	474,535	510,980	556,985	835,524	1,018,995	1,227,889	1,791,984	2,692,975	4,302,924
Europe	Asia	660,297	978,999	1,116,441	1,190,986	1,279,615	1,871,771	2,376,846	3,025,744	5,055,458	8,674,487	15,220,992
Europe	Europe	1,781,337	3,138,308	3,664,239	3,867,005	4,092,735	5,207,129	5,926,066	6,784,808	9,099,516	12,458,779	17,408,994
Europe	Mideast	566,070	885,503	975,014	1,085,611	1,217,497	1,849,417	2,264,907	2,797,506	4,264,822	6,527,633	10,186,365
Europe	North America	664,265	1,204,376	1,269,099	1,365,560	1,477,343	1,855,092	2,156,432	2,433,538	3,136,855	4,119,013	5,393,789
Europe	South America	163,268	280,936	346,023	384,302	423,723	639,470	762,518	884,710	1,183,822	1,588,286	2,165,598
Europe	Caribbean	105,567	94,943	96,095	106,344	116,484	164,660	180,036	195,817	236,244	298,460	401,884
Mideast	Africa	44,839	103,883	109,988	118,125	126,821	174,525	212,876	260,306	397,393	623,800	1,006,675
Mideast	Asia	20,819	43,000	47,218	52,009	57,435	88,394	114,690	147,413	239,684	387,555	626,779
Mideast	Europe	238,136	445,345	541,907	592,162	647,567	862,407	991,874	1,123,378	1,447,311	1,871,424	2,409,390
Mideast	Mideast	152,628	246,131	261,557	272,307	282,901	330,277	372,696	424,895	545,741	705,054	924,995
Mideast	North America	78,719	126,271	156,633	177,631	199,987	230,318	259,967	300,656	401,414	524,332	659,692
Mideast	South America	2,027	5,047	6,164	6,684	7,172	9,535	10,907	12,232	15,359	19,590	25,903
Mideast	Caribbean	793	1,128	1,181	1,260	1,340	1,743	2,083	2,498	3,798	6,200	10,603
North America	Africa	11,320	13,128	12,154	11,594	12,162	14,823	17,159	19,698	27,328	41,407	66,081
North America	Asia	563,194	841,285	860,728	900,918	937,036	802,998	1,015,742	1,314,133	2,348,890	4,427,098	8,524,250
North America	Europe	245,569	319,204	366,399	375,780	388,132	448,157	499,467	574,961	824,120	1,309,011	2,284,889
North America	Mideast	16,119	25,302	22,983	24,284	26,164	34,957	42,698	51,396	75,377	113,518	175,509
North America	North America	7,809	114,116	140,881	148,461	153,873	201,696	236,053	273,789	361,343	471,306	608,601
North America	South America	285,002	372,209	310,299	329,550	346,747	434,314	494,101	548,676	680,869	850,887	1,063,686
North America	Caribbean	165,416	430,022	296,401	309,951	322,420	371,798	401,717	430,972	491,497	558,796	630,019
South America	Africa	2,200	4,212	4,623	4,725	5,106	7,665	8,978	10,310	13,494	17,688	23,276
South America	Asia	22,449	28,871	33,559	36,058	38,083	52,907	66,116	83,493	135,300	223,774	379,728
South America	Europe	101,392	171,888	227,240	241,600	256,921	348,931	368,329	419,469	550,538	716,591	922,971
South America	Mideast	1,988	2,922	3,310	3,657	4,067	6,222	7,706	9,578	14,902	23,452	37,570
South America	North America	163,131	243,015	321,984	348,180	355,850	498,962	569,132	665,369	906,685	1,218,941	1,604,438
South America	South America	130,889	201,298	241,801	264,375	287,289	417,578	493,110	575,965	781,027	1,063,557	1,479,909
South America	Caribbean	41,451	103,403	107,134	115,367	123,119	162,008	194,942	239,523	392,265	683,655	1,189,110
Caribbean	Africa	228	431	465	471	486	583	652	726	898	1,111	1,360
Caribbean	Asia	1,074	1,469	1,522	1,550	1,625	2,154	2,531	2,895	4,030	6,031	9,307
Caribbean	Europe	7,883	15,610	18,374	18,791	19,430	23,296	25,858	28,558	34,880	42,364	51,168
Caribbean	Mideast	308	1,393	1,483	1,556	1,637	2,062	2,362	2,681	3,752	6,270	12,290
Caribbean	North America	157,158	590,686	703,932	722,494	756,130	894,648	1,029,488	1,170,178	1,515,132	1,916,611	2,366,692
Caribbean	South America	34,964	72,479	83,831	88,177	93,047	118,156	129,320	136,858	151,401	171,485	204,603
Caribbean	Caribbean	105,745	238,262	250,235	275,126	297,406	396,764	463,574	533,596	699,635	915,862	1,180,223
Total		**23,790,095**	**40,514,340**	**48,092,747**	**50,406,045**	**53,308,379**	**70,798,847**	**82,378,940**	**96,910,616**	**137,825,374**	**202,291,094**	**308,985,997**
Average Annual Growth Rate			**11.24%**	**5.88%**	**4.81%**	**5.76%**	**5.84%**	**3.08%**	**3.30%**	**3.58%**	**3.91%**	**4.33%**

Containerized WORLD Commodity Forecast For EXTRACTIVE COMMODITIES
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	25,456	30,941	37,375	36,323	35,294	30,885	27,310	25,539	24,259	24,524	25,653
Africa	Asia	82,954	99,283	98,491	109,329	119,524	152,068	169,922	194,844	266,873	384,340	579,192
Africa	Europe	132,265	165,668	172,484	174,026	177,664	185,553	181,707	182,251	187,500	197,337	211,155
Africa	Mideast	3,872	5,458	5,174	5,384	5,706	6,887	6,986	7,397	8,661	10,437	12,714
Africa	North America	22,475	23,033	33,741	36,491	38,655	48,001	50,011	50,776	52,951	55,734	58,950
Africa	South America	1,512	2,023	2,460	2,666	2,801	3,399	3,477	3,612	4,021	4,510	5,037
Africa	Caribbean	32	235	244	256	265	303	336	363	389	398	402
Asia	Africa	16,997	21,943	23,068	23,579	24,120	26,430	27,953	30,046	34,621	40,235	48,125
Asia	Asia	4,724,378	6,755,553	7,493,923	7,783,547	8,108,555	8,977,020	9,114,508	9,823,011	12,594,480	18,548,183	31,236,877
Asia	Europe	164,645	247,406	300,319	291,925	294,147	321,267	312,111	310,669	318,570	333,996	353,380
Asia	Mideast	34,699	62,167	64,134	65,464	65,937	71,291	69,550	71,875	83,537	108,650	161,549
Asia	North America	208,491	221,561	331,505	322,371	329,410	314,338	295,672	277,325	249,780	232,447	224,139
Asia	South America	7,349	15,133	17,162	17,964	18,454	20,501	20,901	21,478	22,956	24,624	26,410
Asia	Caribbean	353	857	980	1,032	1,074	1,269	1,470	1,712	2,395	3,886	7,168
Europe	Africa	175,800	244,188	233,970	241,669	249,744	287,254	326,723	375,731	524,359	829,798	1,541,281
Europe	Asia	469,239	922,599	903,314	989,457	1,016,857	1,178,999	1,297,109	1,455,309	1,863,047	2,344,591	2,911,344
Europe	Europe	3,371,495	3,429,994	3,428,673	3,504,203	3,518,091	3,535,517	3,369,080	3,304,472	3,368,334	3,792,653	4,594,840
Europe	Mideast	577,298	483,974	504,498	496,135	517,141	508,152	535,566	585,545	725,202	910,474	1,155,856
Europe	North America	100,286	163,914	154,562	145,066	141,522	179,188	173,713	166,512	164,236	171,413	185,505
Europe	South America	56,740	48,776	57,440	59,571	59,657	60,850	61,298	63,307	67,671	72,247	77,118
Europe	Caribbean	9,216	47,951	47,482	50,411	52,383	60,044	66,550	72,136	77,445	79,413	80,160
Mideast	Africa	11,817	20,615	21,366	22,190	22,647	24,599	25,712	26,804	28,791	30,539	32,194
Mideast	Asia	305,170	439,923	457,018	500,906	521,568	618,483	673,478	769,210	1,023,476	1,388,608	1,940,222
Mideast	Europe	234,969	466,271	499,052	504,081	521,504	555,966	554,791	566,242	595,254	632,300	674,175
Mideast	Mideast	90,625	118,478	125,083	128,387	132,230	141,207	139,096	143,537	156,874	175,124	197,447
Mideast	North America	16,336	39,744	8,597	9,627	10,647	11,106	11,688	11,983	12,846	13,955	15,270
Mideast	South America	13,385	15,617	19,892	21,334	21,749	21,145	20,425	20,264	20,220	20,311	20,478
Mideast	Caribbean	17	300	310	327	341	397	440	478	521	548	570
North America	Africa	226,734	48,632	55,931	56,821	57,291	61,476	64,388	65,278	66,348	67,087	67,837
North America	Asia	2,589,313	3,080,219	3,736,558	4,018,955	4,103,900	4,518,063	4,726,914	4,987,580	5,682,920	6,476,502	7,481,651
North America	Europe	1,019,700	825,601	1,001,809	1,004,350	1,048,044	1,105,614	1,067,340	1,052,510	1,035,774	1,044,212	1,066,450
North America	Mideast	34,246	17,336	46,345	45,808	45,785	52,769	55,697	59,596	69,302	81,617	96,827
North America	North America	120,285	233,088	250,062	260,641	256,673	280,922	299,956	318,797	363,640	416,997	479,423
North America	South America	381,831	320,063	368,115	387,744	393,752	424,243	436,303	450,365	489,153	533,148	579,385
North America	Caribbean	64,221	10,871	63,633	64,413	65,118	66,093	66,879	67,464	68,706	70,313	72,795
South America	Africa	8,424	15,262	13,963	14,264	15,097	17,349	19,479	21,679	25,642	29,423	33,313
South America	Asia	440,983	573,159	606,397	683,756	753,776	891,816	1,005,314	1,166,688	1,665,766	2,560,349	4,159,393
South America	Europe	333,591	453,548	506,712	482,656	487,843	546,922	543,725	549,606	569,964	599,815	636,062
South America	Mideast	24,421	45,260	47,231	46,370	46,698	49,969	49,720	51,817	59,385	70,708	85,232
South America	North America	200,457	166,562	177,108	183,366	190,780	209,833	216,386	221,907	236,247	256,791	279,326
South America	South America	54,260	79,956	91,669	96,928	100,543	115,273	120,636	128,940	150,658	181,861	230,212
South America	Caribbean	20,827	35,766	33,237	34,105	35,052	41,296	54,493	74,979	167,848	395,499	948,352
Caribbean	Africa	1	36	38	41	42	46	49	53	60	67	74
Caribbean	Asia	1,197	1,199	1,383	1,443	1,460	1,607	1,720	1,895	2,377	3,105	4,305
Caribbean	Europe	7,916	14,983	16,651	16,839	16,870	17,244	16,676	16,415	16,234	16,175	16,184
Caribbean	Mideast	6	42	47	50	51	49	48	52	62	73	85
Caribbean	North America	9,479	10,182	10,473	10,983	11,299	11,943	12,167	12,431	13,182	14,017	14,904
Caribbean	South America	71,663	80,009	88,986	88,154	89,136	87,668	82,348	78,495	71,791	65,789	60,358
Caribbean	Caribbean	6,976	8,037	7,383	8,059	8,557	11,483	16,350	23,286	47,780	96,367	189,079
Total		**16,474,402**	**20,123,316**	**22,166,047**	**23,049,465**	**23,735,450**	**25,853,799**	**26,394,171**	**27,912,265**	**33,282,109**	**43,411,291**	**62,878,455**
Average Annual Growth Rate			**4.08%**	**3.28%**	**3.99%**	**2.98%**	**1.72%**	**0.41%**	**1.12%**	**1.78%**	**2.69%**	**3.77%**

Containerized WORLD Commodity Forecast For FOOD
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	983,503	1,156,633	1,253,678	1,265,080	1,261,594	1,237,505	1,292,152	1,548,786	2,823,133	6,053,183	14,171,151
Africa	Asia	458,635	630,601	702,488	719,148	753,626	888,354	938,299	1,006,517	1,180,670	1,388,460	1,624,802
Africa	Europe	1,302,185	1,651,250	1,946,166	1,945,095	1,996,881	2,256,639	2,323,435	2,392,495	2,547,868	2,724,357	2,911,070
Africa	Mideast	120,963	228,557	248,118	260,837	273,629	339,989	386,997	445,491	586,178	754,946	950,170
Africa	North America	67,766	113,460	136,637	154,811	177,013	239,974	262,896	283,453	323,701	363,442	402,296
Africa	South America	249,351	24,092	29,197	29,854	30,902	37,409	40,784	43,895	52,239	61,929	71,891
Africa	Caribbean	13,132	16,989	18,617	19,501	19,847	21,346	22,710	25,252	34,874	54,833	98,527
Asia	Africa	787,030	1,281,499	1,436,622	1,412,276	1,389,062	1,367,232	1,367,061	1,448,451	1,827,323	2,690,995	4,674,144
Asia	Asia	15,309,215	22,528,003	23,307,684	24,080,290	24,908,327	29,863,091	33,582,991	38,312,262	51,430,295	72,515,253	105,985,111
Asia	Europe	8,282,983	11,417,707	13,771,112	14,463,735	14,660,553	14,605,472	14,704,026	15,360,209	17,099,420	19,775,424	23,841,146
Asia	Mideast	1,635,916	2,004,186	2,156,613	2,228,883	2,328,482	2,691,705	2,986,426	3,373,465	4,312,276	5,510,811	7,023,942
Asia	North America	3,052,310	4,365,041	5,611,963	5,451,481	5,764,064	6,968,010	7,398,852	7,850,085	8,791,409	9,796,677	10,844,777
Asia	South America	254,919	255,897	304,456	320,048	330,486	382,556	415,766	448,148	515,503	588,068	665,279
Asia	Caribbean	164,961	137,304	152,497	149,739	146,276	128,070	120,512	124,149	157,343	244,675	428,340
Europe	Africa	4,128,137	3,974,807	4,309,183	4,504,718	4,581,255	4,787,178	4,903,761	5,132,651	5,713,755	6,505,490	7,797,288
Europe	Asia	4,936,818	6,581,318	7,445,144	7,570,978	7,825,695	9,528,154	10,269,867	11,095,206	13,296,574	15,919,767	18,592,245
Europe	Europe	11,582,153	12,624,273	14,622,479	15,036,084	15,406,687	16,650,993	17,139,608	17,918,178	20,096,158	23,826,208	31,209,285
Europe	Mideast	2,731,653	3,369,233	3,749,126	4,012,995	4,260,006	5,523,440	6,362,003	7,429,797	10,049,059	13,349,341	17,529,441
Europe	North America	3,646,020	5,484,810	6,067,796	6,440,386	7,064,301	8,095,291	8,572,001	9,037,399	10,001,913	10,926,672	11,763,548
Europe	South America	1,675,736	1,276,666	1,528,523	1,629,377	1,738,299	2,300,804	2,563,655	2,810,891	3,329,090	3,871,383	4,428,708
Europe	Caribbean	1,076,672	957,084	1,033,840	1,084,597	1,123,247	1,247,697	1,261,228	1,284,691	1,317,230	1,346,121	1,378,948
Mideast	Africa	352,052	311,735	347,995	321,892	299,256	230,460	208,071	209,227	252,337	366,485	628,000
Mideast	Asia	297,591	668,063	734,817	748,207	772,207	835,899	887,761	968,363	1,185,063	1,545,947	1,959,726
Mideast	Europe	1,392,410	1,485,461	1,622,643	1,639,973	1,713,150	1,678,866	1,668,375	1,683,921	1,769,692	1,960,984	2,287,570
Mideast	Mideast	866,743	1,323,078	1,434,762	1,504,186	1,585,700	1,879,289	2,116,389	2,435,353	3,247,222	4,359,189	6,005,217
Mideast	North America	195,803	174,122	216,416	239,530	269,548	321,607	351,602	379,890	438,910	499,869	561,069
Mideast	South America	35,445	32,005	41,124	43,555	45,915	57,744	64,430	71,220	86,940	107,545	139,139
Mideast	Caribbean	5,384	13,113	14,614	14,450	14,174	13,087	13,427	15,508	26,138	52,239	114,394
North America	Africa	93,711	128,847	186,897	183,238	182,367	205,157	212,726	224,973	251,429	279,382	308,849
North America	Asia	8,627,254	10,255,123	10,269,425	10,709,651	11,135,955	13,277,732	14,332,129	15,627,340	18,513,950	21,959,304	24,886,544
North America	Europe	2,398,724	2,725,828	3,050,281	3,192,567	3,300,724	3,515,501	3,602,326	3,768,012	4,172,791	4,632,456	5,120,509
North America	Mideast	115,429	254,763	282,200	299,571	307,032	448,843	513,208	586,856	753,598	939,025	1,133,063
North America	North America	68,397	109,787	922,728	983,507	1,047,747	1,465,425	1,688,598	1,902,267	2,351,840	2,823,521	3,302,357
North America	South America	1,068,085	826,425	899,993	949,178	1,016,932	1,459,604	1,651,992	1,845,196	2,259,988	2,709,326	3,181,602
North America	Caribbean	247,052	413,453	440,925	461,660	474,515	497,670	507,230	534,998	641,343	865,898	1,269,454
South America	Africa	205,560	297,455	316,129	337,747	339,982	382,908	409,149	447,146	575,474	830,701	1,388,528
South America	Asia	1,688,996	2,035,934	2,296,727	2,441,579	2,568,976	3,358,915	3,913,068	4,681,512	7,082,722	11,600,720	20,854,183
South America	Europe	2,273,765	2,812,913	3,632,425	3,767,009	3,925,084	4,703,638	4,964,145	5,336,851	6,382,518	8,247,212	12,092,909
South America	Mideast	484,489	972,267	993,203	1,044,899	1,106,322	1,402,402	1,556,506	1,749,462	2,201,712	2,746,829	3,374,064
South America	North America	1,000,229	1,356,561	1,776,035	1,866,845	1,953,823	2,443,116	2,608,897	2,781,994	3,144,222	3,508,881	3,882,312
South America	South America	1,346,159	2,223,213	2,695,657	2,836,361	3,019,366	4,084,383	4,610,827	5,181,285	6,581,818	8,449,266	10,918,865
South America	Caribbean	357,415	651,757	665,515	702,538	732,514	899,661	1,113,733	1,431,123	2,619,404	5,114,004	9,923,522
Caribbean	Africa	18,137	30,126	31,433	31,649	31,443	31,367	33,284	39,342	70,985	152,739	330,659
Caribbean	Asia	76,542	114,931	135,527	137,795	145,594	181,779	195,567	209,750	245,203	288,286	336,526
Caribbean	Europe	261,893	499,300	633,041	642,473	655,207	709,185	726,051	761,558	848,237	966,263	1,151,738
Caribbean	Mideast	46,908	71,851	76,220	74,883	74,945	69,288	64,476	63,614	65,808	79,366	104,192
Caribbean	North America	113,222	164,648	205,194	206,221	215,727	226,451	223,812	223,258	221,664	218,945	219,069
Caribbean	South America	164,143	235,860	268,637	284,931	289,465	324,066	346,910	370,881	423,317	481,854	549,457
Caribbean	Caribbean	285,801	644,399	638,554	660,835	682,300	808,787	1,010,228	1,348,952	2,716,117	5,506,834	9,899,667
Total		**86,547,398**	**110,912,424**	**124,660,995**	**129,106,843**	**133,946,202**	**154,673,053**	**166,509,948**	**182,250,726**	**224,616,474**	**289,561,104**	**392,315,292**
Average Annual Growth Rate			**5.09%**	**3.97%**	**3.57%**	**3.75%**	**2.92%**	**1.49%**	**1.82%**	**2.11%**	**2.57%**	**3.08%**

Containerized WORLD Commodity Forecast For FUELS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	157	133	120	120	120	123	124	128	137	147	160
Africa	Asia	17	21	19	20	20	23	27	34	55	93	162
Africa	Europe	6	4	5	5	5	6	7	8	10	12	15
Africa	Mideast	0	2	2	2	2	2	3	3	4	6	7
Africa	North America	0	0	0	0	0	0	0	0	0	0	0
Africa	South America	1	3	4	4	4	4	5	5	5	7	7
Africa	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Asia	Africa	115	188	197	203	208	244	275	310	388	478	587
Asia	Asia	520,501	806,626	892,743	943,029	1,006,917	1,355,025	1,758,145	2,314,794	4,237,341	8,142,106	15,941,625
Asia	Europe	23,974	4,779	5,009	5,378	5,665	7,347	8,843	10,345	14,020	18,942	25,442
Asia	Mideast	1,734	11,416	11,101	11,701	12,183	14,708	17,290	20,224	27,149	35,999	47,110
Asia	North America	5,210	7,026	42,879	48,327	50,797	59,815	68,439	76,660	95,611	119,727	152,241
Asia	South America	2,131	4,800	5,061	5,361	5,545	6,788	7,986	9,604	11,893	14,881	18,436
Asia	Caribbean	351	851	788	814	835	957	1,052	1,129	1,241	1,338	1,426
Europe	Africa	49,776	67,613	68,590	71,017	73,491	89,481	107,065	126,165	168,289	219,340	282,430
Europe	Asia	59,966	69,645	75,925	83,059	91,247	137,019	195,432	279,344	589,843	1,274,047	2,715,818
Europe	Europe	935,614	1,009,845	1,112,105	1,085,433	1,109,743	1,220,938	1,309,794	1,401,493	1,624,860	1,896,425	2,221,572
Europe	Mideast	127,607	217,668	237,349	245,343	252,503	300,812	344,525	394,604	517,342	674,957	872,309
Europe	North America	24,032	33,072	51,337	58,468	61,314	74,197	86,693	99,527	129,807	167,162	212,383
Europe	South America	34,837	22,049	26,264	28,334	29,501	36,289	41,918	46,819	57,311	69,719	84,852
Europe	Caribbean	31,461	53,582	53,766	54,863	56,101	63,965	69,524	73,860	79,363	83,104	86,261
Mideast	Africa	125	895	930	948	962	1,057	1,152	1,238	1,399	1,564	1,746
Mideast	Asia	39	1,434	1,491	1,573	1,658	1,860	2,087	2,364	3,027	3,760	4,448
Mideast	Europe	12,750	6,738	7,885	7,896	8,341	9,764	10,774	11,728	13,816	16,214	18,997
Mideast	Mideast	2,281	8,630	10,099	10,078	10,070	10,238	10,436	10,778	11,640	12,628	13,601
Mideast	North America	0	262	10,183	11,717	12,448	14,876	16,805	18,383	21,253	23,720	25,679
Mideast	South America	17	12	12	13	13	15	16	17	18	19	20
Mideast	Caribbean	170	32	31	31	31	32	32	32	31	29	28
North America	Africa	608	1,383	2,539	2,524	2,582	2,329	2,147	2,138	2,137	2,121	2,066
North America	Asia	77,600	106,130	249,866	245,718	245,381	227,418	216,022	214,657	236,388	302,961	431,531
North America	Europe	17,754	27,839	31,647	32,885	32,610	28,686	26,298	24,870	23,285	22,690	23,338
North America	Mideast	4,044	1,838	858	830	845	768	731	741	758	769	767
North America	North America	615	10,074	9,425	9,925	10,044	10,659	11,172	12,064	13,995	16,210	18,720
North America	South America	23,606	38,513	65,346	65,917	65,514	64,652	64,713	66,922	70,931	74,502	77,655
North America	Caribbean	12,784	13,214	48,399	48,668	48,747	49,607	50,190	50,494	50,594	50,370	49,879
South America	Africa	37	15	14	15	15	17	18	20	22	25	28
South America	Asia	87	1,885	2,166	2,251	2,332	2,689	3,154	3,864	6,554	11,747	22,966
South America	Europe	2,471	4,313	4,230	4,185	4,346	4,737	4,965	5,111	5,451	5,920	6,576
South America	Mideast	219	874	990	994	998	1,040	1,080	1,132	1,274	1,440	1,613
South America	North America	810	7,123	505,356	575,185	607,148	709,853	805,053	891,181	1,088,768	1,341,382	1,684,774
South America	South America	15,589	33,588	38,517	41,838	43,707	55,319	64,736	73,761	94,138	118,686	147,960
South America	Caribbean	14,148	22,485	21,821	21,651	21,688	22,321	22,640	22,916	23,163	23,271	23,315
Caribbean	Africa	1	0	0	0	0	0	0	0	1	1	1
Caribbean	Asia	29	15	19	21	22	32	44	62	109	197	337
Caribbean	Europe	110	114	116	114	119	139	152	162	183	207	235
Caribbean	Mideast	1	2	2	2	2	2	2	2	3	3	4
Caribbean	North America	9	19	21	23	24	28	32	35	43	52	64
Caribbean	South America	2,644	1,012	1,123	1,194	1,236	1,423	1,572	1,658	1,823	2,004	2,221
Caribbean	Caribbean	563	1,331	1,309	1,332	1,350	1,454	1,535	1,604	1,719	1,823	1,923
Total		**2,006,690**	**2,599,091**	**3,595,660**	**3,729,010**	**3,878,435**	**4,588,757**	**5,334,707**	**6,272,991**	**9,227,194**	**14,752,803**	**25,223,335**
Average Annual Growth Rate			**5.31%**	**11.43%**	**3.71%**	**4.01%**	**3.42%**	**3.06%**	**5.29%**	**3.93%**	**4.80%**	**5.51%**

Containerized WORLD Commodity Forecast For III-TECH PRODUCTS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	9,035	15,565	13,609	15,051	16,654	24,565	26,143	28,405	34,349	44,453	61,180
Africa	Asia	361	2,033	1,735	1,947	2,212	3,785	5,627	8,453	19,111	43,652	98,281
Africa	Europe	8,598	19,821	23,933	25,958	28,605	44,246	55,669	67,355	95,162	130,602	175,687
Africa	Mideast	2,892	4,848	4,493	5,050	5,709	8,471	10,219	12,515	18,921	28,891	45,205
Africa	North America	324	403	797	912	1,044	1,707	2,241	2,832	4,308	6,303	8,958
Africa	South America	48	95	79	88	100	162	204	249	370	553	849
Africa	Caribbean	11	24	22	24	27	43	48	52	61	69	79
Asia	Africa	61,648	100,838	92,165	96,313	103,535	156,906	220,653	307,487	590,090	1,141,570	2,245,941
Asia	Asia	2,680,406	4,430,205	4,156,711	4,660,398	5,170,120	8,381,730	11,882,473	16,984,556	35,333,813	74,689,886	151,493,839
Asia	Europe	1,390,693	2,530,547	2,710,766	2,906,173	3,064,304	4,377,532	5,668,748	7,103,281	10,708,532	15,666,653	22,534,588
Asia	Mideast	171,744	232,267	209,049	225,292	246,816	369,552	505,241	689,786	1,265,683	2,306,400	4,221,938
Asia	North America	2,214,078	3,757,633	3,725,461	3,939,971	4,291,290	6,717,384	8,994,651	11,479,722	17,621,979	25,562,920	35,395,007
Asia	South America	202,953	256,472	259,579	287,653	318,267	500,355	655,968	824,460	1,293,064	2,040,442	3,358,442
Asia	Caribbean	19,759	15,432	13,923	14,900	16,085	24,006	32,684	45,358	91,177	187,809	378,265
Europe	Africa	118,369	156,002	145,520	164,716	187,250	321,282	428,441	558,206	943,416	1,657,377	3,090,631
Europe	Asia	204,007	275,974	301,931	339,007	382,346	620,124	863,632	1,266,249	2,711,739	5,841,151	12,713,905
Europe	Europe	462,987	1,036,294	1,210,514	1,313,443	1,466,188	2,322,358	3,120,500	4,059,418	6,621,838	10,542,282	16,497,113
Europe	Mideast	97,909	216,562	224,775	257,943	296,582	508,871	708,282	967,627	1,756,494	3,095,969	5,268,774
Europe	North America	110,736	116,964	140,837	150,427	167,700	261,823	334,135	410,201	595,332	839,430	1,158,707
Europe	South America	38,738	65,390	74,534	84,806	96,678	160,460	196,656	232,127	316,979	427,036	571,006
Europe	Caribbean	20,038	18,322	16,999	19,046	21,276	33,863	41,706	52,316	89,416	165,936	297,414
Mideast	Africa	4,903	11,834	10,017	11,784	12,878	20,200	29,033	39,686	68,903	120,201	214,749
Mideast	Asia	4,302	10,014	9,401	10,429	11,523	18,311	26,496	37,700	74,649	147,321	291,775
Mideast	Europe	25,729	117,259	150,106	159,812	174,214	278,663	377,733	488,849	771,181	1,166,890	1,721,970
Mideast	Mideast	13,015	27,626	26,125	29,482	33,407	53,144	70,600	92,873	158,525	269,691	467,078
Mideast	North America	1,952	5,276	4,419	4,934	5,512	8,531	10,610	12,749	17,748	23,950	31,614
Mideast	South America	897	1,774	1,570	1,763	1,918	2,889	3,617	4,320	5,958	7,987	10,527
Mideast	Caribbean	149	476	451	482	548	818	966	1,069	1,362	1,691	2,028
North America	Africa	3,552	3,406	2,797	2,914	3,026	4,021	4,953	6,012	9,093	14,603	25,937
North America	Asia	235,223	228,056	236,267	256,560	276,947	392,256	532,046	739,783	1,479,734	3,060,114	6,428,426
North America	Europe	95,809	145,713	145,584	151,014	159,811	214,122	256,259	305,908	440,761	648,741	991,238
North America	Mideast	4,685	8,953	8,462	8,755	9,265	12,467	15,309	18,343	25,674	35,019	46,712
North America	North America	996	4,946	5,488	6,202	6,793	10,166	13,705	17,503	27,468	41,359	60,427
North America	South America	131,341	176,418	124,815	136,117	145,456	203,909	261,286	325,184	512,988	846,253	1,509,769
North America	Caribbean	13,012	22,134	24,453	26,791	29,388	46,137	68,984	107,476	258,533	612,411	1,381,910
South America	Africa	161	1,586	1,479	1,710	1,966	3,525	4,797	6,144	9,518	14,074	20,080
South America	Asia	1,359	8,741	8,995	10,301	11,810	20,685	31,227	50,427	123,643	291,227	673,022
South America	Europe	6,276	14,624	16,010	17,682	19,918	34,105	49,084	67,385	114,856	182,963	277,773
South America	Mideast	204	241	250	280	317	516	699	914	1,463	2,233	3,300
South America	North America	6,211	20,673	23,513	27,090	31,184	55,653	84,146	116,324	200,303	321,894	493,697
South America	South America	15,456	41,887	50,426	56,276	63,008	97,669	116,731	135,738	180,523	238,418	315,370
South America	Caribbean	5,526	11,303	10,795	11,612	12,530	17,554	20,008	22,811	29,916	40,380	57,611
Caribbean	Africa	65	199	220	228	246	373	440	511	675	888	1,132
Caribbean	Asia	508	309	319	360	409	678	965	1,394	2,823	5,636	11,128
Caribbean	Europe	1,675	1,287	1,402	1,501	1,641	2,520	3,110	3,743	5,328	7,526	10,602
Caribbean	Mideast	88	76	75	85	97	171	265	433	1,092	2,646	6,440
Caribbean	North America	104	470	758	839	937	1,424	1,739	2,073	2,794	3,632	4,624
Caribbean	South America	2,747	4,428	5,287	5,649	6,059	8,183	9,629	11,128	14,587	18,874	24,089
Caribbean	Caribbean	7,164	7,464	7,683	7,651	7,646	7,894	8,433	9,620	14,554	24,987	46,993
Total		**8,398,342**	**14,128,863**	**14,205,503**	**15,459,422**	**16,911,246**	**26,356,010**	**35,756,790**	**47,726,756**	**84,663,488**	**152,570,994**	**274,745,827**
Average Annual Growth Rate			**10.96%**	**0.18%**	**8.83%**	**9.39%**	**9.28%**	**6.29%**	**5.95%**	**5.90%**	**6.07%**	**6.06%**

Containerized WORLD Commodity Forecast For INTERMEDIATE MANUFACTURED PRODUCTS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	665,862	795,553	815,011	852,517	886,542	1,086,580	1,276,951	1,563,018	2,459,468	4,236,790	8,033,051
Africa	Asia	555,418	902,417	993,460	1,060,198	1,133,452	1,399,908	1,788,543	2,351,953	4,096,475	7,113,063	12,307,638
Africa	Europe	345,314	673,239	900,332	975,525	1,024,722	1,219,120	1,423,330	1,614,721	2,054,217	2,696,290	3,327,558
Africa	Mideast	147,831	159,230	164,824	181,005	195,491	257,801	316,724	402,059	659,941	1,130,560	2,041,110
Africa	North America	125,834	198,014	207,132	226,961	240,593	245,957	260,282	274,458	318,569	369,761	431,243
Africa	South America	18,752	21,181	26,149	29,286	31,544	42,669	50,334	57,634	73,614	92,688	116,198
Africa	Caribbean	3,054	4,361	4,477	4,779	5,041	6,229	6,786	7,346	8,674	10,485	12,913
Asia	Africa	597,263	1,859,386	2,006,887	2,153,390	2,310,691	3,462,604	4,723,034	6,565,356	13,079,502	26,765,968	55,218,811
Asia	Asia	30,772,469	42,488,188	50,795,023	54,677,619	59,593,767	80,808,391	103,912,264	136,465,128	246,189,038	466,959,586	909,891,724
Asia	Europe	3,828,554	8,500,522	11,648,418	12,055,679	12,505,848	15,926,504	18,703,633	21,477,527	28,408,965	38,472,367	54,648,376
Asia	Mideast	1,659,568	3,211,299	3,357,681	3,592,819	3,830,439	5,127,602	6,320,341	8,148,570	14,158,248	25,896,330	47,938,302
Asia	North America	6,003,531	11,361,032	13,287,532	14,054,454	15,257,268	20,944,040	26,604,150	32,157,111	46,084,778	64,918,362	90,010,795
Asia	South America	465,858	873,898	1,077,187	1,163,868	1,253,541	1,765,533	2,225,621	2,876,513	5,097,383	9,770,368	19,729,951
Asia	Caribbean	129,614	307,921	328,152	353,783	379,628	541,068	787,167	1,164,236	2,614,341	5,859,350	12,649,701
Europe	Africa	1,790,331	1,880,027	2,020,973	2,218,382	2,418,344	3,685,728	4,795,135	6,052,408	9,188,923	13,637,042	20,059,199
Europe	Asia	4,333,922	4,384,576	5,145,538	5,485,845	5,930,145	8,722,803	12,053,911	17,294,402	36,709,252	80,255,716	173,918,918
Europe	Europe	7,400,395	10,834,428	13,251,698	13,726,951	14,389,504	18,022,985	21,474,415	24,824,310	32,639,345	43,000,430	57,257,158
Europe	Mideast	2,903,092	3,498,280	3,990,875	4,358,708	4,731,091	6,731,294	8,114,118	9,876,305	14,575,689	21,496,353	31,544,465
Europe	North America	3,444,908	5,726,657	5,455,203	6,047,080	6,793,413	9,480,023	11,588,138	13,677,028	18,783,791	25,525,718	34,396,772
Europe	South America	608,317	925,781	1,190,287	1,317,383	1,443,351	2,129,534	2,505,779	2,886,619	3,775,987	4,913,975	6,415,281
Europe	Caribbean	381,492	347,509	364,996	399,625	432,578	586,045	645,300	695,149	784,256	875,118	977,468
Mideast	Africa	226,383	706,640	724,053	793,915	858,008	1,258,807	1,648,899	2,104,350	3,270,281	5,024,553	7,754,977
Mideast	Asia	1,136,844	1,277,177	1,434,695	1,505,062	1,560,253	1,934,289	2,479,311	3,338,094	6,241,728	11,976,466	22,952,620
Mideast	Europe	706,303	2,193,468	2,842,015	3,062,986	3,254,125	4,059,206	4,902,476	5,768,251	7,810,940	10,580,231	14,841,718
Mideast	Mideast	1,277,917	1,671,985	1,720,237	1,848,310	1,969,832	2,524,810	2,968,557	3,613,594	5,412,351	8,297,132	13,064,428
Mideast	North America	121,263	381,119	546,193	618,530	696,190	931,122	1,117,619	1,305,326	1,757,330	2,340,850	3,086,043
Mideast	South America	11,519	34,344	39,369	42,969	46,389	64,809	78,690	93,034	126,473	169,463	226,250
Mideast	Caribbean	14,051	38,608	39,799	42,529	44,719	51,349	54,088	55,765	58,040	60,009	62,723
North America	Africa	30,944	32,744	38,876	37,682	36,569	42,384	47,358	51,881	61,445	72,922	83,918
North America	Asia	2,722,473	1,524,509	2,008,074	2,107,996	2,175,272	2,594,710	3,134,442	3,717,681	5,580,076	9,103,736	15,872,557
North America	Europe	1,276,154	1,272,135	1,678,744	1,736,776	1,816,850	2,128,008	2,406,420	2,819,342	3,549,627	4,538,911	6,046,054
North America	Mideast	132,877	84,233	90,382	92,724	91,714	113,248	130,319	145,524	180,565	224,240	280,294
North America	North America	225,991	105,985	117,760	129,011	141,275	198,722	272,920	350,691	544,112	807,463	1,158,489
North America	South America	792,910	750,095	665,016	714,136	741,357	909,669	1,049,572	1,179,026	1,460,648	1,792,686	2,194,890
North America	Caribbean	370,353	336,748	334,597	356,401	376,739	478,876	570,007	688,511	1,127,090	2,105,478	3,791,763
South America	Africa	38,591	58,128	65,725	69,599	74,487	109,529	147,562	198,875	365,168	695,868	1,402,109
South America	Asia	962,284	938,140	1,015,033	1,050,688	1,067,147	1,276,780	1,566,392	2,027,306	3,790,970	7,878,940	16,809,448
South America	Europe	537,541	935,999	1,224,185	1,286,746	1,335,224	1,487,641	1,691,254	1,854,371	2,143,565	2,394,417	2,690,840
South America	Mideast	32,366	45,622	56,633	60,912	66,154	93,091	120,517	163,366	311,295	620,162	1,302,712
South America	North America	892,578	1,688,294	2,688,087	2,818,953	3,069,359	4,032,804	4,871,717	5,715,017	7,721,044	10,301,940	13,708,604
South America	South America	984,495	1,139,872	1,456,577	1,563,131	1,671,992	2,286,193	2,730,854	3,262,649	4,744,858	7,264,932	11,988,117
South America	Caribbean	344,782	587,755	639,908	687,813	733,904	1,021,944	1,399,546	2,060,374	4,687,001	10,938,821	25,269,250
Caribbean	Africa	687	5,002	5,582	5,864	6,209	8,609	11,118	14,571	25,699	47,208	93,889
Caribbean	Asia	3,205	3,183	3,368	3,595	3,865	5,215	6,797	9,075	16,563	30,744	57,424
Caribbean	Europe	37,639	18,802	24,395	25,200	25,966	29,186	32,834	35,952	43,643	53,961	68,290
Caribbean	Mideast	875	2,062	2,424	2,565	2,752	3,526	4,104	4,989	7,798	12,778	21,620
Caribbean	North America	36,214	63,094	81,060	91,982	103,654	153,624	211,012	270,992	427,462	646,546	943,530
Caribbean	South America	119,567	265,665	334,341	361,453	388,057	512,516	565,813	617,859	732,342	877,527	1,082,440
Caribbean	Caribbean	300,511	474,273	514,656	546,298	572,381	743,141	972,070	1,371,742	2,954,400	6,716,340	15,389,667
Total		**79,516,698**	**115,589,181**	**137,423,621**	**146,599,684**	**157,717,346**	**211,246,223**	**264,858,228**	**333,270,058**	**546,912,879**	**949,479,741**	**1,723,171,295**
Average Annual Growth Rate			**7.77%**	**5.94%**	**6.68%**	**7.58%**	**6.02%**	**4.63%**	**4.70%**	**5.08%**	**5.67%**	**6.14%**

Containerized WORLD Commodity Forecast For MATERIALS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	210,816	285,504	301,731	302,685	303,537	313,286	341,810	403,228	658,824	1,274,531	2,757,335
Africa	Asia	227,950	302,212	353,407	359,243	373,928	474,125	580,601	727,342	1,226,815	2,320,775	4,802,606
Africa	Europe	432,569	608,321	775,544	812,300	830,573	784,631	794,563	834,692	928,165	1,041,106	1,191,725
Africa	Mideast	58,870	81,654	88,862	91,331	94,287	104,678	116,439	133,807	182,876	261,356	394,719
Africa	North America	18,887	26,502	30,764	47,771	46,783	47,654	49,717	52,631	60,932	72,293	86,623
Africa	South America	41,938	35,406	45,210	46,845	47,908	55,870	61,567	66,630	75,875	88,847	115,287
Africa	Caribbean	1,762	6,492	7,038	7,376	7,556	8,125	8,596	8,989	9,722	10,766	12,522
Asia	Africa	603,973	905,540	937,621	958,573	991,366	1,312,263	1,782,371	2,622,975	5,960,276	13,696,451	31,484,447
Asia	Asia	18,342,271	29,795,056	34,638,585	36,289,732	37,549,810	47,517,462	57,297,095	73,949,966	130,078,857	244,126,836	474,811,436
Asia	Europe	3,210,207	5,133,186	6,468,868	6,436,041	6,446,119	7,353,422	8,136,075	9,260,067	13,133,252	20,918,612	37,737,361
Asia	Mideast	1,675,814	2,431,216	2,554,785	2,709,835	2,810,923	3,490,509	4,217,410	5,353,422	9,596,478	19,427,007	42,857,072
Asia	North America	2,617,029	5,095,531	6,506,932	6,503,704	6,675,769	7,604,698	8,211,367	8,743,291	10,261,050	12,221,182	14,389,703
Asia	South America	369,759	621,000	733,794	772,767	810,568	1,062,919	1,181,504	1,351,304	1,982,525	3,497,660	7,175,961
Asia	Caribbean	155,430	313,020	297,369	305,555	316,712	413,354	595,737	856,607	1,827,791	3,872,589	8,052,543
Europe	Africa	1,349,851	1,848,425	1,967,155	2,026,666	2,075,377	2,469,052	2,809,697	3,140,535	3,895,450	4,902,984	6,235,427
Europe	Asia	3,549,196	6,229,431	7,627,377	7,794,634	8,028,862	9,462,395	11,225,961	14,019,175	23,852,636	45,601,491	94,568,799
Europe	Europe	5,564,422	7,793,107	9,550,213	9,512,034	9,364,859	9,075,301	8,954,205	9,090,427	9,793,769	11,216,451	13,720,076
Europe	Mideast	1,809,829	2,483,319	2,912,193	3,064,031	3,223,551	3,996,093	4,602,532	5,353,526	7,262,347	9,926,627	13,808,158
Europe	North America	1,476,708	2,695,747	3,230,240	3,146,110	3,134,221	3,223,983	3,227,546	3,290,423	3,632,211	4,169,598	4,867,808
Europe	South America	509,828	731,364	995,792	1,047,548	1,096,836	1,364,907	1,555,828	1,739,620	2,142,403	2,650,728	3,301,154
Europe	Caribbean	149,829	153,183	159,154	165,008	168,679	179,614	190,412	201,741	224,116	253,575	298,172
Mideast	Africa	92,512	204,692	211,218	215,095	217,990	243,520	269,144	298,376	386,567	569,071	983,696
Mideast	Asia	86,989	193,993	204,563	209,894	215,840	269,123	337,105	448,662	858,646	1,790,223	3,947,527
Mideast	Europe	385,480	745,443	906,248	961,325	1,013,070	1,078,536	1,158,868	1,253,442	1,512,491	1,924,433	2,622,027
Mideast	Mideast	369,839	570,791	593,245	619,324	640,852	708,484	789,923	890,039	1,154,165	1,558,556	2,151,459
Mideast	North America	47,606	152,421	189,949	202,410	217,322	262,420	284,505	310,884	379,466	470,046	584,951
Mideast	South America	9,954	8,850	10,986	11,793	12,393	17,188	18,736	19,940	22,528	31,056	36,259
Mideast	Caribbean	1,398	3,270	3,380	3,438	3,470	3,479	3,587	3,665	3,853	4,336	5,574
North America	Africa	108,462	95,324	108,392	112,044	114,611	156,601	241,251	412,309	1,122,896	2,874,259	7,268,327
North America	Asia	12,606,501	10,799,825	14,699,991	14,831,329	14,407,295	12,363,643	11,021,172	10,813,972	10,855,712	11,485,911	12,787,056
North America	Europe	3,346,256	3,443,140	3,560,761	3,732,707	3,803,591	3,122,416	2,892,999	3,006,497	3,356,336	3,853,516	4,534,575
North America	Mideast	381,326	421,210	381,711	382,712	379,912	382,444	384,545	400,113	438,821	489,221	555,602
North America	North America	144,660	339,431	384,024	401,751	418,040	456,020	487,968	513,724	567,061	628,480	697,300
North America	South America	1,776,243	1,701,799	1,690,798	1,700,313	1,688,884	1,714,729	1,740,152	1,802,112	1,977,651	2,215,529	2,521,858
North America	Caribbean	553,852	692,063	1,064,186	1,133,044	1,211,466	1,741,856	2,623,466	3,793,179	7,962,132	16,300,499	32,180,045
South America	Africa	60,012	58,126	55,959	50,539	46,559	37,356	36,393	41,324	65,135	120,457	252,151
South America	Asia	564,428	650,986	915,167	910,989	917,517	981,796	1,032,012	1,180,845	1,649,890	2,600,261	4,707,850
South America	Europe	844,897	1,067,085	1,563,440	1,615,119	1,646,271	1,732,329	1,720,994	1,783,720	1,962,787	2,232,850	2,623,551
South America	Mideast	132,922	102,163	113,101	114,742	117,070	120,628	125,702	135,591	162,839	201,847	254,773
South America	North America	598,579	1,157,599	1,852,211	1,849,294	1,909,897	2,411,043	2,634,129	2,832,793	3,267,513	3,787,711	4,421,988
South America	South America	515,729	820,660	1,025,285	1,059,827	1,098,729	1,305,443	1,517,673	1,814,959	2,781,302	4,649,637	8,236,378
South America	Caribbean	137,698	286,563	265,699	277,125	288,199	346,237	439,000	566,661	1,017,760	1,905,897	3,546,296
Caribbean	Africa	569	2,145	2,090	2,087	2,098	2,191	2,204	2,216	2,270	2,378	2,542
Caribbean	Asia	15,331	21,256	27,879	26,898	26,625	33,406	37,043	42,207	56,301	77,183	109,628
Caribbean	Europe	22,233	33,641	44,697	45,977	47,074	49,286	49,709	50,863	56,008	65,471	79,874
Caribbean	Mideast	750	1,412	1,705	1,745	1,774	1,934	2,115	2,320	2,839	3,491	4,170
Caribbean	North America	49,073	53,152	83,332	80,473	81,288	87,441	93,977	99,913	112,192	126,578	144,418
Caribbean	South America	67,761	92,667	109,302	108,655	108,106	110,414	113,464	118,238	125,784	132,746	140,422
Caribbean	Caribbean	87,284	152,528	143,883	147,970	151,765	176,336	214,369	274,746	511,104	958,612	1,619,376
Total		**64,985,684**	**91,447,454**	**110,415,835**	**113,208,406**	**115,185,936**	**130,230,637**	**146,213,234**	**174,113,712**	**269,158,419**	**462,611,718**	**859,678,608**
Average Annual Growth Rate			**7.07%**	**6.48%**	**2.53%**	**1.75%**	**2.49%**	**2.34%**	**3.55%**	**4.45%**	**5.57%**	**6.39%**

Containerized WORLD Commodity Forecast For ALL COMMODITIES
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	2,474,462	3,213,048	3,376,790	3,473,708	3,551,520	4,003,242	4,573,477	5,718,471	10,191,732	20,591,039	45,597,326
Africa	Asia	1,892,668	2,909,890	3,221,246	3,388,523	3,592,101	4,566,118	5,576,150	7,001,502	11,559,063	20,178,055	36,611,711
Africa	Europe	4,336,969	5,940,507	7,161,032	7,348,194	7,535,650	8,311,190	8,879,570	9,417,853	10,754,439	12,470,050	14,690,406
Africa	Mideast	941,810	1,273,536	1,372,173	1,445,902	1,518,432	1,856,049	2,138,382	2,582,583	3,815,741	5,990,279	10,070,544
Africa	North America	327,030	571,612	696,310	751,047	813,100	1,003,799	1,128,656	1,246,182	1,529,706	1,870,638	2,276,751
Africa	South America	347,245	115,660	144,710	153,407	160,664	201,269	225,980	249,518	300,436	362,661	447,084
Africa	Caribbean	21,531	40,963	43,996	46,455	48,210	56,418	62,634	70,711	97,077	147,624	247,001
Asia	Africa	3,088,089	6,034,181	6,432,963	6,654,995	6,931,432	9,292,892	12,322,295	17,215,124	35,775,553	77,453,383	171,545,098
Asia	Asia	115,858,050	175,781,292	203,207,516	215,876,210	229,375,536	301,722,036	376,355,836	484,096,222	852,017,120	1,595,757,293	3,034,438,337
Asia	Europe	26,359,908	45,395,716	56,898,641	58,580,775	59,827,680	69,696,496	77,760,483	87,459,923	114,113,643	156,806,734	230,248,148
Asia	Mideast	8,044,587	12,430,793	12,956,284	13,699,906	14,426,518	18,376,184	22,060,992	27,574,269	45,629,194	81,479,443	155,367,629
Asia	North America	27,587,129	46,304,923	55,925,187	58,193,565	62,539,566	84,608,368	101,234,082	117,906,209	159,647,375	213,800,261	281,603,888
Asia	South America	2,349,835	3,703,420	4,466,996	4,815,618	5,151,650	7,035,463	8,402,615	10,172,933	15,832,816	27,091,622	50,815,569
Asia	Caribbean	639,564	1,161,295	1,192,323	1,253,420	1,316,480	1,735,213	2,395,662	3,387,497	7,158,913	15,388,229	32,358,848
Europe	Africa	10,677,015	12,470,444	13,060,935	13,889,636	14,636,676	19,150,020	22,753,825	26,784,241	36,909,017	51,622,499	74,607,491
Europe	Asia	23,422,247	29,923,994	34,101,556	36,012,424	38,271,954	51,697,400	65,344,098	85,734,716	157,923,404	312,755,877	638,813,047
Europe	Europe	45,605,245	61,098,182	71,307,355	73,477,146	75,897,831	88,598,259	98,093,047	108,367,883	133,914,988	170,661,002	225,216,359
Europe	Mideast	12,441,557	16,889,937	18,837,755	20,360,128	21,948,096	30,153,249	35,704,759	42,716,948	61,256,824	87,837,720	125,894,359
Europe	North America	13,928,875	21,832,926	23,433,737	24,753,752	26,765,317	34,079,515	38,965,596	43,592,963	55,385,249	70,888,393	90,466,708
Europe	South America	4,779,461	5,675,077	7,015,252	7,671,424	8,337,840	11,876,375	13,738,486	15,530,335	19,627,670	24,705,205	31,103,672
Europe	Caribbean	2,190,274	2,207,322	2,288,428	2,443,497	2,580,271	3,162,721	3,362,084	3,553,048	3,938,117	4,442,219	5,212,204
Mideast	Africa	1,167,717	2,167,002	2,251,599	2,391,455	2,535,809	3,604,249	5,133,080	7,717,551	17,749,964	40,988,028	91,457,363
Mideast	Asia	3,535,366	5,484,639	5,996,597	6,304,669	6,560,693	7,975,394	9,760,332	12,327,559	21,356,097	39,377,030	71,027,578
Mideast	Europe	5,280,846	8,511,953	9,905,068	10,426,318	10,945,924	12,936,663	14,675,891	16,461,215	20,903,608	27,355,945	37,715,556
Mideast	Mideast	4,869,459	7,200,602	7,641,882	8,117,473	8,604,497	10,985,883	12,968,542	15,840,547	24,790,791	41,356,535	68,680,044
Mideast	North America	652,531	1,182,653	1,448,274	1,596,208	1,766,142	2,234,000	2,580,478	2,934,090	3,786,505	4,858,809	6,178,339
Mideast	South America	129,506	221,611	277,636	292,832	309,333	392,572	438,882	485,073	596,202	759,637	1,040,772
Mideast	Caribbean	26,764	71,317	74,141	77,923	81,040	91,923	101,437	114,431	161,058	262,183	490,818
North America	Africa	607,933	553,740	644,999	643,981	649,774	769,086	913,669	1,153,605	2,053,009	4,094,471	8,919,236
North America	Asia	39,430,592	36,971,982	44,297,457	45,933,185	46,566,616	50,088,870	53,336,781	58,896,340	75,871,102	106,033,723	161,046,773
North America	Europe	13,260,314	14,307,089	15,566,287	16,028,802	16,354,248	17,264,777	18,301,901	19,723,704	23,367,519	28,550,599	36,228,516
North America	Mideast	1,039,273	1,386,259	1,625,053	1,669,416	1,689,721	2,054,105	2,274,927	2,519,891	3,089,383	3,775,407	4,587,414
North America	North America	915,384	1,481,709	2,319,919	2,451,494	2,564,711	3,224,188	3,678,078	4,115,582	5,103,339	6,265,706	7,610,161
North America	South America	7,657,465	7,973,009	7,904,649	8,284,607	8,499,900	10,031,440	11,188,407	12,464,141	16,000,637	21,498,121	29,428,521
North America	Caribbean	2,104,018	2,780,587	3,216,012	3,381,648	3,542,289	4,421,405	5,576,838	7,080,471	12,291,359	22,584,006	41,737,104
South America	Africa	476,801	658,631	686,646	716,026	731,189	881,104	1,022,005	1,213,838	1,847,195	3,117,232	5,918,715
South America	Asia	4,789,821	5,513,544	6,290,797	6,585,070	6,827,716	8,315,940	9,582,174	11,516,372	17,993,039	31,155,276	58,691,218
South America	Europe	7,526,027	9,977,116	12,575,320	13,078,592	13,481,176	15,939,507	17,098,291	17,564,540	20,425,528	24,477,897	31,115,685
South America	Mideast	985,393	1,642,410	1,732,073	1,835,807	1,952,052	2,483,955	2,876,780	3,422,898	5,081,265	7,789,459	11,767,760
South America	North America	4,766,716	7,634,131	11,467,719	11,949,004	12,558,142	15,572,475	17,643,952	19,620,599	24,368,998	30,271,096	37,673,079
South America	South America	4,587,595	6,806,509	8,291,400	8,810,733	9,370,967	12,436,508	14,382,577	16,604,420	22,465,121	31,405,336	45,704,374
South America	Caribbean	1,175,465	2,130,322	2,175,683	2,315,459	2,446,002	3,198,349	4,119,047	5,529,354	10,841,830	22,559,981	47,443,132
Caribbean	Africa	28,169	49,880	51,663	52,923	53,933	62,643	76,373	103,173	217,118	494,189	1,072,726
Caribbean	Asia	192,712	270,947	309,621	313,430	315,187	372,456	393,191	425,337	530,134	714,546	1,043,444
Caribbean	Europe	1,158,457	1,379,305	1,692,923	1,771,521	1,826,302	1,962,056	2,057,694	2,150,786	2,365,698	2,671,238	3,136,545
Caribbean	Mideast	62,459	122,170	132,209	133,075	135,090	138,478	140,484	152,802	183,907	237,004	316,688
Caribbean	North America	612,129	1,454,979	1,688,819	1,735,700	1,800,413	1,926,314	2,107,976	2,279,042	2,720,501	3,299,595	4,035,481
Caribbean	South America	537,945	854,158	1,006,848	1,058,668	1,101,269	1,316,569	1,420,760	1,528,383	1,753,905	2,030,929	2,405,267
Caribbean	Caribbean	953,394	2,016,072	2,053,868	2,180,321	2,297,677	2,964,826	3,775,541	4,991,092	9,546,754	19,099,246	37,458,686
Total		**415,903,802**	**585,779,045**	**680,466,339**	**714,406,073**	**750,794,332**	**944,828,009**	**1,118,704,744**	**1,350,216,056**	**2,084,839,637**	**3,479,383,450**	**6,112,163,178**
Average Annual Growth Rate			**7.09%**	**5.12%**	**4.99%**	**5.09%**	**4.70%**	**3.44%**	**3.83%**	**4.44%**	**5.26%**	**5.80%**

Containerized World Commodity by Destination (Metric Tonnes)

Containerized WORLD Commodity Forecast For AGRICULTURE COMMODITIES
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	126,675	214,318	238,600	242,992	246,585	272,605	299,894	362,205	581,110	1,083,272	2,275,484
Africa	Asia	206,205	363,976	373,482	384,210	391,532	439,162	523,615	634,346	1,202,951	2,577,500	5,877,924
Africa	Europe	517,552	840,391	836,790	897,737	946,798	1,214,483	1,394,109	1,610,669	2,179,969	3,139,504	5,088,158
Africa	Mideast	72,319	111,694	122,679	128,852	134,824	175,042	197,931	222,770	279,194	353,137	470,088
Africa	North America	24,252	33,571	49,063	50,349	50,979	57,528	62,753	67,555	76,343	84,861	93,126
Africa	South America	90,553	124,718	122,178	127,574	131,920	160,321	197,824	256,781	475,368	977,114	2,197,950
Africa	South America	6,626	7,015	7,108	7,751	8,408	13,384	21,768	37,917	105,856	273,749	617,041
Asia	Africa	281,097	485,481	537,331	555,878	572,896	716,136	832,607	1,003,370	1,570,624	2,716,790	4,830,769
Asia	Asia	7,327,402	10,113,987	10,581,493	10,927,473	11,050,055	12,619,069	14,213,342	16,584,564	23,381,429	34,968,500	51,818,542
Asia	Europe	1,129,995	1,275,076	1,421,800	1,499,382	1,568,970	1,872,885	2,121,361	2,431,395	3,136,732	4,105,219	5,369,844
Asia	Mideast	219,478	536,746	585,809	616,318	653,707	837,489	969,120	1,115,637	1,464,723	1,915,132	2,486,273
Asia	North America	4,755,483	3,333,091	4,346,165	4,714,314	4,831,926	5,569,045	6,047,726	6,522,683	7,694,348	9,094,313	11,162,219
Asia	South America	788,642	922,175	1,018,834	1,028,835	1,014,203	1,093,852	1,120,879	1,182,803	1,341,702	1,501,904	1,788,230
Asia	South America	87,397	119,620	130,272	131,644	124,528	130,966	125,454	124,907	132,439	151,076	184,672
Europe	Africa	1,509,157	1,765,752	1,980,018	2,001,308	2,023,971	2,148,892	2,237,473	2,285,468	2,441,558	2,676,151	3,053,415
Europe	Asia	1,885,286	2,846,559	3,170,060	3,154,137	3,124,979	2,863,330	2,682,623	2,630,462	2,582,533	2,636,708	2,764,746
Europe	Europe	2,946,713	4,399,423	4,826,945	4,971,036	5,141,573	5,937,624	6,354,580	6,968,447	8,011,677	9,495,399	11,904,927
Europe	Mideast	1,293,082	1,350,502	1,335,481	1,403,095	1,432,425	1,608,268	1,703,867	1,785,613	1,975,889	2,230,230	2,541,511
Europe	North America	1,560,773	1,455,691	1,388,621	1,244,257	1,228,926	1,243,340	1,279,756	1,310,978	1,399,580	1,519,246	1,669,062
Europe	South America	2,957,824	3,650,434	4,291,648	4,497,386	4,583,197	5,500,155	5,880,247	5,412,879	5,985,031	6,698,360	7,640,288
Europe	South America	750,954	716,646	850,558	912,216	944,714	991,656	1,048,348	1,082,508	1,150,362	1,257,600	1,434,548
Mideast	Africa	525,655	659,764	725,519	754,344	781,826	902,920	988,489	1,136,983	1,431,062	1,792,077	2,207,646
Mideast	Asia	1,302,544	1,341,153	1,386,505	1,447,397	1,483,685	1,728,251	1,892,010	2,092,623	2,517,897	3,011,175	3,590,023
Mideast	Europe	553,370	1,052,282	1,102,309	1,155,728	1,200,707	1,433,495	1,586,612	1,732,199	2,108,948	2,552,307	3,038,968
Mideast	Mideast	1,477,532	1,924,936	2,113,233	2,247,418	2,391,435	3,150,419	3,577,816	4,068,606	5,128,900	6,389,900	7,897,552
Mideast	North America	98,717	262,458	449,028	463,236	467,110	602,288	684,379	761,252	935,999	1,137,800	1,357,414
Mideast	South America	260,922	393,505	429,256	469,624	510,000	672,633	847,940	1,104,083	2,014,151	3,642,091	5,966,259
Mideast	South America	12,107	37,344	41,522	42,670	43,486	47,166	50,700	59,882	74,954	93,039	112,294
North America	Africa	25,024	64,714	63,278	61,399	61,447	63,277	64,325	64,808	65,167	65,491	66,392
North America	Asia	705,462	1,070,191	1,282,383	1,298,141	1,357,098	1,428,141	1,487,936	1,364,408	1,540,781	1,752,132	1,990,571
North America	Europe	218,895	553,073	697,214	688,421	685,676	779,556	808,664	776,959	814,867	871,121	936,366
North America	Mideast	34,173	36,539	34,780	36,832	38,486	43,834	47,463	47,183	51,960	57,719	64,562
North America	North America	132,031	249,421	129,714	131,702	132,372	127,221	129,800	135,807	157,657	187,562	223,175
North America	South America	1,012,862	1,654,040	2,358,275	2,364,765	2,422,543	2,568,439	2,660,747	2,710,846	2,945,872	3,223,243	3,530,763
North America	South America	241,944	542,049	582,908	599,311	605,441	515,070	491,660	448,053	356,126	275,200	210,403
South America	Africa	4,447	5,450	6,682	6,653	6,715	7,149	7,233	8,041	8,880	9,720	10,569
South America	Asia	102,866	90,455	120,307	126,187	131,556	156,338	168,894	189,171	226,088	270,533	337,066
South America	Europe	165,867	233,725	296,824	312,200	329,622	405,317	436,975	480,487	545,860	612,339	674,551
South America	Mideast	15,756	26,385	30,950	31,608	32,678	38,275	40,096	41,813	44,969	48,160	53,038
South America	North America	354,991	354,771	461,086	465,924	481,891	552,224	590,232	632,644	706,262	779,206	854,691
South America	South America	479,839	575,615	681,243	710,368	754,807	961,016	1,081,437	1,201,557	1,446,136	1,730,721	2,103,388
South America	South America	38,446	43,866	48,314	48,748	49,330	53,158	55,020	62,635	71,274	80,504	90,068
South America	Africa	1,579	4,379	4,820	5,159	5,509	7,568	10,257	13,719	25,617	49,134	94,100
South America	Asia	7,351	33,083	36,723	37,616	38,486	42,602	46,436	52,262	72,964	120,145	214,679
South America	Europe	112,727	170,302	164,920	178,057	189,497	242,204	263,138	278,422	303,938	328,051	353,311
South America	Mideast	733	1,694	1,841	2,008	2,117	2,483	2,559	2,606	2,714	2,814	2,917
South America	North America	227,374	304,989	325,898	338,054	349,045	391,157	411,323	425,877	450,437	472,047	490,717
South America	South America	106,532	168,767	169,022	179,572	190,195	247,214	301,943	367,483	584,034	1,010,727	1,850,461
South America	South America	86,133	347,477	349,786	383,684	418,186	614,642	837,276	1,113,240	2,085,053	4,024,308	7,767,136
Total		**36,643,344**	**46,849,291**	**52,109,278**	**54,083,571**	**55,368,060**	**63,249,291**	**68,886,643**	**75,007,807**	**93,887,289**	**124,045,034**	**171,377,795**
Average Annual Growth Rate			**5.04%**	**3.61%**	**3.79%**	**2.38%**	**2.70%**	**1.72%**	**1.72%**	**2.27%**	**2.82%**	**3.29%**

Containerized WORLD Commodity Forecast For CAPITAL EQUIPMENT
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	96,105	126,665	106,472	116,666	128,880	191,366	215,757	242,462	308,061	401,612	537,918
Africa	Asia	284,339	488,247	482,362	502,452	535,654	820,875	1,221,702	1,882,675	4,491,015	10,603,040	24,739,149
Africa	Europe	786,132	1,197,410	1,105,007	1,232,325	1,398,401	2,406,563	3,160,001	3,893,149	5,785,932	8,488,641	12,331,757
Africa	Mideast	45,073	74,401	65,742	72,733	80,868	132,504	197,174	296,124	668,849	1,502,236	3,407,571
Africa	North America	58,762	44,742	62,823	63,128	65,829	83,904	102,726	124,928	202,474	339,553	533,912
Africa	South America	20,484	22,893	24,054	25,501	28,126	44,531	56,762	69,554	104,150	159,177	255,543
Africa	South America	343	1,709	1,760	1,863	1,984	2,625	3,087	3,380	4,785	6,322	8,220
Asia	Africa	16,204	28,037	25,718	28,236	31,784	52,318	73,223	104,385	215,051	445,570	903,582
Asia	Asia	7,310,565	8,876,448	10,610,475	11,555,946	12,642,628	18,302,201	24,871,648	34,674,351	69,651,822	143,297,321	236,934,584
Asia	Europe	2,766,791	2,609,570	2,726,602	3,047,573	3,440,554	5,627,254	8,017,707	11,870,943	26,181,387	58,080,326	124,166,715
Asia	Mideast	30,683	69,020	66,541	73,778	82,170	131,149	178,572	241,180	441,355	813,482	1,492,120
Asia	North America	1,357,717	1,145,332	1,218,398	1,306,254	1,380,281	1,761,551	2,234,450	2,805,004	4,522,486	7,668,891	13,636,267
Asia	South America	77,356	70,448	93,564	100,958	111,504	159,704	221,537	319,412	680,228	1,473,133	3,087,936
Asia	South America	3,799	1,448	1,753	1,914	2,118	3,234	4,408	6,167	12,286	24,868	51,361
Europe	Africa	120,459	221,349	325,170	360,472	396,181	588,916	714,549	828,508	1,079,051	1,369,691	1,703,926
Europe	Asia	1,830,482	4,065,969	5,316,043	5,509,166	5,811,493	8,077,592	9,774,807	11,559,574	16,203,669	23,006,064	33,148,872
Europe	Europe	2,626,645	4,288,743	5,181,418	5,587,312	6,103,459	8,758,194	10,816,445	12,858,418	17,658,846	23,936,539	32,236,215
Europe	Mideast	175,484	397,435	505,442	551,673	598,240	925,526	1,146,389	1,356,468	1,841,199	2,451,879	3,235,483
Europe	North America	768,153	955,791	1,057,571	1,131,524	1,214,879	1,639,257	1,938,700	2,214,529	2,873,493	3,775,659	4,967,287
Europe	South America	149,011	260,560	381,073	414,155	446,040	614,970	758,943	888,852	1,179,983	1,532,060	1,959,422
Europe	South America	9,657	17,217	26,976	28,292	29,202	33,888	35,727	38,524	47,345	60,662	76,755
Mideast	Africa	10,249	18,489	15,888	17,612	19,405	28,605	33,134	39,078	55,283	80,666	120,581
Mideast	Asia	600,910	1,037,295	1,000,748	1,064,038	1,135,974	1,622,359	2,087,160	2,797,700	5,206,759	10,112,115	20,690,737
Mideast	Europe	1,000,378	1,492,941	1,493,062	1,695,281	1,931,274	3,177,490	3,988,888	4,957,961	7,662,395	11,774,969	17,777,154
Mideast	Mideast	103,974	197,405	185,347	209,475	236,778	384,661	517,589	709,886	1,371,506	2,761,233	5,886,436
Mideast	North America	58,351	66,091	55,234	57,048	59,785	73,798	84,474	92,782	109,146	125,957	144,445
Mideast	South America	13,157	16,305	19,168	21,234	23,841	37,775	51,296	68,376	120,530	210,706	367,608
Mideast	South America	227	2,230	2,459	2,695	2,960	3,832	4,303	4,943	6,763	9,434	13,186
North America	Africa	30,762	67,183	92,827	104,089	118,089	189,300	236,926	283,363	393,436	529,511	692,012
North America	Asia	4,975,587	6,437,685	7,764,022	8,489,074	9,288,887	13,602,661	16,730,335	19,779,645	27,126,874	36,407,430	47,599,960
North America	Europe	1,974,685	2,761,630	2,863,522	3,140,201	3,494,169	5,251,520	6,687,576	8,162,927	11,707,986	16,206,956	21,737,246
North America	Mideast	32,104	47,691	55,708	59,256	66,692	108,116	137,404	165,679	233,843	320,888	428,353
North America	North America	13,061	34,234	22,211	24,844	26,546	34,602	40,590	44,997	54,107	63,737	74,222
North America	South America	569,218	833,817	1,106,305	1,236,255	1,298,598	1,799,391	2,233,727	2,650,110	3,642,338	4,860,053	6,312,527
North America	South America	432	2,157	2,139	2,456	2,801	4,477	5,743	7,013	10,160	14,325	19,695
South America	Africa	5,571	5,018	5,546	6,320	7,087	11,011	13,218	15,267	20,220	26,452	34,074
South America	Asia	315,412	475,552	562,150	612,370	662,405	917,441	1,190,178	1,514,008	1,968,350	3,181,959	5,567,219
South America	Europe	654,231	947,516	1,106,144	1,273,445	1,458,642	2,441,419	2,938,911	3,370,201	4,411,444	5,742,293	7,431,746
South America	Mideast	8,146	11,388	12,309	13,552	14,841	19,801	21,791	23,761	29,397	37,923	49,880
South America	North America	748,123	696,502	567,023	615,688	637,548	792,803	900,496	980,095	1,158,618	1,366,387	1,604,028
South America	South America	154,476	191,711	239,848	268,659	299,068	470,306	558,661	639,672	835,865	1,094,025	1,424,116
South America	South America	6,443	11,075	13,396	15,111	17,164	27,768	33,195	37,521	47,085	58,415	71,858
South America	Africa	266	1,343	1,189	1,323	1,473	2,156	2,295	2,385	2,579	2,793	3,030
South America	Asia	70,556	121,797	119,942	127,520	136,290	194,061	277,963	404,298	902,348	1,994,063	4,099,854
South America	Europe	139,846	183,088	163,001	182,826	205,074	311,576	337,508	359,242	406,482	460,169	519,251
South America	Mideast	1,540	4,328	3,928	4,213	4,614	6,072	8,574	13,350	33,731	84,707	213,735
South America	North America	88,905	105,635	107,234	109,220	112,056	127,081	127,368	128,579	136,720	151,384	170,439
South America	South America	33,626	49,905	46,973	52,259	58,227	89,860	108,828	134,853	225,002	418,313	859,059
South America	South America	11,121	17,907	16,434	18,131	19,966	28,671	31,878	34,684	40,381	46,622	53,542
Total		**30,161,601**	**40,801,371**	**47,028,723**	**51,136,117**	**55,890,528**	**82,116,732**	**105,044,410**	**133,501,161**	**222,073,016**	**387,583,211**	**643,380,588**
Average Annual Growth Rate			**6.23%**	**4.85%**	**8.73%**	**9.30%**	**8.00%**	**5.05%**	**4.91%**	**5.22%**	**5.73%**	**5.20%**

Containerized WORLD Commodity Forecast For CHEMICALS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	218,342	423,716	446,549	468,440	489,593	625,976	855,441	1,282,437	2,974,035	7,041,453	17,145,922
Africa	Asia	345,604	668,047	716,515	747,440	784,714	1,131,122	1,660,104	2,551,891	5,966,132	13,937,902	33,149,940
Africa	Europe	1,454,846	1,804,003	1,899,212	2,021,425	2,149,032	3,053,474	3,809,898	4,666,839	6,716,940	9,549,349	13,878,396
Africa	Mideast	317,694	620,614	636,709	705,922	781,555	1,345,532	2,543,087	4,258,669	12,396,250	32,396,443	76,957,668
Africa	North America	109,589	151,963	125,526	123,689	124,358	140,862	158,209	178,832	233,516	319,177	469,181
Africa	South America	50,779	76,236	82,520	84,354	87,931	117,904	141,044	162,004	213,225	272,706	345,736
Africa	South America	1,511	3,216	2,967	2,968	3,016	3,464	3,769	4,257	5,979	9,728	17,809
Asia	Africa	263,457	449,501	497,452	542,451	591,477	858,967	1,160,606	1,569,819	2,926,045	5,670,506	11,286,619
Asia	Asia	23,305,153	40,863,341	49,992,415	53,664,713	57,643,427	78,052,964	100,977,500	133,118,158	244,540,114	478,631,573	969,766,814
Asia	Europe	5,312,014	6,596,806	7,337,485	8,011,503	8,707,662	12,675,998	16,922,271	22,996,948	44,526,735	90,639,081	188,634,467
Asia	Mideast	1,433,451	2,245,268	2,455,043	2,586,494	2,684,333	3,240,196	4,091,712	5,258,935	9,823,745	19,408,534	35,926,091
Asia	North America	6,495,834	5,958,462	6,971,986	7,141,491	7,372,622	8,581,454	10,076,158	12,153,505	18,956,598	32,454,894	59,886,272
Asia	South America	243,236	283,205	300,355	319,655	342,368	476,797	622,474	820,022	1,516,264	3,013,220	6,208,460
Asia	South America	3,629	7,516	7,578	8,210	8,943	13,385	18,662	26,985	58,005	127,419	278,756
Europe	Africa	133,825	263,492	314,367	329,220	341,850	436,366	504,269	563,426	694,550	857,889	1,060,963
Europe	Asia	2,159,282	4,090,160	5,323,078	5,460,164	5,475,200	6,590,401	7,473,257	8,351,369	10,881,445	15,365,906	23,771,937
Europe	Europe	8,933,484	12,543,768	14,459,070	14,871,645	15,304,990	17,867,220	19,628,356	21,157,911	25,000,646	30,495,836	38,166,180
Europe	Mideast	816,502	1,324,030	1,494,289	1,543,314	1,583,288	1,879,463	2,160,746	2,423,325	3,165,836	4,521,358	7,362,716
Europe	North America	2,331,422	3,136,147	3,484,872	3,426,942	3,360,682	3,819,684	4,242,336	4,646,186	5,691,951	7,206,157	9,505,116
Europe	South America	319,259	605,751	728,356	752,044	776,331	966,079	1,116,605	1,246,296	1,530,835	1,867,710	2,265,292
Europe	South America	58,498	61,705	76,712	80,116	86,079	105,655	119,230	132,505	163,277	201,010	247,153
Mideast	Africa	43,133	68,741	72,763	79,115	86,048	128,270	184,991	289,367	698,127	1,668,317	3,902,797
Mideast	Asia	550,427	1,227,583	1,310,181	1,408,951	1,490,623	1,940,873	2,333,154	2,897,470	4,613,129	7,793,293	14,366,282
Mideast	Europe	2,074,352	3,190,173	3,648,555	3,988,353	4,317,744	6,124,186	7,197,326	8,621,878	12,334,523	17,529,091	24,712,869
Mideast	Mideast	514,904	1,111,543	1,172,194	1,248,505	1,321,292	1,803,353	2,405,440	3,450,986	7,603,865	16,828,028	32,071,832
Mideast	North America	193,479	244,076	287,851	294,447	302,110	332,523	363,567	403,288	500,143	628,242	796,781
Mideast	South America	34,703	63,252	68,933	73,095	76,584	99,680	115,605	138,578	193,712	269,992	374,629
Mideast	South America	1,190	5,758	6,264	6,824	7,388	10,447	12,108	14,485	20,835	29,902	42,407
North America	Africa	24,646	49,318	63,773	68,154	75,247	95,709	118,151	138,483	190,045	258,913	349,336
North America	Asia	1,781,920	3,272,331	3,925,475	4,000,609	4,197,473	5,028,641	5,719,212	6,272,487	7,708,280	9,732,445	12,402,994
North America	Europe	2,268,340	3,092,684	3,503,928	3,552,033	3,745,655	4,878,843	5,330,697	5,538,451	6,418,250	7,888,312	9,814,684
North America	Mideast	124,373	219,208	225,397	235,740	249,311	302,068	342,725	381,355	471,735	583,479	721,107
North America	North America	201,538	280,608	337,625	355,451	371,346	438,755	497,316	545,944	662,115	809,071	987,448
North America	South America	322,642	506,448	660,845	679,072	719,052	843,379	960,017	1,035,057	1,216,006	1,451,159	1,754,651
North America	South America	4,495	28,521	19,002	20,918	23,112	31,208	38,348	45,095	61,746	83,689	112,083
South America	Africa	25,196	21,268	27,949	30,108	31,859	40,920	45,969	50,506	60,279	71,283	83,952
South America	Asia	250,544	621,510	798,959	874,224	934,247	1,248,354	1,493,069	1,828,027	2,888,041	4,996,843	9,674,942
South America	Europe	871,898	1,142,874	1,393,421	1,534,458	1,661,532	2,337,325	2,674,946	3,015,554	3,797,603	4,757,200	5,953,659
South America	Mideast	32,361	86,191	115,260	119,562	126,262	161,171	180,174	198,472	244,338	317,582	459,280
South America	North America	2,095,334	2,736,216	2,752,157	2,920,042	2,981,818	3,475,293	3,999,560	4,633,921	6,683,528	10,330,197	15,840,957
South America	South America	890,703	1,498,769	1,770,377	1,912,971	2,032,458	2,643,328	3,087,912	3,589,895	4,868,795	6,614,234	8,860,000
South America	South America	29,568	47,097	53,631	56,596	59,668	73,218	83,489	93,110	114,502	141,731	179,749
South America	Africa	824	5,655	5,995	6,267	6,529	7,750	8,410	9,033	10,355	11,944	13,823
South America	Asia	32,811	138,807	147,755	159,812	169,814	225,857	293,995	387,898	725,089	1,438,169	2,913,278
South America	Europe	163,427	181,358	188,176	202,719	214,952	273,051	306,684	339,672	419,607	552,272	819,334
South America	Mideast	2,529	8,369	8,605	9,185	9,688	12,463	15,681	19,462	30,870	49,610	78,246
South America	North America	361,048	451,458	510,285	533,445	552,794	651,130	749,673	852,921	1,104,301	1,396,708	1,700,082
South America	South America	113,460	212,617	215,577	233,417	250,574	350,252	463,915	608,631	1,095,436	2,029,413	3,776,158
South America	South America	62,096	124,394	123,946	131,233	138,121	175,654	219,826	279,621	476,012	807,490	1,311,080
Total		**67,379,549**	**102,813,714**	**120,767,932**	**127,627,510**	**134,852,752**	**175,714,659**	**217,327,672**	**273,249,965**	**463,193,395**	**853,076,458**	**1,650,405,986**
Average Annual Growth Rate			**8.82%**	**5.51%**	**5.68%**	**5.66%**	**5.44%**	**4.34%**	**4.69%**	**5.42%**	**6.30%**	**6.82%**

Containerized WORLD Commodity Forecast For CONSUMER GOODS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	138,511	155,019	163,646	173,835	182,720	220,350	237,894	262,263	328,357	431,074	589,471
Africa	Asia	184,917	344,519	364,047	376,558	400,638	576,054	795,526	1,171,588	2,623,256	5,999,245	14,106,031
Africa	Europe	306,321	457,580	474,535	510,980	556,985	835,524	1,018,995	1,227,889	1,791,984	2,692,975	4,302,924
Africa	Mideast	44,839	103,883	109,988	118,125	126,821	174,525	212,876	260,306	397,393	623,800	1,006,675
Africa	North America	11,320	13,128	12,154	11,394	12,162	14,823	17,159	19,698	27,328	41,407	66,081
Africa	South America	2,200	4,212	4,623	4,725	5,106	7,665	8,978	10,310	13,494	17,688	23,276
Africa	South America	228	431	465	471	486	583	652	726	898	1,111	1,360
Asia	Africa	6,576	10,302	11,146	12,074	13,182	20,435	26,694	34,585	57,343	94,804	158,060
Asia	Asia	5,365,599	9,123,885	10,738,463	11,293,463	11,701,931	15,845,173	18,745,870	22,769,433	34,579,931	53,878,050	86,557,785
Asia	Europe	660,297	978,999	1,116,441	1,190,986	1,279,615	1,871,771	2,376,846	3,025,744	5,055,458	8,674,487	15,220,992
Asia	Mideast	20,819	43,000	47,218	52,009	57,435	88,394	114,690	147,413	239,684	387,555	626,779
Asia	North America	563,194	541,235	560,728	600,918	637,036	802,998	1,015,742	1,314,133	2,348,890	4,427,098	8,524,250
Asia	South America	22,449	28,871	33,559	36,058	38,083	52,907	66,116	83,493	135,300	223,774	379,728
Asia	South America	1,074	1,469	1,522	1,550	1,625	2,154	2,531	2,895	4,030	6,031	9,307
Europe	Africa	352,191	571,610	723,072	724,285	715,198	647,422	644,568	648,929	726,359	866,614	1,054,893
Europe	Asia	3,583,802	6,558,882	8,184,969	8,298,375	8,439,371	9,573,630	10,296,358	11,396,419	14,763,235	20,612,062	31,422,301
Europe	Europe	1,781,337	3,138,308	3,664,239	3,867,005	4,092,735	5,207,129	5,926,066	6,784,808	9,099,516	12,458,779	17,408,994
Europe	Mideast	238,136	445,345	541,907	592,162	647,567	862,407	991,874	1,123,378	1,447,311	1,871,424	2,409,390
Europe	North America	245,569	319,204	366,399	375,780	388,132	448,157	499,467	574,961	824,120	1,309,011	2,284,889
Europe	South America	101,392	171,888	227,240	241,609	256,921	348,931	368,329	419,469	550,538	716,591	922,971
Europe	South America	7,883	15,610	18,374	18,791	19,430	23,296	25,858	28,558	34,880	42,364	51,168
Mideast	Africa	28,346	46,795	46,531	51,221	56,238	78,425	94,402	115,881	174,687	263,024	395,595
Mideast	Asia	605,231	872,209	903,487	945,527	1,001,457	1,319,335	1,632,410	2,129,133	3,848,038	7,277,662	14,470,673
Mideast	Europe	566,070	885,503	975,014	1,085,611	1,217,497	1,849,417	2,264,907	2,797,506	4,264,822	6,527,633	10,186,365
Mideast	Mideast	152,628	246,131	261,557	272,307	282,901	330,277	372,696	424,895	545,741	705,054	924,995
Mideast	North America	16,119	25,302	22,983	24,284	26,164	34,957	42,698	51,396	75,377	113,518	175,509
Mideast	South America	1,988	2,922	3,310	3,657	4,067	6,222	7,706	9,578	14,902	23,452	37,570
Mideast	South America	308	1,393	1,483	1,556	1,637	2,062	2,362	2,681	3,752	6,270	12,290
North America	Africa	13,313	28,086	47,361	50,460	54,228	72,220	84,109	95,379	120,598	149,191	180,942
North America	Asia	6,023,510	10,716,891	13,447,034	14,085,432	15,327,510	21,940,641	25,723,418	29,905,475	40,166,833	53,056,940	68,593,701
North America	Europe	664,265	1,204,376	1,269,099	1,365,560	1,477,343	1,855,092	2,156,432	2,433,338	3,136,855	4,119,013	5,393,789
North America	Mideast	78,719	126,271	156,633	177,631	199,987	230,318	259,967	300,656	401,414	524,332	659,692
North America	North America	7,809	114,116	140,881	148,461	153,873	201,696	236,053	273,789	361,343	471,306	608,601
North America	South America	163,131	243,015	321,984	348,180	355,850	498,962	569,132	665,369	906,685	1,218,041	1,604,438
North America	South America	157,158	590,686	703,932	722,494	756,130	894,648	1,029,488	1,170,178	1,515,132	1,916,611	2,366,692
South America	Africa	429	1,125	1,434	1,583	1,746	2,677	3,189	3,678	4,933	6,673	9,221
South America	Asia	378,044	488,704	588,342	635,175	686,581	974,679	1,132,729	1,310,221	1,830,013	2,706,244	4,261,863
South America	Europe	163,268	280,936	346,023	384,302	423,723	639,470	762,518	884,710	1,183,822	1,588,286	2,165,598
South America	Mideast	2,027	5,047	6,164	6,684	7,172	9,535	10,907	12,232	15,359	19,590	25,903
South America	North America	285,002	372,209	310,299	320,550	346,747	434,314	494,101	548,676	680,869	850,887	1,063,686
South America	South America	130,889	201,298	241,801	264,375	287,289	417,578	493,110	575,965	781,027	1,063,557	1,479,909
South America	South America	34,964	72,479	83,831	88,177	93,047	118,156	129,320	136,858	151,401	171,485	204,603
South America	Africa	872	1,483	1,594	1,768	1,963	2,898	3,196	3,571	4,807	7,201	11,605
South America	Asia	58,377	92,222	94,193	102,649	111,280	163,968	238,646	349,848	764,223	1,666,207	3,613,594
South America	Europe	105,567	94,943	96,095	106,344	116,484	164,660	180,036	195,817	236,244	298,460	401,884
South America	Mideast	793	1,128	1,181	1,260	1,340	1,743	2,083	2,498	3,798	6,200	10,603
South America	North America	165,416	430,022	296,461	309,951	322,420	371,798	401,717	430,972	491,497	558,796	630,019
South America	South America	41,451	103,403	107,134	115,367	123,119	162,008	194,942	239,523	392,265	683,655	1,189,110
South America	South America	105,745	238,262	250,235	275,126	297,406	396,764	463,574	533,596	699,635	915,862	1,180,223
Total		**23,790,095**	**40,514,340**	**48,092,747**	**50,406,045**	**53,308,379**	**70,798,847**	**82,378,940**	**96,910,616**	**137,825,374**	**202,291,094**	**308,985,997**
Average Annual Growth Rate			**11.24%**	**5.88%**	**4.81%**	**5.76%**	**5.84%**	**3.08%**	**3.30%**	**3.58%**	**3.91%**	**4.33%**

Containerized WORLD Commodity Forecast For EXTRACTIVE COMMODITIES
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	25,456	39,941	37,375	36,323	35,294	30,885	27,310	25,539	24,259	24,524	25,653
Africa	Asia	16,997	21,943	23,066	23,579	24,120	26,430	27,953	30,046	34,621	40,235	48,125
Africa	Europe	175,800	244,188	233,970	241,669	249,744	287,254	326,723	375,731	524,359	829,798	1,541,281
Africa	Mideast	11,817	20,615	21,366	22,190	22,647	24,599	25,712	26,804	28,791	30,539	32,194
Africa	North America	226,734	48,632	55,931	56,821	57,291	61,476	64,388	65,278	66,348	67,087	67,837
Africa	South America	8,424	15,262	13,963	14,264	15,097	17,349	19,479	21,679	25,642	29,423	33,313
Africa	South America	1	36	38	41	42	46	49	53	60	67	74
Asia	Africa	82,954	99,283	98,491	109,329	119,524	152,068	169,922	194,844	266,873	384,340	579,192
Asia	Asia	4,724,378	6,755,553	7,493,923	7,783,547	8,108,555	8,977,020	9,114,508	9,823,011	12,594,480	18,548,183	31,236,877
Asia	Europe	469,239	922,599	903,314	989,457	1,016,857	1,178,999	1,297,109	1,455,309	1,863,047	2,344,591	2,911,344
Asia	Mideast	305,170	439,923	457,018	500,906	521,568	618,483	673,478	769,210	1,023,476	1,388,608	1,940,222
Asia	North America	2,589,313	3,080,219	3,736,558	4,018,955	4,103,900	4,518,063	4,726,914	4,987,580	5,682,920	6,476,502	7,481,651
Asia	South America	440,983	573,159	606,397	683,756	753,776	891,816	1,005,314	1,166,688	1,665,766	2,560,349	4,159,393
Asia	South America	1,197	1,199	1,383	1,443	1,480	1,607	1,720	1,895	2,377	3,105	4,305
Europe	Africa	132,265	165,668	172,484	174,026	177,664	185,553	181,707	182,251	187,500	197,337	211,155
Europe	Asia	164,645	247,406	300,319	291,925	294,147	321,267	312,111	310,669	318,570	333,996	353,380
Europe	Europe	3,371,495	3,429,994	3,428,673	3,504,203	3,518,091	3,535,517	3,369,080	3,304,472	3,368,334	3,792,653	4,594,840
Europe	Mideast	234,969	466,271	499,052	504,081	521,504	555,966	554,791	566,242	595,254	632,300	674,175
Europe	North America	1,019,700	825,601	1,001,809	1,004,350	1,048,044	1,105,614	1,067,340	1,052,510	1,035,774	1,044,212	1,066,450
Europe	South America	333,591	453,548	506,712	482,656	487,843	546,922	543,725	549,606	569,964	599,815	636,062
Europe	South America	7,916	14,983	16,651	16,839	16,870	17,244	16,676	16,415	16,234	16,175	16,184
Mideast	Africa	3,872	5,458	5,174	5,384	5,706	6,887	6,986	7,397	8,661	10,437	12,714
Mideast	Asia	34,699	62,167	64,134	65,464	65,937	71,291	69,550	71,875	83,537	108,650	161,549
Mideast	Europe	577,298	483,974	504,498	496,135	517,141	508,152	535,566	585,545	725,202	910,474	1,155,856
Mideast	Mideast	90,625	118,478	125,083	128,387	132,230	141,207	139,096	143,537	156,874	175,124	197,447
Mideast	North America	34,246	17,336	46,345	45,808	45,785	52,769	55,697	59,596	69,302	81,617	96,827
Mideast	South America	24,421	45,260	47,231	46,370	46,698	49,969	49,720	51,817	59,385	70,708	85,232
Mideast	South America	6	42	47	50	51	49	48	52	62	73	85
North America	Africa	22,475	23,933	33,741	36,491	38,055	48,001	50,011	50,776	52,951	55,734	58,950
North America	Asia	208,491	221,561	331,505	322,371	329,410	314,338	295,672	277,325	249,780	232,447	224,139
North America	Europe	100,286	163,914	154,562	145,066	141,522	179,188	173,713	166,512	164,236	171,413	185,505
North America	Mideast	16,336	39,744	8,597	9,627	10,647	11,106	11,688	11,983	12,846	13,955	15,270
North America	North America	120,285	233,088	250,062	260,641	256,673	280,922	299,956	318,797	363,640	416,997	479,423
North America	South America	200,457	166,562	177,108	183,366	190,780	209,833	216,386	221,907	236,247	256,791	279,326
North America	South America	9,479	10,182	10,473	10,983	11,299	11,943	12,167	12,431	13,182	14,017	14,904
South America	Africa	1,512	2,023	2,460	2,666	2,801	3,399	3,477	3,612	4,021	4,510	5,037
South America	Asia	7,349	15,133	17,162	17,964	18,454	20,501	20,901	21,478	22,956	24,624	26,410
South America	Europe	56,740	48,776	57,440	59,571	59,657	60,850	61,298	63,307	67,671	72,247	77,118
South America	Mideast	13,385	15,617	19,892	21,334	21,749	21,145	20,425	20,264	20,220	20,311	20,478
South America	North America	381,831	320,063	368,115	387,744	393,752	424,243	436,303	450,365	489,153	533,148	579,385
South America	South America	54,260	79,956	91,669	96,928	100,543	115,273	120,636	128,940	150,658	181,861	230,212
South America	South America	71,663	80,009	88,986	88,154	89,136	87,668	82,348	78,495	71,791	65,789	60,358
South America	Africa	32	235	244	256	265	303	336	363	389	398	402
South America	Asia	353	857	980	1,032	1,074	1,269	1,470	1,712	2,395	3,886	7,168
South America	Europe	9,216	47,951	47,482	50,411	52,383	60,044	66,550	72,136	77,445	79,413	80,160
South America	Mideast	17	300	310	327	341	397	440	478	521	548	570
South America	North America	64,221	10,871	63,633	64,413	65,118	66,093	66,879	67,464	68,706	70,413	72,795
South America	South America	20,827	35,766	33,237	34,105	35,052	41,296	54,493	74,979	167,848	395,499	948,352
South America	South America	6,976	8,037	7,383	8,059	8,557	11,483	16,350	23,286	47,780	96,367	189,079
Total		**16,474,402**	**20,123,316**	**22,166,047**	**23,049,465**	**23,735,450**	**25,853,799**	**26,394,171**	**27,912,265**	**33,282,109**	**43,411,291**	**62,878,455**
Average Annual Growth Rate			**4.08%**	**3.28%**	**3.99%**	**2.98%**	**1.72%**	**0.41%**	**1.12%**	**1.78%**	**2.69%**	**3.77%**

Containerized WORLD Commodity Forecast For FOOD
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	983,503	1,156,633	1,253,678	1,265,080	1,261,594	1,237,505	1,292,152	1,548,786	2,823,133	6,053,183	14,171,151
Africa	Asia	787,030	1,281,499	1,436,622	1,412,276	1,389,062	1,367,232	1,367,061	1,448,451	1,827,323	2,690,995	4,674,144
Africa	Europe	4,128,137	3,974,807	4,309,183	4,504,718	4,581,255	4,787,178	4,903,761	5,132,651	5,713,755	6,505,490	7,797,288
Africa	Mideast	352,052	311,735	347,995	321,892	299,256	230,460	208,071	209,227	252,337	366,485	628,000
Africa	North America	95,711	128,847	186,897	183,238	182,367	205,157	212,726	224,973	251,429	279,382	308,849
Africa	South America	205,560	297,455	316,129	337,747	339,982	382,908	409,149	447,146	575,474	830,701	1,388,528
Africa	South America	18,137	30,126	31,433	31,649	31,443	31,367	33,284	39,342	70,985	152,739	330,659
Asia	Africa	458,635	630,601	702,488	719,148	753,626	888,354	988,299	1,006,517	1,180,670	1,388,460	1,624,802
Asia	Asia	15,309,215	22,528,003	23,307,684	24,086,290	24,908,327	29,863,001	33,582,991	38,312,262	51,430,295	72,515,253	105,985,111
Asia	Europe	4,936,818	6,581,318	7,445,144	7,570,978	7,825,695	9,528,154	10,269,867	11,095,206	13,296,574	15,919,767	18,592,245
Asia	Mideast	297,591	668,063	734,817	748,207	772,207	835,899	887,761	968,363	1,185,063	1,545,947	1,959,726
Asia	North America	8,627,254	10,255,123	10,269,425	10,709,651	11,135,955	13,277,732	14,332,129	15,627,340	18,513,950	21,959,304	24,886,544
Asia	South America	1,688,996	2,035,934	2,296,727	2,441,579	2,568,976	3,358,915	3,913,068	4,681,512	7,082,722	11,600,720	20,854,183
Asia	South America	76,542	114,931	135,527	137,795	145,594	181,779	195,567	209,750	245,203	288,286	336,526
Europe	Africa	1,302,185	1,651,250	1,946,106	1,945,095	1,996,881	2,256,039	2,323,435	2,392,495	2,547,868	2,734,357	2,911,070
Europe	Asia	8,282,983	11,417,707	13,771,112	14,463,735	14,660,553	14,605,472	14,704,026	15,360,209	17,099,420	19,775,424	23,841,146
Europe	Europe	11,582,153	12,624,273	14,622,479	15,036,084	15,406,687	16,650,993	17,139,608	17,918,178	20,096,158	23,826,208	31,209,285
Europe	Mideast	1,592,410	1,485,461	1,622,643	1,639,973	1,713,150	1,678,866	1,668,375	1,683,921	1,769,692	1,960,984	2,287,570
Europe	North America	2,398,724	2,725,828	3,050,281	3,192,567	3,300,724	3,515,501	3,602,326	3,768,012	4,172,791	4,632,456	5,120,509
Europe	South America	2,273,765	2,812,913	3,632,425	3,767,009	3,925,084	4,703,638	4,964,145	5,336,851	6,382,518	8,247,212	12,092,909
Europe	South America	261,893	499,300	633,041	642,473	655,207	709,185	726,051	761,558	848,237	966,263	1,151,738
Mideast	Africa	120,963	228,557	248,118	260,837	273,629	339,989	386,997	445,491	586,178	754,946	950,170
Mideast	Asia	1,635,916	2,004,186	2,156,613	2,228,883	2,328,482	2,691,705	2,986,426	3,373,465	4,312,276	5,510,811	7,023,942
Mideast	Europe	2,731,653	3,369,233	3,749,126	4,012,995	4,260,006	5,523,440	6,362,003	7,429,797	10,049,059	13,349,341	17,529,441
Mideast	Mideast	866,743	1,323,078	1,434,762	1,504,186	1,585,700	1,879,289	2,116,389	2,435,353	3,247,222	4,359,189	6,005,217
Mideast	North America	115,429	254,763	282,200	299,571	307,032	448,843	513,208	586,856	753,598	939,025	1,133,063
Mideast	South America	484,489	972,267	993,203	1,044,899	1,106,322	1,402,402	1,556,306	1,749,462	2,201,712	2,746,829	3,374,064
Mideast	South America	46,908	71,851	76,220	74,883	74,945	69,288	64,476	63,014	65,808	79,366	104,192
North America	Africa	67,786	113,460	136,637	154,811	177,013	239,974	262,896	283,453	323,701	363,442	402,296
North America	Asia	3,052,310	4,365,041	5,611,963	5,451,481	5,764,064	6,908,010	7,398,852	7,850,085	8,794,409	9,796,677	10,844,777
North America	Europe	3,646,020	5,484,810	6,067,796	6,440,386	7,064,301	8,095,291	8,572,001	9,037,399	10,001,913	10,926,672	11,763,548
North America	Mideast	195,803	174,122	216,416	239,530	269,548	321,607	351,602	379,890	438,910	499,869	561,069
North America	North America	68,397	109,787	922,728	983,507	1,047,747	1,465,425	1,688,598	1,902,267	2,351,840	2,823,521	3,302,357
North America	South America	1,000,229	1,356,561	1,776,035	1,866,845	1,953,823	2,443,716	2,608,897	2,781,994	3,144,222	3,508,881	3,882,312
North America	South America	113,222	164,648	205,194	206,221	215,727	226,451	223,812	223,258	221,664	218,945	219,069
South America	Africa	249,351	24,062	29,197	29,854	30,902	37,409	40,784	43,895	52,239	61,929	71,891
South America	Asia	254,919	255,897	304,456	320,048	330,486	382,556	415,766	448,148	515,503	588,068	665,279
South America	Europe	1,675,736	1,276,666	1,528,523	1,629,377	1,738,299	2,300,804	2,563,655	2,810,891	3,329,090	3,871,383	4,428,708
South America	Mideast	35,445	32,005	41,124	43,555	45,915	57,744	64,430	71,220	86,940	107,545	139,139
South America	North America	1,068,085	826,425	899,993	940,178	1,016,932	1,459,604	1,651,992	1,845,196	2,259,988	2,709,326	3,181,602
South America	South America	1,546,159	2,223,213	2,695,657	2,836,361	3,019,366	4,084,383	4,610,827	5,181,285	6,581,818	8,449,266	10,918,865
South America	South America	164,143	235,860	268,637	284,931	289,465	324,066	346,910	370,881	423,317	481,854	549,457
South America	Africa	13,132	16,989	18,617	19,501	19,847	21,346	22,710	25,252	34,874	54,833	98,527
South America	Asia	164,961	137,304	152,497	149,739	146,276	128,070	120,512	124,149	157,343	244,675	428,340
South America	Europe	1,076,672	957,084	1,033,840	1,084,597	1,123,247	1,247,697	1,261,228	1,284,691	1,317,250	1,346,121	1,378,948
South America	Mideast	5,384	13,113	14,614	14,450	14,174	13,087	13,427	15,508	26,138	52,239	114,394
South America	North America	247,052	413,453	440,925	461,660	474,515	497,670	507,230	534,998	641,343	865,898	1,269,454
South America	South America	357,415	651,757	665,515	702,538	732,514	899,661	1,113,733	1,431,123	2,619,404	5,114,004	9,923,522
South America	South America	285,801	644,399	638,554	660,835	682,300	808,787	1,010,228	1,348,952	2,716,117	5,506,834	9,899,667
Total		**86,547,398**	**110,912,424**	**124,660,995**	**129,106,843**	**133,946,202**	**154,673,053**	**166,509,948**	**182,250,726**	**224,616,474**	**289,561,104**	**392,315,292**
Average Annual Growth Rate			**5.09%**	**3.97%**	**3.57%**	**3.75%**	**2.92%**	**1.49%**	**1.82%**	**2.11%**	**2.57%**	**3.08%**

Containerized WORLD Commodity Forecast For FUELS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	157	133	120	120	120	123	124	128	137	147	160
Africa	Asia	113	188	197	203	208	244	275	310	388	478	587
Africa	Europe	49,776	67,613	68,590	71,017	73,491	89,481	107,065	126,165	168,289	219,340	282,430
Africa	Mideast	125	895	930	948	962	1,057	1,152	1,238	1,399	1,564	1,746
Africa	North America	608	1,383	2,539	2,524	2,582	2,329	2,147	2,138	2,137	2,121	2,066
Africa	South America	37	15	14	15	15	17	18	20	22	25	28
Africa	South America	1	0	0	0	0	0	0	0	1	1	1
Asia	Africa	17	21	19	20	20	23	27	34	55	93	162
Asia	Asia	520,591	806,626	892,743	943,029	1,006,917	1,355,025	1,758,145	2,314,794	4,237,341	8,142,106	15,941,625
Asia	Europe	59,966	69,645	75,925	83,059	91,247	137,019	195,432	279,344	589,843	1,274,047	2,715,818
Asia	Mideast	39	1,434	1,491	1,573	1,658	1,860	2,087	2,364	3,027	3,760	4,448
Asia	North America	77,600	106,130	249,866	245,718	245,381	227,418	216,022	214,657	236,388	302,961	431,531
Asia	South America	87	1,885	2,166	2,251	2,332	2,689	3,154	3,864	6,554	11,747	22,966
Asia	South America	29	15	19	21	22	32	44	62	109	197	337
Europe	Africa	6	4	5	5	5	6	7	8	10	12	15
Europe	Asia	25,974	4,779	5,000	5,378	5,665	7,347	8,843	10,345	14,020	18,942	25,442
Europe	Europe	935,614	1,009,845	1,112,105	1,085,433	1,109,743	1,220,938	1,309,794	1,401,493	1,624,860	1,896,425	2,221,572
Europe	Mideast	12,750	6,738	7,885	7,896	8,341	9,764	10,774	11,728	13,816	16,214	18,997
Europe	North America	17,754	27,839	31,647	32,885	32,610	28,686	26,298	24,870	23,285	22,690	23,338
Europe	South America	2,471	4,313	4,230	4,185	4,346	4,737	4,965	5,111	5,451	5,920	6,576
Europe	South America	110	114	116	114	119	130	152	162	183	207	235
Mideast	Africa	0	2	2	2	2	2	3	3	4	6	7
Mideast	Asia	1,734	11,416	11,101	11,701	12,183	14,708	17,280	20,224	27,149	35,999	47,110
Mideast	Europe	127,607	217,668	237,349	245,343	252,503	300,812	344,525	394,604	517,342	674,957	872,309
Mideast	Mideast	2,281	8,630	10,099	10,078	10,070	10,238	10,436	10,778	11,640	12,628	13,601
Mideast	North America	4,044	1,838	858	830	845	768	731	741	758	769	767
Mideast	South America	219	874	990	994	998	1,040	1,080	1,132	1,274	1,440	1,613
Mideast	South America	1	2	2	2	2	2	2	2	3	3	4
North America	Africa	0	0	0	0	0	0	0	0	0	0	0
North America	Asia	5,210	7,026	42,879	48,327	50,797	59,815	68,439	76,660	95,611	119,727	152,241
North America	Europe	24,032	33,072	51,337	58,468	64,314	74,197	86,693	99,527	129,807	167,162	212,383
North America	Mideast	0	262	10,183	11,717	12,448	14,876	16,805	18,383	21,253	23,720	25,679
North America	North America	615	10,074	9,425	9,925	10,044	10,659	11,172	12,064	13,995	16,210	18,720
North America	South America	810	7,125	503,356	575,185	607,148	709,853	805,053	891,181	1,088,768	1,341,382	1,684,774
North America	South America	9	19	21	23	24	28	32	35	43	52	64
South America	Africa	1	3	4	4	4	4	5	5	5	7	7
South America	Asia	2,131	4,800	5,061	5,361	5,545	6,788	7,986	9,604	11,893	14,881	18,436
South America	Europe	34,837	22,049	26,264	28,334	29,501	36,289	41,918	46,819	57,311	69,719	84,852
South America	Mideast	17	12	12	13	13	15	16	17	18	19	20
South America	North America	23,696	38,513	65,346	65,917	65,514	64,652	64,713	66,922	70,931	74,502	77,655
South America	South America	15,589	33,588	38,517	41,838	43,707	55,319	64,736	73,761	94,138	118,686	147,960
South America	South America	2,644	1,012	1,123	1,194	1,236	1,423	1,572	1,658	1,823	2,004	2,221
South America	Africa	0	0	0	0	0	0	0	0	0	0	0
South America	Asia	351	851	788	814	835	957	1,052	1,129	1,241	1,338	1,426
South America	Europe	31,461	53,582	53,766	54,863	56,101	63,965	69,524	73,860	79,363	83,104	86,261
South America	Mideast	170	32	31	31	31	32	32	32	31	29	28
South America	North America	12,784	13,214	48,399	48,668	48,747	49,607	50,190	50,494	50,594	50,370	49,879
South America	South America	14,148	22,485	21,821	21,651	21,688	22,321	22,640	22,916	23,163	23,271	23,315
South America	South America	563	1,331	1,309	1,332	1,350	1,454	1,535	1,604	1,719	1,823	1,923
Total		**2,006,690**	**2,599,091**	**3,595,660**	**3,729,010**	**3,878,435**	**4,588,757**	**5,334,707**	**6,272,991**	**9,227,194**	**14,752,803**	**25,223,335**
Average Annual Growth Rate			**5.31%**	**11.43%**	**3.71%**	**4.01%**	**3.42%**	**3.06%**	**3.29%**	**3.93%**	**4.80%**	**5.51%**

Containerized WORLD Commodity Forecast For HI-TECH PRODUCTS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	9,035	15,565	13,609	15,051	16,654	24,565	26,143	28,405	34,349	44,453	61,180
Africa	Asia	61,648	100,838	92,165	96,313	103,535	156,906	220,653	307,487	590,090	1,141,570	2,245,941
Africa	Europe	118,269	156,002	145,520	164,716	187,250	321,282	428,441	558,206	945,416	1,657,377	3,090,631
Africa	Mideast	4,903	11,834	10,917	11,784	12,878	20,200	29,033	39,686	68,903	120,201	214,749
Africa	North America	3,552	3,406	2,797	2,914	3,026	4,021	4,953	6,012	9,093	14,603	25,937
Africa	South America	161	1,586	1,479	1,710	1,966	3,525	4,797	6,144	9,518	14,074	20,080
Africa	South America	65	199	220	228	246	373	440	511	675	886	1,132
Asia	Africa	361	2,033	1,735	1,947	2,212	3,785	5,627	8,453	19,111	43,652	98,281
Asia	Asia	2,680,406	4,450,205	4,156,711	4,660,398	5,170,120	8,381,730	11,882,473	16,984,556	35,333,813	74,689,886	151,493,839
Asia	Europe	204,007	275,974	301,931	339,007	382,346	620,124	863,632	1,266,249	2,711,739	5,841,151	12,713,905
Asia	Mideast	4,302	10,014	9,401	10,429	11,523	18,511	26,496	37,700	74,649	147,321	291,773
Asia	North America	235,223	228,056	236,267	256,560	276,947	392,256	532,046	739,783	1,479,734	3,060,114	6,428,426
Asia	South America	1,359	8,741	8,995	10,301	11,810	20,685	31,227	50,427	123,643	291,227	673,022
Asia	South America	508	309	319	360	409	678	965	1,394	2,823	5,636	11,128
Europe	Africa	8,598	19,821	23,933	25,958	28,603	44,246	55,669	67,355	95,162	130,602	175,687
Europe	Asia	1,390,693	2,530,547	2,710,766	2,906,173	3,064,304	4,377,532	5,668,748	7,103,281	10,708,532	15,666,653	22,534,588
Europe	Europe	462,987	1,036,294	1,210,514	1,315,443	1,466,188	2,322,358	3,120,500	4,059,418	6,621,838	10,542,282	16,497,113
Europe	Mideast	25,729	117,259	150,106	159,812	174,214	278,663	377,733	488,849	771,181	1,166,890	1,721,970
Europe	North America	95,809	145,713	145,584	151,014	159,811	214,122	256,259	305,908	440,761	648,741	991,238
Europe	South America	6,276	14,624	16,010	17,682	19,918	34,105	49,084	67,385	114,856	182,963	277,773
Europe	South America	1,675	1,287	1,402	1,501	1,641	2,520	3,110	3,743	5,328	7,526	10,602
Mideast	Africa	2,892	4,848	4,493	5,050	5,709	8,471	10,219	12,515	18,921	28,891	45,205
Mideast	Asia	171,744	232,267	209,049	225,292	246,816	369,552	505,241	689,786	1,265,683	2,306,400	4,221,938
Mideast	Europe	97,909	216,562	224,775	257,943	296,582	508,871	708,282	967,627	1,756,494	3,095,969	5,268,774
Mideast	Mideast	13,013	27,626	26,125	29,482	33,407	53,144	70,600	92,873	158,525	269,691	467,078
Mideast	North America	4,685	8,953	8,462	8,755	9,265	12,467	15,309	18,343	25,674	35,019	46,712
Mideast	South America	204	241	250	280	317	516	699	914	1,463	2,233	3,300
Mideast	South America	88	76	75	85	97	171	265	433	1,092	2,646	6,440
North America	Africa	324	403	797	912	1,044	1,707	2,241	2,832	4,308	6,303	8,958
North America	Asia	2,214,078	3,757,633	3,725,461	3,939,971	4,291,290	6,717,384	8,994,651	11,479,722	17,621,979	25,562,920	35,395,007
North America	Europe	110,736	116,964	140,837	150,427	167,700	261,823	334,135	410,201	595,332	839,430	1,138,707
North America	Mideast	1,952	5,276	4,419	4,934	5,512	8,531	10,610	12,749	17,748	23,950	31,614
North America	North America	996	4,946	5,488	6,202	6,793	10,166	13,705	17,503	27,468	41,359	60,427
North America	South America	6,211	20,673	23,513	27,090	31,184	55,653	84,146	110,324	200,303	321,894	493,697
North America	South America	104	470	758	839	937	1,424	1,739	2,073	2,794	3,632	4,624
South America	Africa	48	95	79	88	100	162	204	249	370	553	849
South America	Asia	202,953	256,472	259,579	287,653	318,267	500,355	655,968	824,460	1,290,064	2,040,442	3,358,442
South America	Europe	38,738	65,390	74,534	84,806	96,078	160,460	196,656	232,127	316,979	427,036	571,006
South America	Mideast	897	1,774	1,570	1,763	1,918	2,889	3,617	4,320	5,958	7,987	10,527
South America	North America	131,341	176,418	124,815	136,117	145,456	203,909	261,286	325,184	512,988	846,255	1,509,769
South America	South America	15,456	41,887	50,426	56,276	63,008	97,669	116,731	135,738	180,523	238,418	315,370
South America	South America	2,747	4,428	5,287	5,649	6,059	8,183	9,629	11,128	14,587	18,874	24,089
South America	Africa	11	24	22	24	27	43	48	52	61	69	79
South America	Asia	19,759	15,432	13,923	14,900	16,085	24,006	32,684	45,358	91,177	187,809	378,265
South America	Europe	20,038	18,322	16,999	19,046	21,276	33,863	41,706	52,316	89,416	165,936	297,414
South America	Mideast	149	476	451	482	548	818	966	1,069	1,362	1,691	2,028
South America	North America	13,012	22,134	24,453	26,791	29,388	46,137	68,984	107,476	258,533	612,411	1,381,910
South America	South America	5,526	11,303	10,795	11,612	12,530	17,554	20,008	22,811	29,916	40,380	57,611
South America	South America	7,164	7,464	7,683	7,651	7,646	7,894	8,433	9,620	14,554	24,987	46,993
Total		**8,398,342**	**14,128,863**	**14,205,503**	**15,459,422**	**16,911,246**	**26,356,010**	**35,756,790**	**47,726,756**	**84,663,488**	**152,570,994**	**274,745,827**
Average Annual Growth Rate			**10.96%**	**0.18%**	**8.83%**	**9.39%**	**9.28%**	**6.29%**	**5.95%**	**5.90%**	**6.07%**	**6.06%**

Containerized WORLD Commodity Forecast For INTERMEDIATE MANUFACTURED PRODUCTS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	665,862	795,553	815,011	852,517	886,542	1,086,580	1,276,951	1,563,018	2,459,468	4,236,790	8,033,051
Africa	Asia	597,263	1,859,386	2,006,887	2,153,390	2,310,601	3,462,604	4,723,034	6,565,356	13,079,502	26,765,968	55,218,811
Africa	Europe	1,790,331	1,880,027	2,020,973	2,218,382	2,418,344	3,685,728	4,795,135	6,052,408	9,188,923	13,637,042	20,059,199
Africa	Mideast	226,383	706,640	724,053	793,915	858,008	1,258,807	1,648,899	2,104,350	3,270,281	5,024,553	7,754,977
Africa	North America	30,944	32,744	38,876	37,682	36,569	42,584	47,358	51,881	61,445	72,022	83,918
Africa	South America	38,591	58,128	65,725	69,399	74,487	109,529	147,562	198,875	365,168	695,868	1,402,109
Africa	South America	687	5,002	5,582	5,864	6,209	8,609	11,118	14,571	25,609	47,208	93,889
Asia	Africa	555,418	902,417	993,460	1,060,198	1,133,452	1,599,908	1,788,543	2,351,953	4,096,475	7,113,063	12,307,638
Asia	Asia	30,772,469	42,488,188	50,795,023	54,677,619	59,593,767	80,808,391	103,912,264	136,465,128	246,189,038	466,959,586	909,891,724
Asia	Europe	4,333,922	4,384,576	5,145,538	5,485,845	5,930,145	8,722,803	12,053,911	17,294,402	36,709,252	80,255,716	173,918,918
Asia	Mideast	1,136,844	1,277,177	1,434,695	1,505,062	1,560,253	1,934,289	2,479,311	3,338,094	6,241,728	11,976,466	22,952,620
Asia	North America	2,722,473	1,524,569	2,008,074	2,107,996	2,175,272	2,594,710	3,134,442	3,717,681	5,580,076	9,103,736	15,872,557
Asia	South America	962,284	938,140	1,015,033	1,050,688	1,067,147	1,276,780	1,566,392	2,027,306	3,790,970	7,878,940	16,809,448
Asia	South America	3,205	3,183	3,368	3,595	3,865	5,215	6,797	9,075	16,563	30,744	57,424
Europe	Africa	345,314	673,239	900,332	975,525	1,024,722	1,219,120	1,423,330	1,614,721	2,054,217	2,606,290	3,327,558
Europe	Asia	3,828,554	8,500,522	11,648,418	12,055,679	12,505,848	15,926,504	18,703,633	21,477,527	28,408,965	38,472,367	54,648,376
Europe	Europe	7,400,395	10,834,428	13,251,698	13,726,951	14,389,504	18,022,985	21,474,415	24,824,310	32,639,345	43,000,430	57,257,158
Europe	Mideast	706,303	2,193,468	2,842,015	3,062,986	3,254,125	4,059,206	4,902,476	5,768,251	7,810,940	10,580,231	14,841,718
Europe	North America	1,276,154	1,272,135	1,678,744	1,736,776	1,816,850	2,128,000	2,496,420	2,819,342	3,549,627	4,538,911	6,046,054
Europe	South America	537,541	935,999	1,224,185	1,286,746	1,335,224	1,487,641	1,691,254	1,854,371	2,143,565	2,394,417	2,690,840
Europe	South America	37,639	18,802	24,395	25,200	25,966	29,186	32,834	35,952	43,643	53,961	68,290
Mideast	Africa	147,831	159,230	164,824	181,005	195,491	257,801	316,724	402,059	659,941	1,130,560	2,041,110
Mideast	Asia	1,659,568	3,211,299	3,357,681	3,592,819	3,830,439	5,127,602	6,320,341	8,148,570	14,158,248	25,896,330	47,938,302
Mideast	Europe	2,903,092	3,498,280	3,990,875	4,358,708	4,731,091	6,731,294	8,114,118	9,876,305	14,575,689	21,496,353	31,544,465
Mideast	Mideast	1,277,917	1,671,985	1,720,237	1,848,310	1,969,832	2,524,810	2,968,557	3,613,594	5,412,351	8,297,132	13,064,428
Mideast	North America	132,877	84,233	90,382	92,724	94,714	113,248	130,319	145,524	180,565	224,240	280,294
Mideast	South America	32,366	45,622	56,633	60,912	66,154	93,091	120,517	163,566	311,295	620,162	1,302,712
Mideast	South America	875	2,062	2,424	2,565	2,752	3,526	4,104	4,989	7,798	12,778	21,620
North America	Africa	123,834	198,614	207,132	226,961	240,593	245,957	260,282	274,458	318,569	369,761	431,243
North America	Asia	6,003,531	11,361,032	13,287,532	14,054,454	15,257,268	20,944,040	26,604,150	32,137,111	46,084,778	64,918,362	90,010,795
North America	Europe	3,444,908	5,726,657	5,455,203	6,047,080	6,793,413	9,480,023	11,588,138	13,677,028	18,783,791	25,525,718	34,396,772
North America	Mideast	121,263	381,119	546,193	618,530	696,190	931,122	1,117,619	1,305,326	1,757,330	2,340,859	3,086,043
North America	North America	225,991	105,985	117,760	129,011	141,275	198,722	272,920	350,691	544,112	807,463	1,158,489
North America	South America	892,578	1,688,294	2,688,087	2,818,953	3,069,359	4,032,804	4,871,717	5,715,017	7,721,044	10,301,940	13,708,604
North America	South America	36,214	63,094	81,060	91,982	103,654	153,624	211,012	270,992	427,462	646,546	943,530
South America	Africa	18,752	21,181	26,149	29,286	31,544	42,669	50,334	57,634	73,614	92,688	116,198
South America	Asia	465,858	873,898	1,077,187	1,163,868	1,253,541	1,765,533	2,225,621	2,876,513	5,097,383	9,770,368	19,729,951
South America	Europe	608,317	925,781	1,190,287	1,317,383	1,443,351	2,129,534	2,505,779	2,886,619	3,775,987	4,913,975	6,415,281
South America	Mideast	11,519	34,344	39,369	42,969	46,389	64,809	78,690	93,034	126,473	169,463	226,250
South America	North America	792,910	750,095	665,016	714,136	741,357	909,669	1,049,572	1,179,026	1,460,648	1,792,686	2,194,890
South America	South America	984,495	1,139,872	1,456,577	1,563,131	1,671,992	2,286,193	2,730,854	3,262,649	4,744,858	7,264,932	11,988,117
South America	South America	119,567	265,665	334,341	361,453	388,057	512,516	565,813	617,859	732,342	877,527	1,082,440
South America	Africa	3,054	4,361	4,477	4,779	5,041	6,229	6,786	7,346	8,674	10,485	12,913
South America	Asia	129,614	307,921	328,152	353,783	379,628	541,068	787,167	1,164,236	2,614,341	5,859,350	12,649,701
South America	Europe	381,492	347,569	364,996	399,625	432,578	586,045	645,300	695,149	784,256	875,118	977,468
South America	Mideast	14,051	38,608	39,799	42,529	44,719	51,349	54,088	55,765	58,040	60,009	62,723
South America	North America	370,353	336,748	334,597	356,401	376,739	478,876	570,007	688,511	1,127,090	2,105,478	3,791,763
South America	South America	344,782	587,755	639,908	687,813	733,904	1,021,944	1,399,546	2,060,374	4,687,001	10,938,821	25,269,250
South America	South America	300,511	474,273	514,656	546,298	572,381	743,141	972,070	1,371,742	2,954,400	6,716,340	15,389,667
Total		**79,516,698**	**115,589,181**	**137,423,621**	**146,599,684**	**157,717,346**	**211,246,223**	**264,858,228**	**333,270,058**	**546,912,879**	**949,479,741**	**1,723,171,295**
Average Annual Growth Rate			**7.77%**	**5.94%**	**6.68%**	**7.58%**	**6.02%**	**4.63%**	**4.70%**	**5.08%**	**5.67%**	**6.14%**

Containerized WORLD Commodity Forecast For MATERIALS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	210,816	285,504	301,731	302,685	303,537	313,286	341,810	403,228	658,824	1,274,531	2,757,335
Africa	Asia	603,973	905,540	937,621	958,573	991,366	1,312,263	1,782,371	2,622,975	5,960,276	13,696,451	31,484,447
Africa	Europe	1,349,851	1,848,425	1,967,155	2,026,666	2,075,377	2,469,052	2,809,697	3,140,535	3,895,450	4,902,984	6,235,427
Africa	Mideast	92,512	204,092	211,218	213,095	217,990	243,520	269,144	298,376	386,567	569,071	983,696
Africa	North America	108,462	95,324	108,392	112,044	114,611	156,691	241,251	412,309	1,122,896	2,874,259	7,268,327
Africa	South America	60,012	58,126	55,959	50,539	46,559	37,356	36,393	41,324	65,135	120,457	252,151
Africa	South America	569	2,145	2,090	2,087	2,098	2,191	2,204	2,216	2,270	2,378	2,542
Asia	Africa	227,950	302,212	353,407	359,243	373,928	474,125	580,601	727,342	1,226,815	2,320,775	4,802,606
Asia	Asia	18,342,271	29,795,056	34,638,585	36,289,732	37,549,810	47,517,462	57,297,095	73,949,966	130,078,857	244,126,836	474,811,436
Asia	Europe	3,549,196	6,229,431	7,627,377	7,794,634	8,028,862	9,462,395	11,225,961	14,019,175	23,652,636	45,601,491	94,568,799
Asia	Mideast	86,989	193,093	204,563	209,894	215,840	269,123	337,105	448,662	858,646	1,790,223	3,947,527
Asia	North America	12,006,501	10,799,825	14,699,991	14,831,329	14,407,295	12,363,643	11,021,172	10,813,972	10,855,712	11,485,911	12,737,656
Asia	South America	564,428	650,986	915,167	910,989	917,517	981,796	1,032,012	1,180,845	1,649,890	2,690,261	4,707,850
Asia	South America	15,331	21,256	27,879	26,898	26,625	33,406	37,043	42,207	56,301	77,183	109,628
Europe	Africa	432,969	608,321	775,544	812,300	830,573	784,631	794,563	834,692	928,165	1,041,106	1,191,725
Europe	Asia	3,210,207	5,133,186	6,468,868	6,436,041	6,446,119	7,353,422	8,136,075	9,260,067	13,133,252	20,918,612	37,737,361
Europe	Europe	5,564,422	7,793,107	9,550,213	9,512,034	9,364,859	9,075,301	8,954,205	9,090,427	9,793,769	11,216,451	13,720,076
Europe	Mideast	385,480	745,443	906,248	961,325	1,013,070	1,078,536	1,158,868	1,253,442	1,512,491	1,924,433	2,622,027
Europe	North America	3,546,256	3,443,140	3,560,761	3,732,707	3,803,591	3,122,416	2,892,999	3,006,497	3,350,336	3,853,516	4,554,575
Europe	South America	844,897	1,067,085	1,563,440	1,615,119	1,646,271	1,732,329	1,720,994	1,783,720	1,962,787	2,232,850	2,623,551
Europe	South America	22,233	33,641	44,697	45,977	47,074	49,286	49,709	50,863	56,008	65,471	79,874
Mideast	Africa	58,870	81,654	88,862	91,331	94,287	104,678	116,439	133,807	182,876	261,356	394,719
Mideast	Asia	1,675,814	2,431,216	2,554,785	2,709,835	2,810,923	3,490,509	4,217,410	5,353,422	9,590,478	19,427,007	42,857,072
Mideast	Europe	1,809,829	2,483,319	2,912,193	3,064,031	3,223,551	3,996,093	4,602,532	5,353,526	7,262,347	9,926,627	13,808,158
Mideast	Mideast	369,839	570,791	593,245	619,324	640,852	708,484	789,923	890,039	1,154,165	1,558,556	2,151,459
Mideast	North America	381,326	421,210	381,711	382,712	379,912	382,444	384,545	400,113	438,821	489,221	555,602
Mideast	South America	132,922	102,163	113,101	114,742	117,070	120,628	125,702	135,591	162,839	201,847	254,773
Mideast	South America	750	1,412	1,705	1,745	1,774	1,934	2,115	2,320	2,839	3,491	4,170
North America	Africa	18,887	26,502	30,764	47,771	46,783	47,654	49,717	52,631	60,932	72,293	86,623
North America	Asia	2,617,029	5,095,531	6,506,932	6,503,704	6,675,769	7,604,698	8,211,367	8,743,291	10,261,050	12,221,182	14,389,703
North America	Europe	1,476,708	2,695,747	3,230,240	3,146,110	3,134,221	3,223,983	3,227,546	3,290,423	3,632,211	4,169,598	4,867,808
North America	Mideast	47,606	152,421	189,949	202,410	217,322	262,420	284,505	310,884	379,466	470,046	584,951
North America	North America	144,660	339,431	384,024	401,751	418,040	456,020	487,968	513,724	567,061	628,480	697,300
North America	South America	508,579	1,152,599	1,852,211	1,849,294	1,909,897	2,411,043	2,634,129	2,832,793	3,267,513	3,787,711	4,421,988
North America	South America	49,073	53,152	83,332	80,473	81,288	87,441	93,977	99,913	112,192	126,578	144,418
South America	Africa	41,938	35,406	45,210	46,845	47,908	55,870	61,567	66,630	75,875	88,847	115,287
South America	Asia	369,759	621,000	733,794	772,767	810,568	1,062,919	1,181,504	1,351,304	1,982,525	3,497,660	7,175,961
South America	Europe	509,828	731,364	995,792	1,047,548	1,096,836	1,364,907	1,555,828	1,739,620	2,142,403	2,650,728	3,301,154
South America	Mideast	9,954	8,850	10,986	11,793	12,393	17,188	18,736	19,940	22,528	31,056	36,259
South America	North America	1,776,243	1,701,799	1,690,798	1,700,313	1,688,884	1,714,729	1,740,152	1,802,112	1,977,651	2,215,529	2,521,858
South America	South America	515,729	820,660	1,025,385	1,059,827	1,098,729	1,305,443	1,517,673	1,814,959	2,781,302	4,649,637	8,236,378
South America	South America	67,761	92,667	109,302	108,655	108,106	110,414	113,464	118,238	125,784	132,746	140,422
South America	Africa	1,762	6,492	7,038	7,376	7,556	8,125	8,596	8,989	9,722	10,766	12,522
South America	Asia	155,430	313,020	297,369	305,555	316,712	413,354	595,737	856,607	1,827,791	3,872,589	8,052,543
South America	Europe	149,829	153,183	159,154	165,008	168,679	179,614	190,412	201,741	224,116	253,575	298,172
South America	Mideast	1,398	3,270	3,380	3,438	3,470	3,479	3,587	3,665	3,853	4,336	5,574
South America	North America	553,852	692,063	1,064,186	1,133,044	1,211,466	1,741,856	2,623,466	3,793,179	7,962,132	16,300,499	32,180,045
South America	South America	137,698	286,563	265,699	277,125	288,199	346,237	439,000	566,661	1,017,760	1,905,897	3,546,296
South America	South America	87,284	152,528	143,883	147,970	151,765	176,336	214,369	274,746	511,104	958,612	1,619,376
Total		**64,985,684**	**91,447,454**	**110,415,835**	**113,208,406**	**115,185,936**	**130,230,637**	**146,213,234**	**174,113,712**	**269,158,419**	**462,611,718**	**859,678,608**
Average Annual Growth Rate			**7.07%**	**6.48%**	**2.53%**	**1.75%**	**2.49%**	**2.34%**	**3.55%**	**4.45%**	**5.57%**	**6.39%**

Containerized WORLD Commodity Forecast For ALL COMMODITIES
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	2,474,462	3,213,048	3,376,790	3,473,708	3,551,520	4,003,242	4,573,477	5,718,471	10,191,732	20,591,039	45,597,326
Africa	Asia	3,088,089	6,034,181	6,432,963	6,654,995	6,931,432	9,292,892	12,322,295	17,215,124	35,775,553	77,453,383	171,545,098
Africa	Europe	10,677,015	12,470,444	13,060,935	13,889,636	14,636,676	19,150,020	22,753,825	26,784,241	36,909,017	51,622,499	74,607,491
Africa	Mideast	1,167,717	2,167,002	2,251,599	2,391,455	2,535,809	3,604,249	5,133,080	7,717,551	17,749,964	40,988,028	91,457,365
Africa	North America	667,933	553,740	644,999	643,981	649,774	769,086	913,669	1,153,605	2,053,009	4,094,471	8,919,236
Africa	South America	476,801	658,631	686,646	716,026	731,189	881,104	1,022,005	1,213,838	1,847,195	3,117,232	5,918,715
Africa	South America	28,169	49,880	51,663	52,923	53,933	62,643	76,373	103,173	217,118	494,189	1,072,726
Asia	Africa	1,892,668	2,909,890	3,221,246	3,388,523	3,592,101	4,566,118	5,576,150	7,001,502	11,559,063	20,178,055	36,611,713
Asia	Asia	115,858,050	175,781,292	203,207,516	215,876,210	229,375,536	301,722,036	376,355,836	484,996,222	852,017,120	1,595,757,293	3,034,438,337
Asia	Europe	23,422,247	29,923,994	34,101,556	36,012,424	38,271,954	51,697,400	65,344,098	85,734,716	157,923,404	312,755,877	638,813,047
Asia	Mideast	3,535,366	5,484,639	5,996,597	6,304,669	6,560,693	7,975,394	9,760,332	12,327,559	21,356,097	39,377,030	71,627,578
Asia	North America	39,430,592	36,971,982	44,297,457	45,933,185	46,566,616	50,088,870	53,336,781	58,896,340	75,871,102	106,033,723	161,046,773
Asia	South America	4,789,821	5,513,544	6,290,797	6,585,070	6,827,716	8,315,940	9,582,174	11,516,372	17,993,039	31,155,276	58,691,218
Asia	South America	192,712	270,947	309,621	313,430	315,187	372,456	393,191	425,337	530,134	714,546	1,043,444
Europe	Africa	4,336,969	5,940,507	7,161,032	7,348,194	7,535,650	8,311,190	8,879,570	9,417,853	10,754,439	12,470,050	14,690,406
Europe	Asia	26,359,908	45,395,716	56,898,641	58,580,775	59,827,680	69,696,496	77,760,483	87,459,923	114,113,643	156,806,734	230,248,148
Europe	Europe	45,605,245	61,098,182	71,307,355	73,477,146	75,897,831	88,598,259	98,093,047	108,367,883	133,914,988	170,661,002	225,216,359
Europe	Mideast	5,280,846	8,511,953	9,905,068	10,426,318	10,945,924	12,936,663	14,675,891	16,461,215	20,903,608	27,355,945	37,715,556
Europe	North America	13,260,314	14,307,089	15,566,287	16,028,802	16,354,248	17,264,777	18,301,901	19,723,794	23,367,519	28,550,599	36,228,516
Europe	South America	7,526,027	9,977,116	12,575,320	13,078,592	13,481,176	15,939,507	17,098,291	17,564,540	20,425,528	24,477,897	31,115,685
Europe	South America	1,158,457	1,379,305	1,692,923	1,771,521	1,826,302	1,962,056	2,057,694	2,150,786	2,365,698	2,671,238	3,136,545
Mideast	Africa	941,810	1,273,536	1,372,173	1,445,902	1,518,432	1,856,049	2,138,382	2,582,583	3,815,741	5,990,279	10,070,544
Mideast	Asia	8,044,587	12,430,793	12,956,284	13,699,906	14,426,518	18,376,184	22,060,992	27,574,269	45,629,194	81,479,443	155,367,629
Mideast	Europe	12,441,557	16,889,937	18,837,755	20,360,128	21,948,096	30,153,249	35,704,759	42,716,948	61,256,824	87,837,720	125,894,359
Mideast	Mideast	4,869,459	7,200,602	7,641,882	8,117,473	8,604,497	10,985,883	12,968,542	15,840,547	24,790,791	41,356,535	68,680,044
Mideast	North America	1,039,273	1,386,259	1,625,053	1,669,416	1,689,721	2,054,105	2,274,927	2,519,891	3,089,883	3,775,407	4,587,414
Mideast	South America	985,393	1,642,410	1,732,073	1,835,807	1,952,052	2,483,955	2,876,780	3,422,898	5,081,265	7,789,459	11,767,760
Mideast	South America	62,459	122,170	132,200	133,075	135,090	138,478	140,484	152,802	183,907	237,004	316,688
North America	Africa	327,030	571,612	696,310	751,047	813,100	1,003,799	1,128,656	1,246,182	1,529,706	1,870,638	2,276,751
North America	Asia	27,587,129	46,304,923	55,925,187	58,193,565	62,539,566	84,608,368	101,234,032	117,906,209	159,647,375	213,800,261	281,603,888
North America	Europe	13,928,875	21,832,926	23,433,737	24,733,752	26,765,317	34,079,515	38,965,596	43,592,963	55,385,249	70,888,393	90,466,708
North America	Mideast	652,531	1,182,653	1,448,274	1,590,208	1,766,142	2,254,000	2,580,478	2,934,090	3,786,505	4,858,809	6,178,339
North America	North America	915,384	1,481,709	2,319,919	2,451,494	2,564,711	3,224,188	3,678,078	4,115,582	5,103,339	6,265,706	7,610,161
North America	South America	4,766,716	7,634,131	11,467,719	11,949,004	12,558,142	15,572,475	17,643,952	19,620,599	24,368,998	30,271,096	37,673,079
North America	South America	612,129	1,454,979	1,688,819	1,735,700	1,800,413	1,926,314	2,107,976	2,279,042	2,720,501	3,299,595	4,035,481
South America	Africa	347,245	115,660	144,710	153,407	160,664	201,269	225,980	249,518	300,436	362,661	447,084
South America	Asia	2,349,835	3,703,420	4,466,996	4,815,618	5,151,650	7,035,463	8,402,615	10,172,933	15,832,816	27,091,622	50,815,569
South America	Europe	4,779,461	5,675,077	7,015,252	7,671,424	8,337,840	11,876,375	13,738,486	15,530,335	19,627,670	24,705,205	31,103,672
South America	Mideast	129,506	221,611	277,636	292,832	309,332	392,572	438,882	485,073	596,202	739,637	1,040,772
South America	North America	7,657,465	7,973,009	7,904,649	8,284,607	8,499,909	10,031,440	11,188,407	12,464,141	16,000,637	21,498,121	29,428,521
South America	South America	4,587,595	6,806,509	8,291,400	8,810,733	9,370,967	12,436,508	14,382,577	16,604,420	22,465,121	31,405,336	45,704,374
South America	South America	537,945	854,158	1,006,848	1,058,668	1,101,269	1,316,569	1,420,760	1,528,383	1,753,905	2,030,929	2,405,267
South America	Africa	21,531	40,963	43,996	46,455	48,210	56,418	62,634	70,711	97,077	147,624	247,001
South America	Asia	639,564	1,161,295	1,392,323	1,253,420	1,316,480	1,735,213	2,395,662	3,387,497	7,158,913	15,388,229	32,358,848
South America	Europe	2,190,274	2,207,322	2,288,428	2,443,497	2,580,271	3,162,721	3,362,084	3,553,048	3,938,117	4,442,219	5,212,304
South America	Mideast	26,764	71,317	74,141	77,923	81,040	91,923	101,437	114,431	161,058	262,183	490,818
South America	North America	2,104,018	2,780,587	3,216,012	3,381,648	3,542,289	4,421,405	5,576,838	7,080,471	12,291,353	22,584,006	41,737,104
South America	South America	1,175,465	2,130,322	2,175,683	2,315,459	2,446,002	3,198,349	4,119,047	5,529,354	10,841,830	22,559,981	47,443,132
South America	South America	953,394	2,016,072	2,053,868	2,180,321	2,297,677	2,964,826	3,775,341	4,991,092	9,546,754	19,059,246	37,458,686
Total		**415,903,802**	**585,779,045**	**680,466,339**	**714,406,073**	**750,794,532**	**944,828,009**	**1,118,704,744**	**1,350,216,056**	**2,084,839,637**	**3,479,383,450**	**6,112,163,178**
Average Annual Growth Rate			**7.09%**	**5.12%**	**4.99%**	**5.09%**	**4.70%**	**3.44%**	**3.83%**	**4.44%**	**5.26%**	**5.80%**

Containerized World Commodity By Origin (TEUs)

Containerized WORLD Commodity Forecast For AGRICULTURE COMMODITIES
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(TEUs)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	10,252	16,817	18,707	19,102	19,418	21,681	24,084	29,388	48,087	90,959	192,678
Africa	Asia	23,932	41,713	46,084	47,697	49,258	61,779	72,031	86,969	136,305	235,723	421,622
Africa	Europe	124,837	149,732	167,273	168,852	170,580	184,632	193,246	198,527	213,990	236,148	270,295
Africa	Mideast	45,999	58,083	63,879	66,594	69,150	80,379	88,277	101,603	128,231	161,058	199,657
Africa	North America	2,411	7,454	8,188	7,987	8,069	8,266	8,333	7,957	7,973	7,996	8,108
Africa	South America	362	524	643	640	646	692	702	778	861	944	1,028
Africa	Caribbean	123	385	425	457	491	692	958	1,301	2,484	4,828	9,314
Asia	Africa	15,514	27,965	28,839	29,767	30,413	34,413	41,445	50,566	97,711	212,030	486,898
Asia	Asia	758,778	1,042,582	1,094,082	1,130,626	1,144,451	1,314,264	1,488,050	1,747,223	2,498,849	3,811,660	5,768,974
Asia	Europe	185,607	274,416	307,609	306,861	304,771	283,643	268,588	263,745	262,027	269,985	285,104
Asia	Mideast	110,645	132,791	138,061	144,312	147,981	174,507	191,762	212,834	257,836	310,187	371,855
Asia	North America	55,451	94,691	151,593	151,331	155,459	163,393	168,667	158,885	176,880	199,916	226,757
Asia	South America	10,049	8,567	11,419	11,988	12,503	14,884	16,089	18,008	21,532	25,774	32,133
Asia	Caribbean	652	3,043	3,372	3,447	3,521	3,890	4,252	4,825	6,906	11,706	21,350
Europe	Africa	42,503	68,798	68,715	73,724	77,720	99,783	114,573	132,599	180,550	262,564	430,952
Europe	Asia	131,682	150,495	165,116	173,161	180,936	215,245	242,849	276,846	354,515	461,247	600,795
Europe	Europe	283,755	433,878	475,546	490,125	507,394	585,071	626,549	686,428	790,661	939,027	1,179,981
Europe	Mideast	51,477	97,026	101,925	106,996	111,104	133,189	147,508	161,308	196,953	238,968	285,117
Europe	North America	31,631	77,805	100,096	97,746	96,637	112,895	114,779	107,803	109,057	114,291	121,732
Europe	South America	16,883	23,085	29,371	30,918	32,657	40,237	43,445	47,710	54,176	60,843	67,063
Europe	Caribbean	10,474	16,008	15,526	16,772	17,852	22,830	24,796	26,236	28,651	30,956	33,309
Mideast	Africa	6,502	9,951	10,946	11,501	12,038	15,688	17,743	19,961	24,956	31,415	41,458
Mideast	Asia	25,846	63,893	89,846	73,468	77,955	99,940	115,715	133,239	174,893	228,505	296,259
Mideast	Europe	127,304	130,999	131,225	137,868	140,568	157,190	166,106	173,547	190,622	212,983	239,968
Mideast	Mideast	143,561	188,191	206,641	219,809	233,953	308,560	350,569	398,491	502,060	624,651	770,307
Mideast	North America	3,642	5,304	7,169	7,864	8,658	10,222	11,341	8,388	9,579	10,930	12,454
Mideast	South America	1,672	2,759	3,227	3,299	3,407	3,952	4,137	4,315	4,641	4,969	5,470
Mideast	Caribbean	86	209	230	254	267	299	302	305	311	317	324
North America	Africa	1,598	2,214	2,743	2,857	2,921	3,356	3,704	4,062	4,711	5,346	5,963
North America	Asia	462,409	329,794	437,021	471,862	480,371	544,935	587,175	631,624	740,798	881,487	1,073,980
North America	Europe	162,736	154,151	151,624	155,821	152,102	149,143	149,012	149,998	156,202	166,910	181,306
North America	Mideast	9,723	20,051	31,868	32,954	33,265	43,021	48,691	54,077	66,337	80,492	95,908
North America	North America	18,095	17,218	8,060	8,311	8,529	8,773	9,349	9,954	12,040	14,674	17,741
North America	South America	30,347	36,380	38,725	39,528	41,059	48,724	52,859	57,619	66,008	74,445	83,209
North America	Caribbean	20,432	25,873	31,536	32,920	34,170	39,415	41,769	43,563	46,655	49,450	51,958
South America	Africa	7,684	9,262	9,073	9,476	9,788	11,847	14,453	18,428	32,887	65,664	144,985
South America	Asia	72,688	82,318	90,421	91,430	90,320	99,470	103,250	110,084	126,842	144,951	174,478
South America	Europe	274,097	341,921	400,462	421,545	432,163	534,527	577,651	531,238	592,825	665,299	754,800
South America	Mideast	24,305	36,148	39,413	43,198	46,999	61,453	75,843	96,172	165,202	284,924	453,321
South America	North America	81,277	141,173	220,756	221,904	228,956	250,367	262,405	270,721	296,556	325,255	356,293
South America	South America	47,287	56,842	67,275	70,346	74,897	95,834	107,930	119,820	143,872	171,440	206,697
South America	Caribbean	10,355	16,525	16,566	17,602	18,639	24,170	29,375	35,602	56,122	96,532	176,243
Caribbean	Africa	577	616	623	682	744	1,201	1,969	3,446	9,658	25,010	56,401
Caribbean	Asia	7,099	9,509	10,127	10,225	9,761	10,419	10,176	10,358	11,483	13,616	17,143
Caribbean	Europe	67,457	62,632	73,848	79,398	81,920	88,281	94,468	98,948	107,918	120,409	139,100
Caribbean	Mideast	1,060	3,462	3,858	3,976	4,065	4,461	4,824	5,718	7,207	8,993	10,899
Caribbean	North America	26,648	45,122	48,382	49,644	50,118	44,013	42,654	39,569	33,374	27,737	22,997
Caribbean	South America	3,826	4,244	4,677	4,723	4,788	5,203	5,405	6,151	7,028	7,963	8,933
Caribbean	Caribbean	8,399	34,322	34,582	37,952	41,366	60,694	82,092	108,514	201,151	385,679	742,141
Total		**3,559,731**	**4,556,941**	**5,147,394**	**5,339,522**	**5,464,791**	**6,281,524**	**6,851,953**	**7,465,452**	**9,366,172**	**12,416,854**	**17,155,545**
Average Annual Growth Rate			**5.06%**	**4.14%**	**3.73%**	**2.35%**	**2.82%**	**1.75%**	**1.73%**	**2.29%**	**2.86%**	**3.29%**

Containerized WORLD Commodity Forecast For CAPITAL EQUIPMENT
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(TEUs)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	12,066	15,688	13,154	14,382	15,859	23,413	26,477	29,839	38,163	50,262	68,482
Africa	Asia	2,094	3,695	3,396	3,726	4,190	6,904	9,731	14,009	29,392	61,997	128,506
Africa	Europe	15,308	28,551	41,985	46,493	51,079	75,869	91,779	106,230	138,058	175,018	217,556
Africa	Mideast	1,385	2,470	2,137	2,360	2,602	3,765	4,351	5,121	7,230	10,565	15,876
Africa	North America	3,549	6,355	11,242	12,582	14,301	23,119	28,718	34,070	46,514	61,609	79,390
Africa	South America	715	670	734	836	936	1,443	1,727	1,991	2,629	3,431	4,413
Africa	Caribbean	38	208	189	209	231	326	345	358	387	418	454
Asia	Africa	34,972	60,578	59,595	62,130	66,251	101,567	151,192	233,279	557,766	1,319,069	3,074,828
Asia	Asia	1,155,302	1,407,746	1,682,784	1,831,863	2,001,917	2,886,261	3,912,937	5,442,682	10,900,951	22,376,562	37,033,429
Asia	Europe	280,702	632,540	832,217	862,600	908,279	1,250,746	1,503,053	1,770,231	2,468,855	3,497,550	5,041,440
Asia	Mideast	93,284	160,071	154,443	164,277	178,495	250,349	320,520	428,167	792,658	1,534,125	3,133,688
Asia	North America	731,870	1,006,615	1,263,264	1,374,222	1,498,495	2,153,611	2,622,783	3,087,495	4,219,425	5,658,918	7,396,918
Asia	South America	46,731	70,754	84,004	91,315	98,740	136,423	162,979	194,207	289,995	468,420	820,960
Asia	Caribbean	10,300	17,578	17,293	18,405	19,688	27,980	39,782	57,523	127,286	279,754	574,559
Europe	Africa	99,794	131,284	139,303	155,220	175,887	301,479	395,372	486,632	722,100	1,057,719	1,533,322
Europe	Asia	441,621	413,324	429,461	479,414	540,689	880,759	1,250,320	1,842,048	4,033,665	8,888,992	18,907,025
Europe	Europe	357,755	583,573	703,262	758,201	827,935	1,185,871	1,462,604	1,737,666	2,385,698	3,234,751	4,359,378
Europe	Mideast	139,194	207,404	207,155	234,827	267,089	436,216	545,741	676,640	1,041,674	1,595,925	2,404,048
Europe	North America	240,604	411,643	459,159	497,595	550,515	828,572	1,042,774	1,259,627	1,779,963	2,431,762	3,213,858
Europe	South America	91,760	131,645	153,215	176,208	201,642	335,888	403,554	462,265	604,053	785,418	1,015,792
Europe	Caribbean	21,652	27,856	25,186	28,097	31,341	45,949	49,514	52,486	59,028	66,564	74,899
Mideast	Africa	5,749	9,522	8,409	9,276	10,285	16,681	24,650	36,767	82,245	183,614	415,092
Mideast	Asia	5,285	11,351	10,828	11,980	13,327	21,069	28,637	38,717	71,245	132,201	243,939
Mideast	Europe	24,319	54,988	69,913	76,175	82,400	125,943	155,132	183,008	247,651	329,507	434,975
Mideast	Mideast	14,554	28,006	26,442	29,777	33,544	53,105	69,681	92,797	169,552	324,532	661,635
Mideast	North America	5,963	8,472	17,909	18,729	20,367	30,685	37,549	44,149	60,741	82,452	109,580
Mideast	South America	1,113	1,598	1,719	1,892	2,069	2,756	3,031	3,304	4,083	5,257	6,902
Mideast	Caribbean	298	825	777	829	910	1,081	1,407	2,029	4,770	11,692	29,226
North America	Africa	9,835	9,116	14,530	14,429	14,936	18,061	20,666	23,219	31,144	44,162	62,216
North America	Asia	268,045	237,791	286,033	303,895	317,248	390,260	471,746	573,266	886,009	1,470,274	2,620,070
North America	Europe	176,000	242,102	320,826	337,768	353,461	463,721	541,620	612,726	778,948	994,004	1,261,211
North America	Mideast	12,088	12,563	15,767	16,859	18,246	20,289	21,893	23,383	26,222	28,903	31,728
North America	North America	5,273	14,349	11,795	13,304	14,633	20,811	25,200	29,259	38,630	49,775	62,646
North America	South America	145,272	146,874	130,005	140,121	143,387	171,119	189,750	204,576	240,307	284,008	334,801
North America	Caribbean	20,856	29,070	29,421	30,467	31,781	37,007	37,403	37,985	40,573	44,645	49,587
South America	Africa	2,695	3,019	3,167	3,350	3,689	5,826	7,412	9,059	13,496	20,499	32,653
South America	Asia	13,533	11,120	14,618	15,623	17,068	23,581	31,866	44,924	92,914	198,256	412,922
South America	Europe	20,638	36,422	53,403	57,975	62,370	85,593	105,106	122,735	162,337	210,237	268,309
South America	Mideast	1,916	2,378	2,761	3,047	3,404	5,306	7,137	9,450	16,499	28,649	49,717
South America	North America	55,721	83,558	195,093	219,847	240,799	361,483	453,634	543,989	760,978	1,030,645	1,353,393
South America	South America	23,383	28,731	36,198	40,586	45,208	71,408	84,868	97,157	126,880	165,807	215,428
South America	Caribbean	4,930	7,266	6,833	7,591	8,446	12,941	15,574	19,146	33,412	57,473	116,471
Caribbean	Africa	45	219	224	238	254	337	398	463	621	821	1,069
Caribbean	Asia	929	268	327	350	379	536	699	941	1,777	3,492	7,095
Caribbean	Europe	2,157	3,873	6,252	6,520	6,619	6,984	6,857	7,042	8,241	10,290	12,817
Caribbean	Mideast	35	463	511	555	605	723	783	872	1,146	1,563	2,161
Caribbean	North America	1,390	5,611	17,222	20,027	22,994	32,299	37,807	42,621	54,245	68,549	85,333
Caribbean	South America	952	1,648	1,995	2,247	2,548	4,108	4,906	5,544	6,956	8,629	10,616
Caribbean	Caribbean	1,665	2,709	2,493	2,749	3,024	4,316	4,793	5,211	6,060	6,993	8,030
Total		**4,605,339**	**6,334,157**	**7,568,673**	**8,201,169**	**8,930,166**	**12,944,539**	**16,416,460**	**20,736,905**	**34,211,118**	**59,349,759**	**97,998,442**
Average Annual Growth Rate			**6.58%**	**6.12%**	**8.36%**	**8.89%**	**7.71%**	**4.87%**	**4.78%**	**5.13%**	**5.66%**	**5.14%**

Containerized WORLD Commodity Forecast For CHEMICALS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(TEUs)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	16,570	32,977	34,751	36,465	38,124	48,918	67,177	101,203	236,143	560,775	1,367,402
Africa	Asia	20,030	33,076	36,721	40,072	43,708	63,656	86,270	117,262	221,264	434,485	874,857
Africa	Europe	10,127	20,894	24,905	26,122	27,140	34,762	40,238	45,009	55,576	68,733	85,081
Africa	Mideast	3,339	5,379	5,697	6,210	6,767	10,185	14,848	23,475	57,408	138,208	324,552
Africa	North America	1,025	3,326	4,035	4,182	4,491	5,897	7,345	8,675	12,053	16,795	23,405
Africa	South America	1,827	1,626	2,120	2,283	2,419	3,119	3,502	3,852	4,607	5,459	6,445
Africa	Caribbean	68	494	524	548	570	677	734	788	904	1,043	1,208
Asia	Africa	27,197	32,115	55,851	58,248	61,127	87,959	128,870	197,542	459,533	1,069,798	2,540,155
Asia	Asia	2,264,883	3,964,000	4,836,674	5,189,967	5,573,226	7,549,116	9,772,314	12,887,401	23,669,816	46,282,236	93,663,214
Asia	Europe	225,663	430,406	559,812	574,918	576,431	694,213	787,788	880,863	1,148,260	1,620,822	2,504,337
Asia	Mideast	58,299	130,596	189,329	149,705	158,329	205,902	246,755	304,498	476,658	788,427	1,419,517
Asia	North America	161,958	298,866	378,533	391,069	413,508	505,899	582,947	649,265	820,956	1,061,554	1,377,579
Asia	South America	22,548	55,809	71,646	78,357	83,766	112,232	134,630	165,244	262,356	456,030	886,461
Asia	Caribbean	2,932	12,542	13,344	14,424	15,311	20,232	26,063	34,082	62,798	123,558	249,609
Europe	Africa	116,387	144,081	151,664	161,522	171,797	244,630	305,834	375,379	542,181	773,469	1,128,432
Europe	Asia	534,097	659,793	732,305	799,810	869,426	1,267,266	1,695,456	2,308,199	4,476,562	9,106,157	18,892,649
Europe	Europe	727,765	1,026,525	1,183,191	1,220,674	1,260,602	1,486,017	1,640,734	1,775,831	2,112,178	2,589,903	3,255,102
Europe	Mideast	179,133	275,041	314,766	344,345	372,933	529,883	622,626	746,202	1,068,673	1,521,361	2,149,362
Europe	North America	186,486	255,863	308,339	313,203	329,247	427,335	475,042	507,419	615,202	776,559	980,124
Europe	South America	75,219	99,145	120,860	133,143	144,238	203,233	232,713	262,604	331,375	415,863	521,172
Europe	Caribbean	14,191	15,765	16,353	17,627	18,691	23,721	26,598	29,371	35,914	46,401	66,903
Mideast	Africa	25,992	51,009	52,329	58,051	64,317	110,832	193,742	352,773	1,028,649	2,690,170	6,392,292
Mideast	Asia	147,049	226,789	247,922	260,966	270,804	327,384	415,770	539,152	1,026,961	2,057,464	3,833,745
Mideast	Europe	69,846	113,377	127,932	132,121	135,559	161,461	186,033	209,173	274,968	395,570	648,991
Mideast	Mideast	44,847	97,860	103,232	109,964	116,403	158,784	212,516	306,224	679,805	1,511,760	2,887,807
Mideast	North America	10,427	16,892	26,320	26,106	26,883	29,033	30,521	32,092	37,425	45,686	56,512
Mideast	South America	2,640	7,173	9,569	9,922	10,468	13,322	14,905	16,462	20,443	26,949	39,764
Mideast	Caribbean	224	731	752	802	845	1,080	1,351	1,671	2,632	4,190	6,519
North America	Africa	6,903	9,787	8,658	8,504	8,589	9,805	11,113	12,674	16,859	23,576	35,781
North America	Asia	535,461	522,588	668,953	677,084	699,519	809,935	937,050	1,114,980	1,678,251	2,751,511	4,848,762
North America	Europe	191,592	236,898	248,114	245,431	242,385	277,360	310,101	341,668	424,154	545,631	728,702
North America	Mideast	15,282	18,445	26,145	26,686	27,568	30,296	32,995	36,365	44,313	54,397	67,208
North America	North America	13,533	17,608	28,277	29,438	30,731	36,808	41,912	45,858	55,094	66,639	80,877
North America	South America	158,280	207,323	214,809	228,029	233,361	272,706	313,183	361,328	514,636	785,070	1,192,058
North America	Caribbean	32,668	41,275	46,657	48,761	50,507	59,365	68,209	77,419	99,740	125,619	152,436
South America	Africa	4,179	6,184	6,689	6,836	7,122	9,572	11,438	13,170	17,379	22,311	28,361
South America	Asia	20,972	24,532	26,015	27,741	29,751	41,678	54,795	72,674	135,843	271,993	562,883
South America	Europe	27,498	51,385	61,827	63,962	66,044	82,592	95,865	107,269	132,285	161,931	196,946
South America	Mideast	3,078	5,431	5,949	6,317	6,621	8,661	10,067	12,079	16,991	23,817	33,223
South America	North America	27,981	45,355	58,962	60,975	64,610	76,763	88,308	96,332	115,722	140,998	173,770
South America	South America	78,385	131,692	155,549	168,179	178,535	232,158	271,563	316,344	431,102	588,639	792,081
South America	Caribbean	10,182	19,040	19,312	20,926	22,475	31,505	41,927	55,220	100,032	186,143	347,374
Caribbean	Africa	120	253	234	234	238	274	300	341	488	811	1,510
Caribbean	Asia	328	677	681	737	803	1,203	1,683	2,443	5,289	11,678	25,641
Caribbean	Europe	4,950	5,190	6,467	6,771	7,294	8,992	10,173	11,339	14,046	17,369	21,435
Caribbean	Mideast	109	521	567	618	668	944	1,094	1,310	1,885	2,707	3,841
Caribbean	North America	459	2,702	1,928	2,143	2,382	3,244	4,014	4,752	6,583	9,010	12,173
Caribbean	South America	2,546	4,165	4,742	5,005	5,275	6,469	7,381	8,242	10,157	12,602	16,034
Caribbean	Caribbean	5,493	10,966	10,936	11,570	12,169	15,424	19,238	24,387	41,217	69,607	113,087
Total		**6,090,766**	**9,394,168**	**11,160,945**	**11,806,772**	**12,493,779**	**16,342,502**	**20,285,730**	**25,597,903**	**43,603,385**	**80,461,484**	**155,617,361**
Average Annual Growth Rate			**9.05%**	**5.91%**	**5.79%**	**5.82%**	**5.52%**	**4.42%**	**4.76%**	**5.47%**	**6.32%**	**6.82%**

Containerized WORLD Commodity Forecast For CONSUMER GOODS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(TEUs)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	16,519	19,225	20,246	21,491	22,571	27,382	29,507	32,499	40,937	54,721	77,159
Africa	Asia	976	1,413	1,541	1,645	1,772	2,661	3,425	4,384	7,151	11,708	19,372
Africa	Europe	67,588	109,135	138,125	138,211	136,093	120,882	119,383	119,231	132,061	156,708	190,223
Africa	Mideast	3,655	5,617	5,681	6,218	6,788	9,353	11,235	13,824	21,158	32,695	50,946
Africa	North America	4,812	9,127	23,553	26,009	28,706	37,035	41,870	44,740	53,916	60,064	67,803
Africa	South America	71	199	255	282	312	480	572	658	875	1,174	1,602
Africa	Caribbean	155	282	303	337	374	555	610	678	902	1,328	2,104
Asia	Africa	29,466	54,456	57,611	59,265	63,039	92,140	130,746	198,323	463,249	1,085,116	2,584,755
Asia	Asia	1,179,655	1,949,574	2,289,219	2,400,117	2,472,096	3,298,071	3,848,004	4,624,483	6,908,208	10,608,927	16,798,771
Asia	Europe	794,709	1,486,707	1,817,810	1,841,760	1,871,330	2,122,569	2,286,914	2,535,766	3,300,114	4,636,792	7,131,197
Asia	Mideast	127,595	176,479	183,198	190,908	201,820	266,508	331,028	435,084	804,242	1,556,723	3,157,158
Asia	North America	1,169,125	2,268,080	3,198,039	3,338,935	3,630,545	5,195,385	6,089,052	7,082,171	9,535,119	12,644,968	16,433,646
Asia	South America	79,561	100,839	121,323	130,749	141,420	200,894	233,575	270,947	381,911	570,541	904,595
Asia	Caribbean	11,736	17,935	18,301	19,943	21,669	32,523	48,412	72,342	162,065	358,377	784,083
Europe	Africa	43,163	65,324	67,536	72,627	78,978	116,918	141,866	169,433	242,160	353,271	540,842
Europe	Asia	122,574	172,769	197,912	210,398	225,045	328,669	417,950	532,769	895,906	1,548,324	2,723,815
Europe	Europe	268,103	499,726	584,004	614,477	647,794	808,455	910,813	1,034,537	1,370,463	1,854,985	2,553,592
Europe	Mideast	88,998	139,181	152,322	160,999	189,152	286,884	348,903	428,023	644,017	970,308	1,478,289
Europe	North America	141,319	305,603	336,469	364,936	392,557	506,546	594,888	679,497	893,793	1,187,020	1,562,645
Europe	South America	23,797	41,370	51,160	56,919	62,830	95,442	113,700	131,507	175,089	233,358	314,295
Europe	Caribbean	16,470	15,602	15,732	17,451	19,170	27,510	29,846	32,201	38,069	46,589	59,905
Mideast	Africa	6,132	14,064	14,979	15,937	16,974	22,617	27,196	32,793	48,845	75,279	119,696
Mideast	Asia	3,648	7,185	7,944	8,667	9,558	14,369	18,724	23,967	38,992	63,274	101,903
Mideast	Europe	41,645	77,844	96,071	104,965	114,772	150,568	172,530	194,897	250,478	324,274	418,733
Mideast	Mideast	21,325	36,077	38,457	39,954	41,497	48,150	53,969	61,493	79,215	102,569	134,282
Mideast	North America	14,146	27,543	38,883	44,427	50,380	57,260	67,235	79,323	110,785	152,774	206,794
Mideast	South America	337	802	995	1,070	1,160	1,541	1,765	1,975	2,461	3,108	4,023
Mideast	Caribbean	115	176	185	197	210	267	309	358	506	771	1,246
North America	Africa	1,631	2,115	2,155	2,101	2,192	2,725	3,071	3,422	4,340	5,772	8,000
North America	Asia	106,821	90,230	97,056	104,079	110,004	136,443	171,612	221,525	395,439	749,303	1,460,970
North America	Europe	50,759	63,301	77,162	79,884	82,516	92,058	100,967	113,401	163,194	256,131	446,211
North America	Mideast	4,015	5,707	4,744	4,974	5,313	7,075	8,616	10,340	15,101	22,670	34,864
North America	North America	4,340	30,640	50,487	52,031	53,598	65,644	73,315	82,632	102,035	125,223	154,430
North America	South America	59,583	39,924	49,904	53,048	55,282	67,933	77,021	85,632	106,152	132,439	165,680
North America	Caribbean	30,478	80,234	53,011	55,223	57,289	65,093	69,574	74,047	83,374	93,868	105,048
South America	Africa	338	569	621	647	706	1,074	1,265	1,460	1,935	2,579	3,463
South America	Asia	2,834	3,630	4,267	4,584	4,838	6,728	8,435	10,691	17,450	29,066	49,689
South America	Europe	19,851	33,784	44,834	47,706	50,820	69,329	72,763	82,859	108,798	141,614	182,340
South America	Mideast	346	492	535	612	677	1,027	1,274	1,596	2,536	4,106	6,789
South America	North America	28,875	47,325	73,865	79,262	81,029	108,892	122,853	142,792	193,630	259,330	340,596
South America	South America	18,631	28,090	34,108	36,949	39,795	56,647	66,285	77,026	104,985	146,587	214,471
South America	Caribbean	6,133	15,177	15,751	16,940	18,107	24,155	29,346	36,612	62,679	113,256	198,793
Caribbean	Africa	35	70	75	76	78	91	102	113	139	172	210
Caribbean	Asia	193	255	261	262	272	350	401	439	566	807	1,213
Caribbean	Europe	1,385	2,947	3,429	3,510	3,630	4,342	4,826	5,330	6,512	7,911	9,537
Caribbean	Mideast	48	207	222	234	246	315	371	443	689	1,245	2,553
Caribbean	North America	42,812	125,322	157,539	162,006	169,678	201,501	232,121	264,044	342,133	432,996	534,942
Caribbean	South America	4,497	9,538	11,156	11,786	12,471	16,201	17,786	18,920	21,364	24,940	31,030
Caribbean	Caribbean	13,179	28,988	30,460	33,328	35,913	47,698	56,177	65,558	89,908	124,611	169,347
Total		**4,674,178**	**8,200,879**	**10,189,520**	**10,646,247**	**11,233,064**	**14,847,157**	**17,192,209**	**20,138,783**	**28,425,670**	**41,370,377**	**62,543,654**
Average Annual Growth Rate			**11.90%**	**7.51%**	**4.48%**	**5.51%**	**5.74%**	**2.98%**	**3.21%**	**3.51%**	**3.82%**	**4.22%**

Containerized WORLD Commodity Forecast For EXTRACTIVE COMMODITIES
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(TEUs)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	1,674	2,638	2,468	2,399	2,331	2,039	1,803	1,686	1,601	1,618	1,692
Africa	Asia	5,343	6,319	6,274	6,954	7,595	9,713	10,860	12,468	17,133	24,757	37,420
Africa	Europe	8,841	11,115	11,570	11,695	11,950	12,448	12,191	12,230	12,580	13,227	14,132
Africa	Mideast	257	369	349	364	386	468	474	501	586	706	858
Africa	North America	1,356	1,673	2,365	2,475	2,666	3,322	3,422	3,442	3,536	3,685	3,872
Africa	South America	110	145	177	192	202	245	251	261	291	327	365
Africa	Caribbean	2	17	18	19	19	22	25	27	28	29	29
Asia	Africa	1,133	1,508	1,597	1,640	1,687	1,862	1,974	2,124	2,454	2,864	3,434
Asia	Asia	410,698	592,908	658,647	684,937	713,827	793,606	808,990	880,096	1,161,906	1,781,871	3,143,208
Asia	Europe	14,068	21,074	25,506	24,750	24,835	26,963	26,107	25,919	26,492	27,713	29,274
Asia	Mideast	2,997	5,552	5,743	5,864	5,906	6,891	6,233	6,441	7,492	9,763	14,559
Asia	North America	6,468	25,087	17,621	16,696	16,297	15,757	14,340	13,007	11,000	9,621	8,778
Asia	South America	553	1,147	1,301	1,361	1,399	1,553	1,583	1,627	1,737	1,862	1,996
Asia	Caribbean	27	66	76	80	83	98	113	131	184	298	551
Europe	Africa	11,903	16,211	15,536	16,074	16,604	19,143	21,794	25,103	35,207	56,081	104,832
Europe	Asia	39,288	77,021	75,414	82,520	84,787	98,204	108,035	121,277	155,308	195,481	242,678
Europe	Europe	249,455	255,665	256,069	262,402	263,578	265,004	253,185	249,736	261,100	308,657	395,329
Europe	Mideast	41,470	35,109	36,632	35,940	37,330	36,432	38,349	41,928	51,930	65,107	82,328
Europe	North America	17,626	24,292	56,066	51,073	49,616	70,464	67,679	64,515	63,686	66,473	71,841
Europe	South America	4,325	3,758	4,429	4,597	4,608	4,705	4,738	4,888	5,216	5,560	5,927
Europe	Caribbean	695	3,641	3,605	3,827	3,977	4,559	5,052	5,476	5,880	6,029	6,086
Mideast	Africa	820	1,530	1,576	1,645	1,679	1,830	1,909	1,999	2,165	2,312	2,448
Mideast	Asia	34,546	50,234	52,152	57,296	59,623	70,282	76,190	87,402	117,621	161,700	228,899
Mideast	Europe	20,243	35,883	38,496	38,921	40,221	42,802	42,643	43,486	45,641	48,420	51,554
Mideast	Mideast	7,131	9,661	10,197	10,545	10,896	11,785	11,701	12,163	13,502	15,308	17,503
Mideast	North America	1,058	4,410	1,201	1,341	1,474	1,561	1,662	1,719	1,872	2,064	2,289
Mideast	South America	1,467	1,715	2,186	2,345	2,390	2,318	2,236	2,217	2,207	2,211	2,224
Mideast	Caribbean	1	23	24	25	26	30	34	36	40	42	43
North America	Africa	15,872	3,399	3,968	4,015	4,033	4,370	4,587	4,658	4,743	4,797	4,849
North America	Asia	147,996	167,782	187,887	198,213	201,300	213,124	219,342	229,700	258,829	298,481	356,842
North America	Europe	59,266	60,482	73,615	74,297	77,153	79,545	76,592	75,169	73,576	73,244	73,815
North America	Mideast	2,135	810	3,686	3,517	3,603	3,536	3,592	3,750	4,140	4,622	5,245
North America	North America	3,175	3,399	4,591	4,701	4,741	5,095	5,233	5,378	5,793	6,295	6,839
North America	South America	22,292	19,189	22,517	24,079	24,561	26,768	27,587	28,486	31,143	34,210	37,440
North America	Caribbean	4,723	1,040	5,228	5,369	5,442	5,535	5,614	5,681	5,808	5,971	6,178
South America	Africa	501	886	812	831	880	1,009	1,132	1,259	1,489	1,708	1,933
South America	Asia	27,486	36,456	38,650	43,429	47,778	56,555	63,819	73,985	105,354	161,516	261,657
South America	Europe	22,579	31,716	35,365	33,881	34,231	37,970	37,692	38,071	39,421	41,423	43,867
South America	Mideast	1,503	2,973	3,101	3,047	3,067	3,295	3,293	3,436	3,938	4,676	5,611
South America	North America	7,376	13,159	11,095	11,398	11,676	12,895	13,483	13,987	15,235	16,788	18,679
South America	South America	3,932	6,559	7,547	8,087	8,440	9,792	10,292	11,046	12,981	15,810	20,413
South America	Caribbean	1,564	2,637	2,455	2,520	2,592	3,065	4,020	5,569	12,395	29,816	71,602
Caribbean	Africa	0	3	3	3	3	3	4	4	4	5	5
Caribbean	Asia	91	89	103	107	109	120	128	142	178	234	326
Caribbean	Europe	588	1,291	1,432	1,461	1,465	1,506	1,455	1,441	1,446	1,464	1,488
Caribbean	Mideast	1	4	5	5	5	5	5	5	6	7	8
Caribbean	North America	360	408	448	456	469	519	539	560	619	683	753
Caribbean	South America	5,489	6,152	6,841	6,778	6,855	6,745	6,338	6,043	5,531	5,073	4,658
Caribbean	Caribbean	576	734	677	739	779	1,004	1,378	1,927	3,857	7,694	15,054
Total		**1,211,059**	**1,547,914**	**1,697,317**	**1,754,912**	**1,805,173**	**1,976,064**	**2,009,697**	**2,132,202**	**2,595,082**	**3,528,292**	**5,411,431**
Average Annual Growth Rate			**5.03%**	**3.12%**	**3.39%**	**2.86%**	**1.83%**	**0.34%**	**1.19%**	**1.98%**	**3.12%**	**4.37%**

Containerized WORLD Commodity Forecast For FOOD
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(TEUs)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	81,167	94,843	102,685	103,628	103,187	99,666	101,497	117,405	199,870	411,190	942,935
Africa	Asia	38,590	51,936	57,913	59,410	62,305	73,231	76,886	82,041	95,388	111,226	128,816
Africa	Europe	103,448	132,059	154,093	154,580	159,088	182,359	188,239	193,857	206,646	221,302	236,885
Africa	Mideast	9,457	18,254	19,746	20,717	21,669	26,449	29,828	34,145	44,662	57,380	72,188
Africa	North America	6,707	7,957	11,542	12,844	14,461	19,500	21,230	22,797	25,945	29,139	32,326
Africa	South America	21,259	1,986	2,411	2,464	2,547	3,074	3,339	3,585	4,262	5,057	5,876
Africa	Caribbean	1,097	1,442	1,585	1,661	1,685	1,779	1,855	2,020	2,680	4,074	7,150
Asia	Africa	88,404	96,246	107,794	105,891	104,084	101,968	101,825	108,137	138,958	210,140	374,102
Asia	Asia	1,448,020	2,116,979	2,186,234	2,258,778	2,335,984	2,780,811	3,121,164	3,563,482	4,829,713	6,949,968	10,416,675
Asia	Europe	774,573	1,056,766	1,272,755	1,334,010	1,351,038	1,348,245	1,358,232	1,419,276	1,588,611	1,864,619	2,309,676
Asia	Mideast	167,731	201,954	216,677	223,380	232,470	265,046	292,579	329,150	419,248	536,756	689,540
Asia	North America	232,742	350,247	474,378	463,431	494,115	607,772	645,775	685,860	769,249	857,718	950,890
Asia	South America	20,514	20,757	24,763	25,594	26,796	30,886	33,555	36,182	41,720	47,780	54,304
Asia	Caribbean	13,139	11,439	12,692	12,440	12,113	10,472	9,781	10,065	12,857	20,262	35,853
Europe	Africa	354,040	334,043	362,534	379,001	385,210	400,694	409,278	427,070	472,226	532,706	628,630
Europe	Asia	523,061	693,028	782,525	794,413	820,791	998,805	1,073,286	1,156,618	1,380,670	1,647,627	1,916,988
Europe	Europe	993,023	1,097,797	1,272,248	1,309,217	1,343,931	1,461,049	1,506,147	1,578,471	1,777,859	2,113,611	2,769,837
Europe	Mideast	242,660	298,441	332,479	356,307	378,369	489,811	563,120	656,497	884,673	1,169,770	1,524,669
Europe	North America	298,140	516,555	601,606	642,063	708,813	822,635	873,229	922,470	1,024,601	1,122,455	1,212,694
Europe	South America	154,188	118,504	141,925	151,388	161,713	215,044	239,631	262,770	311,272	361,996	414,670
Europe	Caribbean	96,598	86,383	93,315	98,068	101,567	112,693	113,978	116,145	119,104	121,569	124,200
Mideast	Africa	28,165	24,575	27,453	25,513	23,816	18,515	16,722	16,776	20,224	29,552	51,086
Mideast	Asia	27,831	65,729	72,232	73,560	75,853	82,359	87,538	95,495	116,985	153,058	189,614
Mideast	Europe	115,176	121,357	132,801	134,100	139,407	137,494	136,558	137,704	144,914	161,127	189,097
Mideast	Mideast	76,994	114,838	124,744	130,802	137,958	162,523	182,259	209,733	280,402	377,849	522,766
Mideast	North America	16,228	14,544	18,802	20,834	23,505	29,755	32,555	35,222	40,854	46,739	52,702
Mideast	South America	3,396	2,871	3,672	3,872	4,079	5,109	5,686	6,287	7,703	9,608	12,627
Mideast	Caribbean	462	1,143	1,275	1,268	1,248	1,162	1,196	1,369	2,235	4,330	9,232
North America	Africa	8,201	10,096	14,793	15,058	14,936	15,303	14,997	15,215	15,876	16,741	17,812
North America	Asia	787,539	890,164	929,344	968,888	1,006,508	1,190,822	1,275,980	1,384,099	1,617,860	1,895,052	2,147,736
North America	Europe	218,961	238,746	282,530	293,443	301,202	321,601	327,819	340,927	374,677	414,213	457,560
North America	Mideast	10,716	23,731	30,071	31,257	32,097	47,605	54,055	61,902	79,805	99,825	120,816
North America	North America	10,847	21,282	249,384	264,464	285,063	383,250	431,326	477,811	577,314	683,629	792,908
North America	South America	73,446	75,344	75,697	79,702	84,941	117,774	131,960	146,487	178,108	212,591	248,958
North America	Caribbean	23,314	34,703	35,900	37,261	37,750	37,378	37,071	38,541	46,167	64,612	99,466
South America	Africa	16,310	24,384	25,953	27,620	27,785	30,920	32,909	36,041	47,063	69,681	120,107
South America	Asia	148,475	179,502	203,203	215,561	226,294	292,843	338,714	402,887	604,595	985,481	1,764,335
South America	Europe	201,557	247,894	321,650	333,763	348,877	421,673	445,679	479,893	578,808	760,658	1,143,566
South America	Mideast	43,024	86,500	88,484	92,768	97,904	122,041	134,604	150,613	188,084	232,965	284,303
South America	North America	95,571	130,360	180,559	189,066	196,507	240,915	254,587	270,231	303,175	335,875	369,464
South America	South America	122,249	205,435	249,026	261,412	277,627	370,830	417,474	467,835	590,336	752,341	968,153
South America	Caribbean	34,126	61,010	62,327	65,596	68,143	82,336	100,434	127,416	228,465	439,115	838,921
Caribbean	Africa	1,450	2,590	2,716	2,723	2,692	2,613	2,744	3,262	6,108	13,587	29,875
Caribbean	Asia	6,525	10,046	11,819	11,979	12,610	15,490	16,458	17,444	20,005	23,201	26,789
Caribbean	Europe	22,479	42,807	54,888	55,381	56,212	59,592	60,336	62,837	69,282	78,644	94,317
Caribbean	Mideast	4,380	6,810	7,213	7,079	7,077	6,502	6,008	5,820	5,994	7,208	9,507
Caribbean	North America	13,111	17,088	20,546	20,553	21,654	22,598	22,242	22,151	21,931	21,514	21,483
Caribbean	South America	15,686	22,296	25,362	26,945	27,322	30,362	32,424	34,599	39,380	44,747	51,004
Caribbean	Caribbean	27,370	60,310	59,711	61,829	63,872	76,182	95,572	127,741	256,168	515,461	919,918
Total		**7,792,146**	**10,043,773**	**11,544,055**	**11,961,660**	**12,424,879**	**14,377,553**	**15,460,357**	**16,904,381**	**20,812,730**	**26,845,750**	**36,402,428**
Average Annual Growth Rate			**5.21%**	**4.75%**	**3.62%**	**3.87%**	**2.96%**	**1.46%**	**1.80%**	**2.10%**	**2.58%**	**3.09%**

Containerized WORLD Commodity Forecast For FUELS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(TEUs)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	11	10	9	9	9	9	9	9	10	11	12
Africa	Asia	1	2	1	1	2	2	2	3	4	7	12
Africa	Europe	0	0	0	0	0	0	1	1	1	1	1
Africa	Mideast	0	0	0	0	0	0	0	0	0	0	1
Africa	North America	0										
Africa	South America	0	0	0	0	0	0	0	0	0	1	1
Africa	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Asia	Africa	8	14	14	15	15	18	20	23	28	35	45
Asia	Asia	49,297	75,661	83,558	88,170	94,035	125,737	162,422	213,079	387,270	739,660	1,442,345
Asia	Europe	2,394	477	500	537	566	734	883	1,033	1,400	1,891	2,540
Asia	Mideast	171	1,124	1,096	1,156	1,205	1,456	1,713	2,006	2,696	3,579	4,688
Asia	North America	944	1,531	3,718	4,280	4,542	5,504	6,425	7,300	9,292	11,805	15,225
Asia	South America	179	404	426	451	467	571	672	808	1,001	1,252	1,552
Asia	Caribbean	30	72	66	68	70	80	88	95	104	112	120
Europe	Africa	3,736	5,075	5,149	5,331	5,517	6,717	8,037	9,471	12,633	16,465	21,200
Europe	Asia	5,734	6,499	7,082	7,736	8,483	12,633	17,928	25,540	53,629	115,376	245,399
Europe	Europe	76,428	82,492	90,846	88,667	90,653	99,736	106,995	114,485	132,732	154,915	181,476
Europe	Mideast	9,927	17,021	18,571	19,206	19,771	23,593	27,047	30,997	40,690	53,160	68,812
Europe	North America	8,883	2,678	2,893	3,197	3,255	3,631	4,005	4,385	5,356	6,614	8,181
Europe	South America	2,903	1,837	2,188	2,361	2,458	3,024	3,493	3,901	4,775	5,809	7,070
Europe	Caribbean	2,621	4,465	4,480	4,571	4,674	5,330	5,793	6,154	6,613	6,924	7,187
Mideast	Africa	9	67	70	71	72	79	86	93	105	117	131
Mideast	Asia	4	142	147	156	164	184	206	234	299	372	439
Mideast	Europe	1,041	550	644	645	681	798	880	958	1,129	1,325	1,552
Mideast	Mideast	185	696	815	813	813	826	842	870	939	1,019	1,098
Mideast	North America	0	8	7	8	9	12	15	19	27	39	54
Mideast	South America	1	1	1	1	1	1	1	1	2	2	2
Mideast	Caribbean	14	3	3	3	3	3	3	3	3	2	2
North America	Africa	83	167	240	238	244	220	203	202	202	200	195
North America	Asia	17,649	20,111	36,604	35,969	35,566	31,153	27,607	25,108	22,362	22,770	27,214
North America	Europe	3,985	5,257	7,092	7,424	7,317	6,095	5,330	4,826	4,080	3,545	3,234
North America	Mideast	373	630	587	567	578	544	523	529	540	543	533
North America	North America	124	364	383	423	433	508	572	646	803	982	1,186
North America	South America	7,115	10,198	16,153	16,222	16,151	15,907	15,917	16,420	17,176	17,709	18,026
North America	Caribbean	4,714	6,510	19,054	19,168	19,201	19,559	19,803	19,930	19,972	19,880	19,677
South America	Africa	3	1	1	1	1	1	1	2	2	2	2
South America	Asia	7	158	181	189	195	225	265	324	550	988	1,932
South America	Europe	208	363	356	352	366	399	418	430	459	498	553
South America	Mideast	17	70	79	79	80	83	86	91	102	116	130
South America	North America	77	221	350	387	406	481	550	609	741	903	1,111
South America	South America	1,312	2,827	3,242	3,521	3,679	4,656	5,448	6,208	7,923	9,989	12,453
South America	Caribbean	1,191	1,892	1,837	1,822	1,825	1,879	1,905	1,929	1,950	1,959	1,962
Caribbean	Africa	0	0	0	0	0	0	0	0	0	0	0
Caribbean	Asia	2	1	2	2	2	3	4	5	9	17	28
Caribbean	Europe	9	10	10	10	10	12	13	14	15	17	20
Caribbean	Mideast	0	0	0	0	0	0	0	0	0	0	0
Caribbean	North America	1	2	2	2	2	2	3	3	4	4	5
Caribbean	South America	222	85	95	101	104	120	132	140	153	169	187
Caribbean	Caribbean	47	112	110	112	114	122	129	135	145	153	162
Total		**201,665**	**249,808**	**308,664**	**314,043**	**323,737**	**372,647**	**426,478**	**499,017**	**737,926**	**1,200,940**	**2,097,754**
Average Annual Growth Rate			**4.37%**	**7.31%**	**1.74%**	**3.09%**	**2.85%**	**2.74%**	**3.19%**	**3.99%**	**4.99%**	**5.74%**

Containerized WORLD Commodity Forecast For HI-TECH PRODUCTS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(TEUs)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	1,277	2,349	2,025	2,248	2,500	3,770	4,077	4,482	5,531	7,346	10,396
Africa	Asia	58	308	261	294	333	570	851	1,279	2,890	6,581	14,761
Africa	Europe	1,466	3,454	4,153	4,494	4,946	7,661	9,642	11,672	16,523	22,741	30,700
Africa	Mideast	367	665	607	682	772	1,156	1,405	1,731	2,637	4,040	6,298
Africa	North America	44	171	52	59	68	117	173	236	406	657	1,012
Africa	South America	9	19	15	17	19	32	40	49	72	106	158
Africa	Caribbean	2	4	4	4	5	8	9	10	13	13	15
Asia	Africa	10,762	17,888	16,406	17,098	18,360	27,762	38,944	54,066	102,903	197,306	384,944
Asia	Asia	591,119	979,325	919,970	1,032,661	1,143,883	1,845,117	2,588,212	3,669,980	7,331,774	15,715,423	31,821,115
Asia	Europe	319,433	581,717	621,813	667,510	703,931	1,001,714	1,295,381	1,620,928	2,439,242	3,565,246	5,127,217
Asia	Mideast	39,722	51,436	46,504	49,928	54,531	80,825	109,606	148,610	270,012	489,143	894,285
Asia	North America	438,296	726,059	782,915	835,223	907,165	1,410,219	1,869,345	2,366,939	3,586,508	5,144,430	7,046,912
Asia	South America	42,142	52,367	53,052	58,774	65,011	102,020	133,350	167,352	261,933	416,237	692,185
Asia	Caribbean	4,282	3,278	2,956	3,160	3,411	5,094	6,920	9,559	18,993	38,658	77,398
Europe	Africa	17,516	24,898	22,442	25,449	29,020	50,271	67,727	88,253	148,250	256,802	469,852
Europe	Asia	40,838	55,498	58,800	66,182	74,668	122,256	172,457	255,967	558,043	1,215,817	2,660,222
Europe	Europe	88,254	197,780	226,203	245,763	274,662	441,754	600,941	787,155	1,298,963	2,086,970	3,289,385
Europe	Mideast	16,343	38,155	38,785	44,509	51,181	88,227	122,963	167,928	304,061	534,292	907,088
Europe	North America	19,660	26,837	38,673	41,182	45,512	69,355	89,104	110,123	162,009	230,789	320,575
Europe	South America	6,942	11,448	12,650	14,446	16,529	27,793	34,356	40,735	56,083	76,060	102,123
Europe	Caribbean	3,350	3,166	2,823	3,175	3,564	5,745	6,992	8,584	13,911	24,572	42,742
Mideast	Africa	818	2,055	1,906	2,061	2,260	3,607	5,216	7,076	11,930	20,047	34,017
Mideast	Asia	931	2,266	2,131	2,386	2,630	4,222	6,055	8,396	16,922	33,107	65,097
Mideast	Europe	5,173	23,982	31,164	33,258	36,344	58,677	80,486	104,938	167,220	254,805	377,994
Mideast	Mideast	2,259	5,235	4,949	5,577	6,314	10,093	13,480	17,703	29,906	49,840	83,379
Mideast	North America	339	843	731	807	894	1,366	1,785	2,116	3,033	4,210	5,710
Mideast	South America	178	360	316	355	387	584	734	878	1,218	1,640	2,171
Mideast	Caribbean	29	99	94	101	115	172	204	227	291	362	437
North America	Africa	709	1,123	1,074	1,120	1,166	1,539	1,918	2,337	3,550	5,734	10,328
North America	Asia	52,708	84,448	61,796	66,612	71,560	98,755	132,467	181,754	357,338	737,354	1,498,687
North America	Europe	29,804	42,738	44,563	45,758	48,064	60,759	70,549	81,983	112,011	155,038	217,825
North America	Mideast	961	1,988	3,230	3,489	3,838	4,752	5,708	6,705	9,036	11,838	15,260
North America	North America	299	1,622	3,065	3,493	3,908	6,044	8,249	10,803	17,830	28,292	43,368
North America	South America	32,959	39,235	29,579	32,263	34,388	48,417	63,387	81,267	137,943	246,690	475,531
North America	Caribbean	2,784	4,413	6,245	6,642	7,084	10,052	14,538	22,690	55,631	134,987	310,462
South America	Africa	27	244	226	261	301	538	728	928	1,430	2,108	3,001
South America	Asia	265	1,566	1,625	1,863	2,135	3,749	5,693	9,286	23,050	54,793	127,985
South America	Europe	1,179	2,740	3,051	3,365	3,791	6,479	9,204	12,479	20,926	32,954	49,597
South America	Mideast	39	43	43	49	55	90	122	160	257	393	582
South America	North America	2,510	9,114	22,735	26,230	30,026	50,803	77,703	110,730	205,006	350,418	563,378
South America	South America	2,463	7,101	8,370	9,336	10,455	16,332	19,801	23,239	31,503	42,486	57,521
South America	Caribbean	897	2,004	1,898	2,056	2,238	3,233	3,725	4,262	5,564	7,370	10,141
Caribbean	Africa	11	29	31	32	35	54	64	75	99	131	168
Caribbean	Asia	77	59	61	69	78	130	185	265	530	1,049	2,050
Caribbean	Europe	350	253	278	298	326	503	623	752	1,075	1,524	2,152
Caribbean	Mideast	13	13	13	14	16	28	42	67	161	381	908
Caribbean	North America	181	203	1,263	1,382	1,571	2,293	2,816	3,357	4,675	6,391	8,612
Caribbean	South America	403	655	773	831	895	1,231	1,473	1,722	2,308	3,047	3,960
Caribbean	Caribbean	967	1,032	1,054	1,055	1,060	1,122	1,206	1,373	2,044	3,441	6,365
Total		**1,781,207**	**2,982,284**	**3,083,373**	**3,363,622**	**3,672,004**	**5,687,094**	**7,680,607**	**10,213,406**	**18,003,243**	**32,213,625**	**57,876,072**
Average Annual Growth Rate			**10.86%**	**1.12%**	**9.09%**	**9.17%**	**9.14%**	**6.19%**	**5.87%**	**5.83%**	**5.99%**	**6.03%**

Containerized WORLD Commodity Forecast For INTERMEDIATE MANUFACTURED PRODUCTS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(TEUs)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	51,651	61,679	63,313	66,712	70,067	89,265	107,744	136,990	235,362	442,088	899,315
Africa	Asia	38,730	63,540	69,858	74,500	79,505	98,764	126,571	167,232	294,688	519,029	912,622
Africa	Europe	28,806	58,564	79,030	85,197	89,883	110,479	130,712	150,080	194,978	252,090	327,617
Africa	Mideast	11,371	12,425	12,869	14,122	15,309	20,522	25,158	31,908	52,425	89,962	161,548
Africa	North America	5,894	10,644	11,077	12,202	13,187	15,277	17,575	19,777	25,210	31,772	39,872
Africa	South America	1,512	1,809	2,234	2,497	2,704	3,740	4,421	5,076	6,519	8,252	10,387
Africa	Caribbean	273	403	415	445	472	602	668	740	918	1,166	1,503
Asia	Africa	60,504	153,770	165,833	176,454	188,591	282,814	397,697	578,394	1,260,712	2,770,304	6,015,742
Asia	Asia	2,911,957	4,089,753	4,898,283	5,272,746	5,726,141	7,817,377	10,129,981	13,387,698	24,507,627	47,085,572	92,622,636
Asia	Europe	501,894	1,051,628	1,435,664	1,476,802	1,522,246	1,901,933	2,221,166	2,541,585	3,363,429	4,594,175	6,636,365
Asia	Mideast	201,258	359,198	376,129	402,515	431,023	587,261	731,866	957,014	1,717,551	3,234,725	6,143,023
Asia	North America	607,675	1,221,115	1,579,920	1,661,592	1,804,609	2,486,980	3,141,395	3,781,586	5,391,208	7,568,571	10,465,321
Asia	South America	59,321	105,576	130,232	140,665	151,672	215,417	273,392	356,251	642,141	1,248,853	2,559,445
Asia	Caribbean	17,163	35,391	37,499	40,341	43,366	63,275	95,221	145,338	339,812	777,750	1,705,755
Europe	Africa	144,724	159,793	171,828	189,086	207,307	321,271	419,615	531,403	810,136	1,207,214	1,786,590
Europe	Asia	431,484	446,168	523,839	561,120	606,911	897,026	1,239,144	1,778,019	3,770,366	8,220,488	17,799,804
Europe	Europe	667,474	1,006,584	1,230,780	1,280,739	1,349,577	1,701,706	2,036,273	2,363,933	3,137,666	4,181,065	5,646,763
Europe	Mideast	252,851	303,532	346,289	379,743	415,042	602,746	732,383	897,205	1,537,671	1,987,937	2,935,357
Europe	North America	273,189	449,868	455,093	492,467	547,159	738,669	914,609	1,089,584	1,518,438	2,083,848	2,824,997
Europe	South America	60,439	93,649	120,984	134,749	148,742	225,758	267,261	308,979	406,027	529,037	688,399
Europe	Caribbean	35,710	34,556	36,296	39,984	43,684	61,062	67,514	72,920	82,494	92,163	103,030
Mideast	Africa	18,901	55,120	56,262	61,353	66,151	96,122	126,774	164,201	266,229	434,716	717,450
Mideast	Asia	106,211	121,614	136,471	143,151	148,502	184,831	236,740	318,299	593,412	1,134,833	2,170,191
Mideast	Europe	72,317	201,631	260,630	280,951	299,496	377,409	458,804	544,725	756,989	1,065,149	1,577,095
Mideast	Mideast	106,563	142,334	146,278	157,215	167,962	218,458	260,731	322,231	498,299	792,605	1,369,231
Mideast	North America	16,387	41,906	55,524	62,025	68,981	94,275	117,661	142,006	201,869	280,890	382,326
Mideast	South America	1,174	3,598	4,147	4,526	4,895	6,918	8,364	9,837	13,253	17,580	23,241
Mideast	Caribbean	1,284	3,261	3,378	3,622	3,837	4,560	4,857	5,061	5,375	5,652	5,993
North America	Africa	3,396	3,781	4,480	4,350	4,247	5,164	5,868	6,554	7,989	9,540	11,227
North America	Asia	347,317	251,747	314,732	329,486	342,869	420,609	518,940	621,854	938,173	1,519,201	2,599,357
North America	Europe	128,210	139,521	196,224	202,620	211,974	250,391	294,332	334,675	429,559	563,738	779,948
North America	Mideast	12,544	8,878	9,186	9,441	9,463	11,696	13,654	15,484	19,740	25,077	31,994
North America	North America	6,209	12,037	23,169	25,010	27,438	36,128	46,918	56,749	80,230	111,805	153,874
North America	South America	109,203	88,093	79,797	85,350	88,840	109,581	127,668	144,367	180,597	222,390	271,625
North America	Caribbean	39,252	39,381	39,382	41,750	44,126	56,769	69,317	87,862	161,104	330,188	624,474
South America	Africa	3,118	5,026	5,672	6,030	6,478	9,627	12,782	16,832	29,273	52,753	100,918
South America	Asia	74,919	73,335	79,081	81,943	83,261	99,761	122,731	159,546	300,430	627,181	1,341,575
South America	Europe	45,321	77,996	102,408	107,633	111,580	124,454	141,543	155,197	179,881	202,163	228,979
South America	Mideast	2,732	4,165	5,162	5,572	6,072	8,652	11,068	14,703	26,792	50,955	102,116
South America	North America	76,225	137,448	401,003	441,688	491,715	643,303	726,590	805,353	999,513	1,260,754	1,610,826
South America	South America	92,470	110,319	140,377	151,395	163,057	228,313	276,819	336,698	510,465	822,507	1,445,556
South America	Caribbean	31,359	53,016	57,682	62,039	66,397	93,472	128,374	188,895	428,897	997,352	2,278,992
Caribbean	Africa	70	479	532	554	583	790	1,033	1,397	2,657	5,341	11,515
Caribbean	Asia	254	274	296	317	343	476	629	854	1,614	3,114	6,104
Caribbean	Europe	3,058	1,612	2,077	2,151	2,227	2,561	2,919	3,247	4,033	5,088	6,556
Caribbean	Mideast	89	225	264	279	298	381	444	542	857	1,439	2,541
Caribbean	North America	4,683	7,874	9,174	10,458	11,879	17,520	23,903	30,670	48,350	73,290	107,449
Caribbean	South America	9,714	21,220	26,845	29,037	31,282	41,923	47,384	52,841	65,193	81,620	106,314
Caribbean	Caribbean	27,183	42,175	45,645	48,454	50,977	68,306	94,659	142,379	335,094	798,311	1,852,529
Total		**7,674,045**	**11,367,708**	**13,953,342**	**14,863,029**	**15,972,123**	**21,454,334**	**26,962,074**	**33,984,767**	**56,181,245**	**98,421,294**	**180,146,089**
Average Annual Growth Rate			**8.18%**	**7.07%**	**6.52%**	**7.46%**	**6.08%**	**4.68%**	**4.74%**	**5.16%**	**5.77%**	**6.23%**

Containerized WORLD Commodity Forecast For MATERIALS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(TEUs)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	20,756	27,126	28,501	28,532	28,553	29,548	32,765	39,692	68,856	139,170	307,957
Africa	Asia	20,911	28,293	33,225	33,692	34,978	44,445	54,216	67,502	112,101	208,191	423,728
Africa	Europe	48,620	67,599	85,876	90,215	92,468	88,374	90,423	95,127	105,837	118,721	135,944
Africa	Mideast	6,275	8,143	8,879	9,084	9,335	10,268	11,374	13,050	17,918	25,963	40,119
Africa	North America	1,912	2,807	4,956	4,828	4,928	5,776	6,529	7,133	8,469	10,047	11,907
Africa	South America	4,045	3,534	4,587	4,770	4,883	5,717	6,313	6,837	7,787	9,184	12,222
Africa	Caribbean	177	642	693	724	741	792	834	870	945	1,065	1,277
Asia	Africa	71,678	102,812	105,811	107,940	111,491	150,866	208,593	313,609	734,374	1,717,872	4,002,541
Asia	Asia	2,403,502	3,757,692	4,332,325	4,513,296	4,639,489	5,812,869	6,932,157	8,865,563	15,378,606	28,567,845	55,047,018
Asia	Europe	485,303	767,729	956,767	949,854	950,332	1,079,367	1,193,125	1,367,916	2,028,191	3,426,461	6,580,307
Asia	Mideast	232,600	329,666	344,074	365,535	379,697	469,686	570,908	729,970	1,336,427	2,767,274	6,217,591
Asia	North America	439,106	809,253	1,099,786	1,091,092	1,115,582	1,234,948	1,317,243	1,382,575	1,600,650	1,907,914	2,273,557
Asia	South America	52,271	84,305	98,727	103,691	108,845	144,546	161,515	185,817	275,532	487,811	959,361
Asia	Caribbean	20,632	41,416	39,289	40,442	42,007	55,347	79,949	115,178	246,446	522,314	1,084,006
Europe	Africa	134,261	185,806	197,402	203,226	207,767	245,862	277,699	307,298	373,113	460,536	576,925
Europe	Asia	413,742	718,869	877,572	895,110	919,677	1,081,310	1,274,962	1,580,281	2,643,291	4,967,334	10,161,894
Europe	Europe	575,359	804,404	983,110	980,173	967,737	954,123	950,464	967,378	1,043,615	1,195,140	1,463,354
Europe	Mideast	189,390	258,172	301,690	317,106	333,009	408,667	467,778	540,518	724,752	981,427	1,354,431
Europe	North America	148,548	270,737	395,881	383,231	382,272	410,792	423,363	438,765	489,460	561,739	654,284
Europe	South America	51,430	74,196	100,613	105,875	110,735	137,364	156,054	173,761	212,142	260,419	322,317
Europe	Caribbean	16,225	16,523	17,167	17,779	18,157	19,244	20,255	21,346	23,584	26,774	31,931
Mideast	Africa	9,109	21,017	21,883	22,187	22,442	24,987	27,735	31,128	42,310	67,109	125,935
Mideast	Asia	10,757	23,314	24,731	25,334	26,013	32,538	40,446	53,369	100,140	204,631	443,537
Mideast	Europe	46,857	91,569	111,743	118,855	125,549	134,261	144,856	156,781	189,373	241,297	329,324
Mideast	Mideast	40,911	61,673	64,637	67,509	69,784	76,632	85,138	95,221	122,523	166,287	234,351
Mideast	North America	7,978	24,896	33,436	36,202	38,283	44,735	47,415	50,947	60,542	73,579	90,389
Mideast	South America	1,190	1,077	1,341	1,442	1,515	2,110	2,304	2,446	2,762	3,848	7,088
Mideast	Caribbean	172	372	388	394	396	398	404	413	448	550	823
North America	Africa	10,891	9,736	10,769	11,005	11,230	14,602	21,454	35,451	93,910	237,715	597,675
North America	Asia	1,079,322	1,021,526	1,533,385	1,543,660	1,495,667	1,269,793	1,119,432	1,082,649	1,054,069	1,089,098	1,201,064
North America	Europe	309,835	309,488	335,180	351,134	357,631	294,176	272,476	281,815	313,705	363,221	441,757
North America	Mideast	33,360	40,301	33,597	33,655	33,541	33,746	33,986	35,253	38,492	42,795	48,539
North America	North America	16,295	21,847	51,862	49,656	49,025	44,305	41,497	40,967	40,181	40,510	42,361
North America	South America	147,431	156,965	162,397	163,254	162,331	164,862	167,101	171,438	185,938	206,654	233,965
North America	Caribbean	53,373	72,778	138,770	151,402	165,851	264,170	428,855	646,350	1,426,378	3,001,018	6,029,481
South America	Africa	5,614	5,507	5,319	4,832	4,476	3,679	3,598	4,051	6,211	11,388	22,978
South America	Asia	58,944	67,688	94,773	94,277	94,992	102,449	107,867	123,160	170,731	265,376	472,600
South America	Europe	90,286	115,927	168,616	174,356	178,165	190,641	190,905	198,209	218,838	249,630	293,858
South America	Mideast	13,234	10,656	11,865	12,038	12,286	12,627	13,104	14,087	16,802	20,683	25,944
South America	North America	62,606	108,325	507,264	483,957	480,569	466,269	442,880	452,309	468,959	486,297	515,370
South America	South America	55,076	86,840	108,600	112,166	116,048	136,971	158,007	187,282	282,232	466,808	824,083
South America	Caribbean	14,685	30,517	28,475	29,643	30,767	36,475	45,423	57,816	101,500	187,326	345,699
Caribbean	Africa	59	214	210	210	212	225	228	231	240	255	276
Caribbean	Asia	1,811	2,455	3,212	3,098	3,066	3,847	4,260	4,844	6,427	8,766	12,422
Caribbean	Europe	2,624	4,023	5,288	5,443	5,575	5,835	5,888	6,018	6,592	7,641	9,219
Caribbean	Mideast	85	160	191	196	198	213	230	249	296	358	425
Caribbean	North America	5,077	8,575	13,323	13,148	13,470	13,684	14,268	14,945	16,413	18,213	20,532
Caribbean	South America	7,359	9,888	11,666	11,619	11,565	11,832	12,117	12,539	13,181	13,784	14,488
Caribbean	Caribbean	9,328	16,128	15,313	15,750	16,146	18,598	22,252	28,057	50,766	93,711	157,051
Total		**7,430,111**	**10,683,177**	**13,515,167**	**13,782,618**	**13,989,475**	**15,794,567**	**17,690,644**	**21,008,231**	**32,462,052**	**55,931,552**	**104,243,903**
Average Annual Growth Rate			**7.53%**	**8.15%**	**1.98%**	**1.50%**	**2.46%**	**2.29%**	**3.50%**	**4.45%**	**5.59%**	**6.42%**

Containerized WORLD Commodity Forecast For ALL COMMODITIES
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(TEUs)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	211,943	273,353	285,859	294,968	302,619	345,690	395,141	493,191	874,579	1,758,140	3,868,028
Africa	Asia	150,665	230,294	255,274	267,992	283,645	361,725	440,843	553,156	916,316	1,613,705	2,961,716
Africa	Europe	409,041	581,103	707,010	725,859	743,229	817,467	875,853	931,963	1,076,249	1,264,689	1,508,433
Africa	Mideast	82,105	111,403	119,845	126,351	132,777	162,545	186,950	225,359	332,255	520,576	872,043
Africa	North America	27,712	49,513	77,010	83,168	90,877	118,308	135,195	148,827	184,022	221,764	267,696
Africa	South America	29,912	10,512	13,177	13,982	14,668	18,542	20,868	23,087	27,903	33,935	42,495
Africa	Caribbean	1,935	3,877	4,155	4,403	4,589	5,453	6,039	6,793	9,259	13,965	23,033
Asia	Africa	309,636	567,351	599,350	618,449	645,061	881,369	1,201,306	1,736,061	3,817,707	8,584,533	19,467,464
Asia	Asia	13,173,210	19,976,221	22,981,778	24,403,160	25,845,049	34,223,230	42,764,231	55,281,685	97,774,721	183,913,722	347,757,385
Asia	Europe	3,584,347	6,273,458	7,830,453	8,039,602	8,213,759	9,710,127	10,941,238	12,427,261	16,626,620	23,505,254	35,647,458
Asia	Mideast	1,034,303	1,548,868	1,605,255	1,697,581	1,791,456	2,307,932	2,802,970	3,553,775	6,084,820	11,230,701	22,043,905
Asia	North America	3,843,635	6,801,526	8,949,767	9,327,872	10,040,316	13,779,467	16,457,973	19,215,082	26,120,288	35,065,417	46,195,584
Asia	South America	333,869	500,527	596,892	643,345	690,617	959,427	1,151,339	1,396,445	2,179,858	3,724,561	6,952,992
Asia	Caribbean	80,892	142,759	144,888	152,750	161,239	218,991	310,581	449,139	977,402	2,132,790	4,533,282
Europe	Africa	968,021	1,155,312	1,202,109	1,281,211	1,355,806	1,806,769	2,161,796	2,552,641	3,538,557	4,976,825	7,221,579
Europe	Asia	2,684,122	3,393,464	3,850,026	4,069,864	4,331,414	5,902,173	7,492,387	9,877,564	18,321,955	36,366,845	74,151,269
Europe	Europe	4,287,373	5,988,423	7,005,258	7,250,437	7,533,863	8,988,787	10,094,705	11,295,620	14,310,935	18,659,025	25,094,197
Europe	Mideast	1,211,442	1,669,081	1,850,615	2,008,076	2,174,982	3,035,648	3,616,417	4,347,245	6,295,095	9,118,254	13,189,503
Europe	North America	1,366,085	2,341,880	2,754,276	2,886,693	3,105,584	3,990,913	4,599,473	5,184,189	6,661,566	8,581,549	10,970,931
Europe	South America	487,886	598,637	737,394	810,603	886,152	1,288,488	1,498,046	1,699,121	2,160,207	2,734,363	3,458,230
Europe	Caribbean	217,987	223,064	230,483	247,352	262,678	328,642	350,338	370,921	413,247	468,542	550,282
Mideast	Africa	102,197	188,910	195,813	207,595	220,033	310,959	441,774	663,578	1,527,660	3,534,332	7,899,605
Mideast	Asia	362,109	572,516	624,404	656,964	684,431	837,379	1,026,021	1,298,471	2,257,470	4,169,143	7,573,623
Mideast	Europe	523,922	852,180	1,000,619	1,057,859	1,114,997	1,346,604	1,544,029	1,749,219	2,268,986	3,034,457	4,269,282
Mideast	Mideast	457,431	684,572	726,392	771,966	819,124	1,048,917	1,240,887	1,516,926	2,376,204	3,966,421	6,622,357
Mideast	North America	76,168	144,809	199,982	218,342	239,432	298,904	347,689	395,980	526,727	699,363	918,809
Mideast	South America	13,167	21,954	27,173	28,734	30,371	38,611	43,164	47,723	58,771	75,172	103,510
Mideast	Caribbean	2,684	6,841	7,105	7,494	7,856	9,049	10,066	11,471	16,609	27,909	53,846
North America	Africa	59,120	51,533	63,431	63,677	64,493	75,085	87,589	107,793	183,324	353,583	754,045
North America	Asia	3,775,267	3,586,181	4,552,811	4,699,748	4,760,613	5,105,829	5,461,351	6,066,559	7,949,128	11,404,531	17,834,683
North America	Europe	1,331,149	1,492,684	1,736,931	1,793,581	1,833,805	1,904,851	2,148,798	2,339,190	2,830,105	3,535,675	4,591,569
North America	Mideast	101,196	133,104	158,883	163,400	167,511	202,562	223,713	247,790	303,724	371,162	452,095
North America	North America	78,191	140,365	431,074	450,829	478,091	607,365	683,572	760,057	929,950	1,127,815	1,356,231
North America	South America	785,929	839,523	819,583	861,599	884,301	1,043,790	1,166,433	1,297,618	1,658,007	2,216,176	3,061,292
North America	Caribbean	232,594	335,278	405,205	428,903	453,200	594,343	792,354	1,054,069	1,985,399	3,870,237	7,448,769
South America	Africa	40,468	55,081	57,535	59,885	61,227	74,093	85,718	101,230	151,165	248,493	458,401
South America	Asia	420,123	480,304	552,834	576,441	596,633	727,037	837,434	1,007,559	1,577,759	2,739,600	5,170,057
South America	Europe	703,214	940,148	1,191,972	1,244,537	1,288,407	1,553,657	1,676,825	1,728,379	2,034,577	2,466,409	3,162,815
South America	Mideast	90,193	148,856	157,412	166,726	177,164	223,234	256,598	302,386	437,203	651,283	961,737
South America	North America	438,219	716,039	1,671,683	1,734,654	1,826,293	2,212,172	2,442,993	2,707,052	3,359,515	4,207,263	5,302,882
South America	South America	445,188	664,436	810,291	861,977	917,740	1,222,941	1,418,486	1,642,654	2,242,279	3,182,414	4,756,856
South America	Caribbean	115,422	209,086	213,135	226,736	239,628	313,229	400,103	532,466	1,029,215	2,116,342	4,386,198
Caribbean	Africa	2,367	4,471	4,647	4,753	4,838	5,589	6,841	9,331	20,014	46,133	101,031
Caribbean	Asia	17,309	23,633	26,888	27,147	27,422	32,574	34,621	37,734	47,880	65,974	98,811
Caribbean	Europe	105,059	124,638	153,969	160,943	165,278	178,607	187,559	196,966	219,161	250,357	296,640
Caribbean	Mideast	5,819	11,867	12,844	12,955	13,179	13,572	13,801	15,026	18,243	23,902	32,844
Caribbean	North America	94,721	212,906	269,826	279,818	294,217	337,673	380,365	422,673	528,325	658,388	814,279
Caribbean	South America	50,693	79,890	94,153	99,072	103,105	124,193	135,347	146,741	171,250	202,574	247,223
Caribbean	Caribbean	94,297	197,477	200,980	213,537	225,420	293,467	377,496	505,281	986,410	2,005,653	3,983,664
Total		**45,020,247**	**65,360,809**	**78,168,449**	**82,033,595**	**86,309,191**	**110,077,980**	**130,976,208**	**158,681,047**	**246,398,624**	**411,739,926**	**719,492,679**
Average Annual Growth Rate			**7.74%**	**6.15%**	**4.94%**	**5.21%**	**4.99%**	**3.54%**	**3.91%**	**4.50%**	**5.27%**	**5.74%**

Containerized World Commodity By Destination (TEUs)

Containerized WORLD Commodity Forecast For AGRICULTURE COMMODITIES
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(TEUs)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	10,252	16,817	18,707	19,102	19,418	21,681	24,084	29,388	48,087	90,959	192,678
Africa	Asia	15,314	27,965	28,839	29,767	30,415	34,413	41,445	50,566	97,711	212,030	486,898
Africa	Europe	42,503	68,798	68,715	73,724	77,720	99,783	114,573	132,599	180,550	262,564	430,952
Africa	Mideast	6,502	9,951	10,946	11,501	12,038	15,688	17,743	19,961	24,956	31,415	41,458
Africa	North America	1,598	2,214	2,743	2,857	2,921	3,356	3,704	4,062	4,711	5,346	5,963
Africa	South America	7,684	9,262	9,073	9,476	9,788	11,847	14,453	18,428	32,887	65,664	144,985
Africa	Caribbean	577	616	623	682	744	1,201	1,959	3,446	9,658	25,010	56,401
Asia	Africa	23,932	41,713	46,084	47,697	49,258	61,779	72,031	86,969	136,305	235,723	421,622
Asia	Asia	758,778	1,042,582	1,094,082	1,130,626	1,144,451	1,314,264	1,488,050	1,747,223	2,498,849	3,851,660	5,768,974
Asia	Europe	131,682	150,495	165,116	173,161	180,936	215,248	242,849	276,846	354,515	461,247	600,795
Asia	Mideast	25,846	63,893	69,846	73,468	77,955	99,040	115,715	133,239	174,893	228,505	296,259
Asia	North America	462,409	329,794	437,021	471,862	480,371	544,935	587,175	631,624	740,798	881,487	1,073,980
Asia	South America	72,688	82,318	90,421	91,430	90,320	99,470	103,250	110,084	126,842	144,951	174,478
Asia	Caribbean	7,099	9,509	10,127	10,225	9,761	10,419	10,176	10,358	11,483	13,616	17,143
Europe	Africa	124,837	149,732	167,273	168,852	170,580	184,632	193,246	198,527	213,990	236,148	270,295
Europe	Asia	185,607	274,416	307,609	306,861	304,771	283,643	268,585	263,745	262,027	269,985	285,104
Europe	Europe	283,755	433,878	475,546	490,125	507,394	585,071	626,549	686,428	790,661	939,027	1,179,981
Europe	Mideast	127,304	130,999	131,225	137,868	140,568	157,190	166,106	173,547	190,622	212,983	239,968
Europe	North America	162,736	154,151	151,624	155,821	152,102	149,143	149,012	149,998	156,202	166,910	181,306
Europe	South America	274,097	341,921	400,462	421,545	432,163	534,527	577,651	531,238	592,825	665,299	754,800
Europe	Caribbean	67,457	62,632	73,848	79,398	81,920	88,281	94,468	98,948	107,918	120,409	139,100
Mideast	Africa	45,999	58,083	63,879	66,594	69,150	80,379	88,277	101,603	128,231	161,058	199,657
Mideast	Asia	110,645	132,791	138,051	144,312	147,981	174,507	191,762	212,834	257,836	310,187	371,855
Mideast	Europe	51,477	97,026	101,925	106,996	111,104	133,189	147,508	161,308	196,955	238,968	285,117
Mideast	Mideast	143,561	188,191	206,641	219,809	233,953	308,560	350,569	398,491	502,060	624,651	770,307
Mideast	North America	9,723	20,051	31,868	32,954	33,265	43,021	48,691	54,077	66,337	80,492	95,908
Mideast	South America	24,305	36,148	39,413	43,198	46,909	61,453	75,843	96,172	165,202	284,924	453,321
Mideast	Caribbean	1,060	3,462	3,858	3,976	4,065	4,461	4,824	5,718	7,207	8,993	10,899
North America	Africa	2,411	7,454	8,188	7,987	8,069	8,266	8,333	7,957	7,973	7,996	8,108
North America	Asia	55,451	94,691	151,593	151,331	155,459	163,393	168,667	158,885	176,880	199,916	226,757
North America	Europe	31,631	77,805	100,096	97,746	96,637	112,895	114,779	107,803	109,057	114,291	121,732
North America	Mideast	3,642	5,304	7,169	7,864	8,658	10,222	11,341	8,388	9,579	10,930	12,454
North America	North America	18,095	17,218	8,060	8,311	8,520	8,773	9,349	9,954	12,040	14,674	17,741
North America	South America	81,277	141,173	220,756	221,904	228,956	250,867	262,405	270,721	296,556	325,255	356,293
North America	Caribbean	26,648	45,122	48,382	49,644	50,118	44,013	42,654	39,569	33,374	27,737	22,997
South America	Africa	362	524	643	640	646	692	702	778	861	944	1,028
South America	Asia	10,049	8,567	11,419	11,988	12,503	14,884	16,089	18,008	21,532	25,774	32,133
South America	Europe	16,883	23,085	29,371	30,918	32,657	40,237	43,445	47,710	54,176	60,843	67,063
South America	Mideast	1,672	2,759	3,227	3,299	3,407	3,952	4,137	4,315	4,641	4,969	5,470
South America	North America	30,347	36,380	38,725	39,528	41,059	48,724	52,859	57,619	66,008	74,445	83,209
South America	South America	47,287	56,842	67,275	70,346	74,897	95,834	107,930	119,820	143,872	171,440	206,697
South America	Caribbean	3,826	4,244	4,677	4,723	4,788	5,203	5,405	6,151	7,028	7,963	8,933
Caribbean	Africa	123	385	425	457	491	692	958	1,301	2,484	4,828	9,314
Caribbean	Asia	652	3,043	3,372	3,447	3,521	3,890	4,252	4,825	6,906	11,706	21,350
Caribbean	Europe	10,474	16,008	15,526	16,772	17,852	22,830	24,796	26,236	28,651	30,956	33,399
Caribbean	Mideast	86	209	230	254	267	299	302	305	311	317	324
Caribbean	North America	20,432	25,873	31,536	32,920	34,170	39,415	41,769	43,563	46,655	49,450	51,958
Caribbean	South America	10,355	16,525	16,566	17,602	18,639	24,170	29,375	35,602	56,122	96,532	176,243
Caribbean	Caribbean	8,399	34,322	34,582	37,952	41,366	60,694	82,092	108,514	201,151	385,679	742,141
Total		**3,559,731**	**4,556,941**	**5,147,394**	**5,339,522**	**5,464,791**	**6,281,524**	**6,851,953**	**7,465,452**	**9,366,172**	**12,416,854**	**17,155,545**
Average Annual Growth Rate			**5.06%**	**4.14%**	**3.73%**	**2.35%**	**2.82%**	**1.75%**	**1.73%**	**2.29%**	**2.86%**	**3.29%**

Containerized WORLD Commodity Forecast For CAPITAL EQUIPMENT
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(TEUs)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	12,066	15,688	13,154	14,382	15,859	23,413	26,477	29,839	38,163	50,262	68,482
Africa	Asia	34,972	60,578	59,595	62,130	66,251	101,567	151,192	233,279	557,766	1,319,069	3,074,828
Africa	Europe	99,794	151,284	139,303	155,220	175,887	301,479	395,372	486,632	722,100	1,057,719	1,533,322
Africa	Mideast	5,749	9,522	8,409	9,276	10,285	16,681	24,650	36,767	82,245	183,614	415,092
Africa	North America	9,835	9,116	14,550	14,429	14,936	18,061	20,666	23,219	31,144	44,162	62,216
Africa	South America	2,695	3,019	3,167	3,350	3,689	5,826	7,412	9,059	13,496	20,499	32,653
Africa	Caribbean	45	219	224	238	254	337	398	463	621	823	1,069
Asia	Africa	2,094	3,695	3,396	3,726	4,190	6,904	9,731	14,009	29,392	61,997	128,506
Asia	Asia	1,155,302	1,407,746	1,682,784	1,831,863	2,001,917	2,886,261	3,912,937	5,442,682	10,900,951	22,370,562	37,033,429
Asia	Europe	441,621	413,324	429,461	479,414	540,689	880,759	1,250,320	1,842,048	4,033,665	8,888,992	18,907,025
Asia	Mideast	5,285	11,351	10,828	11,980	13,327	21,069	28,637	38,717	71,245	132,201	243,939
Asia	North America	268,045	237,791	286,033	303,895	317,248	390,260	471,746	573,266	886,009	1,470,274	2,620,070
Asia	South America	13,533	11,120	14,618	15,623	17,068	23,581	31,866	44,924	92,914	198,256	412,922
Asia	Caribbean	929	268	327	350	379	536	699	941	1,777	3,492	7,095
Europe	Africa	15,308	28,551	41,985	46,493	51,079	75,869	91,779	106,230	138,058	175,018	217,556
Europe	Asia	280,702	632,540	832,217	862,600	908,279	1,250,746	1,503,053	1,770,231	2,468,855	3,497,550	5,041,440
Europe	Europe	357,755	583,573	703,262	758,201	827,935	1,185,871	1,462,604	1,737,666	2,385,698	3,234,751	4,359,378
Europe	Mideast	24,319	54,988	69,913	76,175	82,400	125,943	155,132	183,008	247,651	329,507	434,975
Europe	North America	176,000	242,102	320,826	337,768	353,461	463,721	541,620	612,726	778,948	994,004	1,261,211
Europe	South America	20,638	36,422	53,403	57,975	62,370	85,593	105,106	122,735	162,337	210,237	268,309
Europe	Caribbean	2,157	3,873	6,252	6,529	6,619	6,984	6,857	7,042	8,241	10,290	12,817
Mideast	Africa	1,385	2,470	2,137	2,360	2,602	3,765	4,351	5,121	7,230	10,565	15,876
Mideast	Asia	93,284	160,071	154,443	164,277	178,495	250,349	320,520	428,167	792,658	1,534,125	3,133,688
Mideast	Europe	139,194	207,404	207,155	234,827	267,089	436,216	545,741	676,640	1,041,674	1,595,925	2,404,048
Mideast	Mideast	14,554	28,006	26,442	29,777	33,544	53,105	69,681	92,797	169,552	324,532	661,635
Mideast	North America	12,088	12,563	15,767	16,859	18,246	20,289	21,893	23,383	26,222	28,903	31,728
Mideast	South America	1,916	2,378	2,761	3,047	3,404	5,306	7,137	9,450	16,499	28,649	49,717
Mideast	Caribbean	35	463	511	555	605	723	783	872	1,146	1,563	2,161
North America	Africa	3,549	6,355	11,242	12,582	14,301	23,119	28,718	34,070	46,514	61,609	79,390
North America	Asia	731,870	1,086,615	1,263,264	1,374,222	1,498,495	2,153,611	2,622,783	3,087,495	4,219,423	5,658,918	7,396,918
North America	Europe	240,604	411,643	459,159	497,595	550,515	828,572	1,042,774	1,259,627	1,779,963	2,431,762	3,213,858
North America	Mideast	5,963	8,472	17,909	18,729	20,367	30,685	37,549	44,149	60,741	82,452	109,580
North America	North America	5,273	14,349	11,795	13,304	14,633	20,811	25,200	29,259	38,639	49,775	62,646
North America	South America	55,721	83,558	195,093	219,847	240,709	361,483	453,634	543,989	760,978	1,030,645	1,353,393
North America	Caribbean	1,390	5,611	17,222	20,027	22,994	32,299	37,807	42,621	54,245	68,549	85,333
South America	Africa	715	670	734	836	936	1,443	1,727	1,991	2,629	3,431	4,413
South America	Asia	46,731	70,754	84,004	91,315	98,740	136,423	162,979	194,207	289,995	468,420	820,960
South America	Europe	91,760	131,645	153,215	176,208	201,642	335,888	403,554	462,265	604,053	785,418	1,015,792
South America	Mideast	1,113	1,598	1,719	1,892	2,069	2,756	3,031	3,304	4,083	5,257	6,902
South America	North America	145,272	146,874	130,005	140,121	143,387	171,119	189,750	204,576	240,307	284,008	334,801
South America	South America	23,383	28,731	36,198	40,586	45,208	71,408	84,868	97,157	126,880	165,807	215,428
South America	Caribbean	952	1,648	1,995	2,247	2,548	4,108	4,906	5,544	6,956	8,629	10,616
Caribbean	Africa	38	208	189	209	231	326	345	358	387	418	454
Caribbean	Asia	10,300	17,578	17,293	18,405	19,688	27,980	39,782	57,523	127,236	279,754	574,559
Caribbean	Europe	21,652	27,856	25,186	28,097	31,341	45,949	49,514	52,486	59,028	66,564	74,899
Caribbean	Mideast	298	825	777	829	910	1,081	1,407	2,029	4,770	11,692	29,226
Caribbean	North America	20,856	29,070	29,421	30,467	31,781	37,007	37,403	37,985	40,573	44,645	49,587
Caribbean	South America	4,930	7,266	6,833	7,591	8,446	12,941	15,574	19,146	31,412	57,473	116,471
Caribbean	Caribbean	1,665	2,709	2,493	2,749	3,024	4,316	4,793	5,211	6,060	6,993	8,030
Total		**4,605,339**	**6,334,157**	**7,568,673**	**8,201,169**	**8,930,166**	**12,944,539**	**16,416,460**	**20,736,905**	**34,211,118**	**59,349,759**	**97,998,442**
Average Annual Growth Rate			**6.58%**	**6.12%**	**8.36%**	**8.89%**	**7.71%**	**4.87%**	**4.78%**	**5.13%**	**5.66%**	**5.14%**

Containerized WORLD Commodity Forecast For CHEMICALS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(TEUs)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	16,570	32,977	34,751	36,465	38,124	48,918	67,177	101,203	236,142	560,775	1,367,402
Africa	Asia	27,197	52,115	55,851	58,248	61,127	82,959	128,870	197,542	459,553	1,069,798	2,540,155
Africa	Europe	116,387	144,081	151,664	161,522	171,797	244,630	305,834	375,379	542,181	773,469	1,128,432
Africa	Mideast	25,992	51,009	52,329	58,051	64,317	110,832	193,742	352,773	1,028,649	2,690,170	6,392,292
Africa	North America	6,903	9,787	8,658	8,504	8,589	9,805	11,113	12,674	16,859	23,576	35,781
Africa	South America	4,179	6,184	6,689	6,836	7,122	9,572	11,438	13,170	17,379	22,311	28,361
Africa	Caribbean	120	253	234	234	238	274	300	341	488	811	1,510
Asia	Africa	20,030	33,076	36,721	40,072	43,708	63,656	86,270	117,262	221,264	434,485	874,857
Asia	Asia	2,264,883	3,964,000	4,836,674	5,189,967	5,573,226	7,549,116	9,772,314	12,887,401	23,669,816	46,282,236	93,663,214
Asia	Europe	534,097	659,793	732,305	799,810	869,426	1,267,266	1,695,456	2,308,199	4,476,562	9,106,157	18,892,649
Asia	Mideast	147,049	226,789	247,922	260,966	270,804	327,384	415,770	539,152	1,026,961	2,057,464	3,833,745
Asia	North America	535,461	522,588	668,953	677,084	699,519	809,935	937,050	1,114,980	1,678,251	2,751,511	4,848,762
Asia	South America	20,972	24,532	26,015	27,741	29,751	41,678	54,795	72,674	135,843	271,993	562,883
Asia	Caribbean	328	677	681	737	803	1,203	1,683	2,443	5,289	11,678	25,641
Europe	Africa	10,127	20,894	24,905	26,122	27,140	34,762	40,238	45,009	55,576	68,733	85,081
Europe	Asia	225,663	430,406	559,812	574,918	576,431	694,213	787,788	880,863	1,148,260	1,620,822	2,504,337
Europe	Europe	727,765	1,026,525	1,183,191	1,220,674	1,260,602	1,486,017	1,640,734	1,775,831	2,112,178	2,589,903	3,255,102
Europe	Mideast	69,846	113,377	127,932	132,121	135,559	161,461	186,033	209,173	274,968	395,570	648,991
Europe	North America	191,592	236,898	248,114	245,431	242,385	277,360	310,101	341,668	424,154	545,631	728,702
Europe	South America	27,498	51,385	61,827	63,962	66,044	82,592	95,865	107,269	132,285	161,931	196,946
Europe	Caribbean	4,950	5,190	6,467	6,771	7,294	8,992	10,173	11,339	14,046	17,369	21,435
Mideast	Africa	3,339	5,379	5,697	6,210	6,767	10,185	14,848	23,475	57,408	138,208	324,552
Mideast	Asia	58,299	130,596	139,329	149,705	158,329	205,902	246,755	304,498	476,658	788,427	1,419,517
Mideast	Europe	179,133	275,041	314,766	344,345	372,933	529,883	622,626	746,202	1,068,673	1,521,361	2,149,362
Mideast	Mideast	44,847	97,860	103,232	109,964	116,403	158,784	212,516	306,224	679,805	1,511,760	2,887,807
Mideast	North America	15,282	18,445	26,145	26,686	27,568	30,296	32,995	36,365	44,313	54,397	67,208
Mideast	South America	3,078	5,431	5,949	6,317	6,621	8,661	10,067	12,079	16,991	23,817	33,223
Mideast	Caribbean	109	521	567	618	668	944	1,094	1,310	1,885	2,707	3,841
North America	Africa	1,025	3,326	4,035	4,182	4,491	5,897	7,345	8,675	12,053	16,795	23,405
North America	Asia	161,958	298,866	378,533	391,069	413,508	505,899	582,947	649,265	820,956	1,061,554	1,377,579
North America	Europe	186,486	255,863	308,339	313,203	329,247	427,335	475,042	507,419	615,202	776,559	980,124
North America	Mideast	10,427	16,892	26,320	26,106	26,883	29,033	30,521	32,092	37,425	45,686	56,512
North America	North America	13,533	17,608	28,277	29,438	30,731	36,808	41,912	45,858	55,094	66,639	80,827
North America	South America	27,981	45,355	58,962	60,975	64,610	76,763	88,308	96,332	115,722	140,998	173,770
North America	Caribbean	459	2,702	1,928	2,143	2,382	3,244	4,014	4,752	6,583	9,010	12,173
South America	Africa	1,827	1,626	2,120	2,283	2,419	3,119	3,502	3,852	4,607	5,459	6,445
South America	Asia	22,548	55,809	71,646	78,357	83,766	112,232	134,630	165,244	262,356	456,030	885,465
South America	Europe	75,219	99,345	120,860	133,143	144,238	203,233	232,713	262,604	331,375	415,863	521,172
South America	Mideast	2,640	7,173	9,569	9,922	10,468	13,322	14,905	16,462	20,442	26,949	39,764
South America	North America	158,280	207,323	214,809	228,029	233,361	272,706	313,183	361,328	514,636	785,070	1,192,058
South America	South America	78,385	131,692	155,549	168,179	178,535	232,158	271,563	316,344	431,102	588,639	792,081
South America	Caribbean	2,546	4,165	4,742	5,005	5,275	6,469	7,381	8,242	10,157	12,602	16,034
Caribbean	Africa	68	494	524	548	570	677	734	788	904	1,043	1,208
Caribbean	Asia	2,932	12,542	13,344	14,424	15,311	20,232	26,063	34,082	62,798	125,558	249,609
Caribbean	Europe	14,191	15,765	16,353	17,627	18,691	23,721	26,598	29,371	35,914	46,401	66,903
Caribbean	Mideast	224	731	752	802	845	1,080	1,351	1,671	2,632	4,190	6,519
Caribbean	North America	32,668	41,275	46,657	48,761	50,597	59,365	68,200	77,419	99,740	125,619	152,436
Caribbean	South America	10,182	19,040	19,312	20,926	22,475	31,505	41,927	55,220	100,032	186,143	347,374
Caribbean	Caribbean	3,493	10,966	10,936	11,570	12,109	15,424	19,238	24,387	41,217	69,607	113,067
Total		**6,090,766**	**9,394,168**	**11,160,945**	**11,806,772**	**12,493,779**	**16,342,502**	**20,285,730**	**25,597,903**	**43,603,385**	**80,461,484**	**155,617,361**
Average Annual Growth Rate			**9.05%**	**5.91%**	**5.79%**	**5.82%**	**5.52%**	**4.42%**	**4.76%**	**5.47%**	**6.32%**	**6.82%**

Containerized WORLD Commodity Forecast For CONSUMER GOODS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(TEUs)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	16,519	19,225	20,246	21,491	22,571	27,382	29,507	32,499	40,957	54,721	77,159
Africa	Asia	29,466	54,456	57,611	59,265	63,039	92,140	130,746	198,323	463,249	1,085,116	2,584,755
Africa	Europe	43,163	65,324	67,536	72,627	78,978	116,918	141,866	169,433	242,160	353,271	540,842
Africa	Mideast	6,132	14,064	14,979	15,937	16,974	22,617	27,196	32,793	48,845	75,279	119,696
Africa	North America	1,631	2,115	2,155	2,101	2,192	2,725	3,071	3,422	4,340	5,772	8,000
Africa	South America	338	569	621	647	706	1,074	1,265	1,460	1,935	2,579	3,463
Africa	Caribbean	35	70	75	76	78	91	102	113	139	172	210
Asia	Africa	976	1,413	1,541	1,645	1,772	2,661	3,425	4,384	7,151	11,708	19,372
Asia	Asia	1,179,655	1,949,574	2,289,219	2,400,117	2,472,096	3,298,071	3,848,004	4,624,483	6,908,208	10,608,927	16,798,771
Asia	Europe	122,574	172,769	197,912	210,398	225,045	328,669	417,950	532,769	895,906	1,548,324	2,723,815
Asia	Mideast	3,648	7,185	7,944	8,667	9,558	14,569	18,724	23,967	38,992	63,274	101,903
Asia	North America	106,821	90,230	97,056	104,079	110,004	136,443	171,612	221,525	395,439	749,303	1,460,970
Asia	South America	2,834	3,630	4,267	4,584	4,838	6,728	8,435	10,691	17,450	29,066	49,689
Asia	Caribbean	193	255	261	262	272	350	401	439	566	807	1,213
Europe	Africa	67,588	109,135	138,125	138,211	136,093	120,882	119,383	119,231	132,061	156,708	190,223
Europe	Asia	794,709	1,456,707	1,817,810	1,841,760	1,871,330	2,122,569	2,286,914	2,535,766	3,300,114	4,636,792	7,131,197
Europe	Europe	268,103	499,726	584,004	614,477	647,794	808,455	910,813	1,034,537	1,370,463	1,854,985	2,553,592
Europe	Mideast	41,645	77,844	96,071	104,965	114,772	150,568	172,530	194,897	250,478	324,274	418,733
Europe	North America	50,759	63,301	77,162	79,884	82,516	92,058	100,967	115,401	163,194	256,131	446,211
Europe	South America	19,851	33,784	44,854	47,706	50,820	69,329	72,763	82,859	108,798	141,614	182,340
Europe	Caribbean	1,385	2,947	3,429	3,510	3,630	4,342	4,826	5,330	6,512	7,911	9,537
Mideast	Africa	3,655	5,617	5,681	6,218	6,788	9,353	11,235	13,824	21,158	32,695	50,946
Mideast	Asia	127,595	176,479	183,198	190,908	201,820	266,508	331,028	433,084	804,242	1,556,723	3,157,158
Mideast	Europe	88,998	139,181	152,322	169,099	189,152	286,884	348,903	428,023	644,017	970,308	1,478,289
Mideast	Mideast	21,325	36,077	38,457	39,954	41,497	48,150	53,969	61,493	79,215	102,569	134,282
Mideast	North America	4,015	5,707	4,744	4,974	5,313	7,075	8,616	10,340	15,101	22,670	34,864
Mideast	South America	346	492	535	612	677	1,027	1,274	1,596	2,536	4,106	6,789
Mideast	Caribbean	48	207	222	234	246	315	371	443	689	1,245	2,553
North America	Africa	4,812	9,127	23,553	26,009	28,706	37,035	41,870	44,740	53,916	60,064	67,803
North America	Asia	1,169,125	2,268,080	3,198,039	3,338,935	3,630,545	5,195,385	6,089,052	7,082,171	9,535,119	12,644,968	16,433,646
North America	Europe	141,319	305,603	336,469	364,936	392,357	506,546	594,888	679,497	893,793	1,187,020	1,562,645
North America	Mideast	14,146	27,543	38,883	44,427	50,380	57,260	67,235	79,323	110,785	152,774	206,794
North America	North America	4,340	30,640	50,487	52,031	53,598	65,644	73,315	82,632	102,035	125,223	154,430
North America	South America	28,875	47,325	73,865	79,262	81,029	108,892	122,853	142,792	193,630	259,330	340,596
North America	Caribbean	42,812	125,322	157,539	162,006	169,678	201,501	232,121	264,044	342,133	432,996	534,942
South America	Africa	71	199	255	282	312	480	572	658	875	1,174	1,602
South America	Asia	79,361	100,839	121,323	130,749	141,420	200,894	233,575	270,947	381,911	570,541	904,595
South America	Europe	23,797	41,370	51,160	56,919	62,830	95,442	113,700	131,507	175,089	233,358	314,295
South America	Mideast	337	802	995	1,079	1,160	1,541	1,765	1,975	2,461	3,108	4,023
South America	North America	59,583	59,924	49,904	53,048	55,282	67,933	77,021	85,632	106,152	132,439	165,680
South America	South America	18,631	28,090	34,108	36,949	39,795	56,647	66,285	77,026	104,985	146,587	214,471
South America	Caribbean	4,497	9,538	11,156	11,786	12,471	16,201	17,786	18,920	23,364	29,940	31,030
Caribbean	Africa	155	282	303	337	374	555	610	678	902	1,328	2,104
Caribbean	Asia	11,736	17,935	18,301	19,943	21,669	32,523	48,412	72,342	162,065	358,377	784,083
Caribbean	Europe	16,470	15,602	15,732	17,451	19,170	27,510	29,846	32,201	38,069	46,589	59,905
Caribbean	Mideast	115	176	185	197	210	267	309	358	506	771	1,246
Caribbean	North America	30,478	80,234	53,011	55,223	57,289	65,093	69,574	74,047	83,374	93,868	105,048
Caribbean	South America	6,133	15,177	15,751	16,940	18,107	24,155	29,346	36,612	62,679	113,256	198,793
Caribbean	Caribbean	13,179	28,988	30,460	33,328	35,913	47,698	56,177	65,558	89,908	124,611	169,347
Total		**4,674,178**	**8,200,879**	**10,189,520**	**10,646,247**	**11,233,064**	**14,847,157**	**17,192,209**	**20,138,783**	**28,425,670**	**41,370,377**	**62,543,654**
Average Annual Growth Rate			**11.90%**	**7.51%**	**4.48%**	**5.51%**	**5.74%**	**2.98%**	**3.21%**	**3.51%**	**3.82%**	**4.22%**

Containerized WORLD Commodity Forecast For EXTRACTIVE COMMODITIES
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(TEUs)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	1,674	2,638	2,468	2,399	2,331	2,039	1,803	1,686	1,601	1,618	1,692
Africa	Asia	1,133	1,508	1,597	1,640	1,687	1,862	1,974	2,124	2,454	2,864	3,454
Africa	Europe	11,903	16,211	15,536	16,074	16,604	19,143	21,794	25,103	35,207	56,081	104,832
Africa	Mideast	820	1,530	1,576	1,645	1,679	1,830	1,909	1,999	2,165	2,312	2,448
Africa	North America	15,872	3,399	3,968	4,015	4,033	4,370	4,587	4,658	4,743	4,797	4,849
Africa	South America	501	886	812	831	880	1,009	1,132	1,259	1,489	1,708	1,933
Africa	Caribbean	0	3	3	3	3	3	4	4	4	5	5
Asia	Africa	5,343	6,319	6,274	6,954	7,595	9,713	10,860	12,468	17,133	24,757	37,420
Asia	Asia	410,698	592,908	658,647	684,937	713,827	793,606	808,990	880,096	1,161,906	1,781,871	3,143,208
Asia	Europe	39,288	77,021	75,414	82,520	84,787	98,204	108,035	121,277	155,308	195,481	242,678
Asia	Mideast	34,546	50,234	52,152	57,296	59,623	70,282	76,190	87,402	117,621	161,700	228,899
Asia	North America	147,996	167,782	187,887	198,213	201,300	213,124	219,342	229,700	258,829	298,481	356,842
Asia	South America	27,486	36,456	38,650	43,429	47,778	56,555	63,819	73,985	105,354	161,516	261,657
Asia	Caribbean	91	89	103	107	109	120	128	142	178	234	326
Europe	Africa	8,841	11,115	11,570	11,695	11,950	12,448	12,191	12,230	12,580	13,227	14,132
Europe	Asia	14,068	21,074	25,506	24,750	24,835	26,963	26,107	25,919	26,492	27,713	29,274
Europe	Europe	249,455	255,665	256,069	262,402	263,578	265,004	253,185	249,736	261,100	308,657	395,329
Europe	Mideast	20,243	35,883	38,496	38,921	40,221	42,802	42,643	43,486	45,641	48,420	51,554
Europe	North America	59,266	60,482	73,615	74,297	77,153	79,545	76,592	75,169	73,576	73,244	73,815
Europe	South America	22,579	31,716	35,365	33,881	34,231	37,970	37,692	38,071	39,421	41,423	43,867
Europe	Caribbean	588	1,291	1,432	1,461	1,465	1,506	1,455	1,441	1,446	1,464	1,488
Mideast	Africa	257	369	349	364	386	468	474	501	586	706	858
Mideast	Asia	2,997	5,552	5,743	5,864	5,906	6,391	6,233	6,441	7,492	9,763	14,559
Mideast	Europe	41,470	35,109	36,632	35,940	37,330	36,432	38,349	41,928	51,930	65,107	82,328
Mideast	Mideast	7,133	9,661	10,197	10,545	10,896	11,785	11,701	12,163	13,502	15,308	17,501
Mideast	North America	2,135	810	3,686	3,517	3,603	3,536	3,592	3,750	4,140	4,622	5,245
Mideast	South America	1,503	2,973	3,101	3,047	3,067	3,295	3,293	3,436	3,938	4,676	5,611
Mideast	Caribbean	1	4	5	5	5	5	5	5	6	7	8
North America	Africa	1,356	1,673	2,365	2,475	2,666	3,322	3,422	3,442	3,536	3,685	3,872
North America	Asia	6,468	25,067	17,621	16,696	16,297	15,757	14,340	13,007	11,000	9,621	8,778
North America	Europe	17,626	24,292	56,066	51,073	49,616	70,464	67,679	64,515	63,686	66,473	71,841
North America	Mideast	1,058	4,410	1,201	1,341	1,474	1,561	1,662	1,719	1,872	2,064	2,289
North America	North America	3,175	3,399	4,591	4,701	4,741	5,095	5,233	5,378	5,793	6,285	6,839
North America	South America	7,376	13,159	11,095	11,398	11,676	12,895	13,483	13,987	15,235	16,788	18,679
North America	Caribbean	360	408	448	456	469	519	539	560	619	683	753
South America	Africa	110	145	177	192	202	245	251	261	291	327	365
South America	Asia	553	1,147	1,301	1,361	1,399	1,553	1,583	1,627	1,737	1,862	1,996
South America	Europe	4,325	3,758	4,429	4,597	4,608	4,705	4,738	4,888	5,216	5,560	5,927
South America	Mideast	1,467	1,715	2,186	2,345	2,390	2,318	2,236	2,217	2,207	2,211	2,224
South America	North America	22,292	19,189	22,517	24,079	24,561	26,768	27,587	28,486	31,143	34,210	37,440
South America	South America	3,932	6,559	7,547	8,087	8,440	9,792	10,292	11,046	12,981	15,810	20,415
South America	Caribbean	5,489	6,152	6,841	6,778	6,855	6,745	6,338	6,043	5,531	5,073	4,658
Caribbean	Africa	2	17	18	19	19	22	25	27	28	29	29
Caribbean	Asia	27	66	76	80	83	98	113	131	184	298	551
Caribbean	Europe	695	3,641	3,605	3,827	3,977	4,559	5,052	5,476	5,880	6,029	6,086
Caribbean	Mideast	1	23	24	25	26	30	34	36	40	42	43
Caribbean	North America	4,723	1,040	5,228	5,369	5,442	5,535	5,614	5,681	5,808	5,971	6,178
Caribbean	South America	1,561	2,637	2,455	2,520	2,592	3,065	4,020	5,569	12,595	29,816	71,602
Caribbean	Caribbean	576	734	677	739	779	1,004	1,378	1,927	3,857	7,694	15,054
Total		**1,211,059**	**1,547,914**	**1,697,317**	**1,754,912**	**1,805,173**	**1,976,064**	**2,009,697**	**2,132,202**	**2,595,082**	**3,528,292**	**5,411,431**
Average Annual Growth Rate			**5.03%**	**3.12%**	**3.39%**	**2.86%**	**1.83%**	**0.34%**	**1.19%**	**1.98%**	**3.12%**	**4.37%**

Containerized WORLD Commodity Forecast For FOOD
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(TEUs)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	81,167	94,843	102,685	103,628	103,187	99,666	101,497	117,405	199,870	411,190	942,935
Africa	Asia	58,404	96,246	107,794	105,891	104,084	101,968	101,825	108,137	138,958	210,140	374,102
Africa	Europe	354,040	334,043	362,534	379,001	385,210	400,694	409,278	427,070	472,226	532,706	628,630
Africa	Mideast	28,165	24,575	27,453	25,513	23,816	18,515	16,722	16,776	20,224	29,552	51,086
Africa	North America	8,201	10,096	14,793	15,058	14,936	15,303	14,997	15,215	15,876	16,741	17,812
Africa	South America	16,310	24,384	25,953	27,620	27,785	30,920	32,909	36,041	47,063	69,681	120,107
Africa	Caribbean	1,450	2,590	2,710	2,723	2,692	2,613	2,744	3,262	6,108	13,587	29,875
Asia	Africa	38,590	51,936	57,913	59,410	62,305	73,231	76,886	82,041	95,388	111,226	128,816
Asia	Asia	1,448,020	2,116,979	2,186,234	2,258,778	2,335,984	2,780,811	3,121,164	3,563,482	4,829,713	6,949,968	10,416,675
Asia	Europe	523,061	693,028	782,525	794,413	820,791	998,805	1,073,286	1,156,618	1,380,670	1,647,627	1,916,988
Asia	Mideast	27,831	65,729	72,232	73,560	75,855	82,359	87,588	95,495	116,985	153,058	189,614
Asia	North America	787,539	890,164	929,344	968,888	1,006,508	1,190,822	1,275,980	1,384,099	1,617,860	1,895,052	2,147,736
Asia	South America	148,475	179,502	203,203	215,361	226,294	292,843	338,714	402,887	604,595	985,481	1,764,335
Asia	Caribbean	6,525	10,046	11,819	11,979	12,610	15,490	16,458	17,444	20,005	23,201	26,789
Europe	Africa	103,448	132,059	154,093	154,580	159,088	182,359	188,239	193,857	206,646	221,302	236,885
Europe	Asia	774,573	1,056,766	1,272,755	1,334,010	1,351,038	1,348,245	1,358,232	1,419,276	1,588,611	1,864,619	2,309,676
Europe	Europe	993,023	1,097,797	1,272,248	1,309,217	1,343,931	1,461,049	1,506,147	1,578,471	1,777,859	2,113,611	2,769,837
Europe	Mideast	115,176	121,357	132,801	134,100	139,407	137,494	136,558	137,704	144,914	161,127	189,097
Europe	North America	218,961	238,746	282,530	293,443	301,202	321,601	327,819	340,927	374,677	414,213	457,560
Europe	South America	201,557	247,894	321,650	333,763	348,877	421,673	445,679	479,893	578,808	760,658	1,143,566
Europe	Caribbean	32,479	42,807	54,888	55,381	56,212	59,592	60,336	62,837	69,282	78,644	94,317
Mideast	Africa	9,457	18,254	19,746	20,717	21,669	26,449	29,828	34,145	44,662	57,380	72,188
Mideast	Asia	167,731	201,954	216,677	223,380	232,470	265,046	292,579	329,150	419,248	536,750	689,540
Mideast	Europe	242,660	298,441	332,479	356,307	378,369	489,811	563,120	656,497	884,673	1,169,770	1,524,669
Mideast	Mideast	76,994	114,838	124,744	130,802	137,958	162,523	182,259	209,733	280,402	377,849	522,766
Mideast	North America	10,716	23,731	30,071	31,257	32,097	47,605	54,055	61,902	79,805	99,825	120,816
Mideast	South America	43,024	86,500	88,484	92,768	97,904	122,041	134,604	150,613	188,084	232,965	284,303
Mideast	Caribbean	4,380	6,810	7,213	7,079	7,077	6,502	6,008	5,820	5,994	7,208	9,507
North America	Africa	6,707	7,957	11,542	12,844	14,461	19,500	21,230	22,797	25,945	29,139	32,326
North America	Asia	232,742	350,247	474,378	463,431	494,115	607,772	645,775	685,860	769,249	857,718	950,890
North America	Europe	298,140	516,535	601,606	642,063	708,815	822,655	873,229	922,470	1,024,601	1,122,455	1,212,694
North America	Mideast	16,228	14,544	18,802	20,834	23,505	29,755	32,555	35,222	40,854	46,739	52,702
North America	North America	10,847	21,282	249,384	264,464	285,063	383,250	431,326	477,811	577,314	683,629	792,908
North America	South America	95,571	130,369	180,559	189,006	196,507	240,915	254,587	270,231	303,175	335,875	369,464
North America	Caribbean	15,111	17,088	20,546	20,553	21,654	22,598	22,242	22,151	21,931	21,514	21,483
South America	Africa	21,259	1,980	2,411	2,464	2,547	3,074	3,339	3,585	4,262	5,057	5,876
South America	Asia	20,514	20,757	24,763	25,994	26,796	30,886	33,555	36,182	41,720	47,780	54,304
South America	Europe	154,188	118,504	141,925	151,388	161,713	215,044	239,631	262,770	311,272	361,996	414,070
South America	Mideast	3,396	2,871	3,672	3,872	4,079	5,109	5,686	6,287	7,703	9,608	12,627
South America	North America	73,446	75,344	75,697	79,702	84,941	117,774	131,960	146,487	178,108	212,591	248,958
South America	South America	122,249	205,435	249,026	261,412	277,627	370,830	417,474	467,835	590,336	752,341	968,153
South America	Caribbean	15,686	22,296	25,362	26,945	27,322	30,362	32,424	34,599	39,380	44,747	51,004
Caribbean	Africa	1,097	1,442	1,585	1,661	1,685	1,779	1,855	2,020	2,680	4,074	7,150
Caribbean	Asia	13,139	11,439	12,692	12,440	12,113	10,472	9,781	10,065	12,857	20,262	35,853
Caribbean	Europe	96,598	86,383	93,315	98,068	101,567	112,693	113,978	116,145	119,104	121,569	124,200
Caribbean	Mideast	462	1,143	1,275	1,268	1,248	1,162	1,196	1,369	2,235	4,330	9,232
Caribbean	North America	23,314	34,703	35,900	37,201	37,750	37,378	37,071	38,541	46,167	64,612	99,466
Caribbean	South America	34,126	61,010	62,327	65,596	68,143	82,336	100,434	127,416	228,465	439,115	838,921
Caribbean	Caribbean	27,370	60,310	59,711	61,829	63,872	76,182	95,572	127,741	256,168	515,461	919,918
Total		**7,792,146**	**10,043,773**	**11,544,055**	**11,961,660**	**12,424,879**	**14,377,553**	**15,460,357**	**16,904,381**	**20,812,730**	**26,845,750**	**36,402,428**
Average Annual Growth Rate			**5.21%**	**4.75%**	**3.62%**	**3.87%**	**2.96%**	**1.46%**	**1.80%**	**2.10%**	**2.58%**	**3.09%**

Containerized WORLD Commodity Forecast For FUELS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(TEUs)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	11	10	9	9	9	9	9	9	10	11	12
Africa	Asia	8	14	14	15	15	18	20	23	28	35	43
Africa	Europe	3,736	5,075	5,149	5,331	5,517	6,717	8,037	9,471	12,633	16,465	21,200
Africa	Mideast	9	67	70	71	72	79	86	93	105	117	131
Africa	North America	83	167	240	238	244	220	203	202	202	200	195
Africa	South America	3	1	1	1	1	1	1	2	2	2	2
Africa	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Asia	Africa	1	2	1	1	2	2	2	3	4	7	12
Asia	Asia	49,297	75,661	83,558	88,170	94,035	125,737	162,422	213,079	387,270	739,660	1,442,345
Asia	Europe	5,734	6,499	7,082	7,736	8,483	12,633	17,928	25,540	53,629	115,376	245,399
Asia	Mideast	4	142	147	156	164	184	206	234	299	372	439
Asia	North America	17,649	20,111	36,604	35,969	35,566	31,153	27,607	25,108	22,362	22,770	27,214
Asia	South America	7	158	181	189	195	225	265	324	550	988	1,932
Asia	Caribbean	2	1	2	2	2	3	4	5	9	17	28
Europe	Africa	0	0	0	0	0	0	1	1	1	1	1
Europe	Asia	2,394	477	500	537	566	734	883	1,033	1,400	1,891	2,540
Europe	Europe	76,428	82,492	90,846	88,667	90,653	99,736	106,995	114,485	132,732	154,915	181,476
Europe	Mideast	1,041	550	644	645	681	798	880	958	1,129	1,325	1,552
Europe	North America	3,985	5,257	7,092	7,424	7,317	6,095	5,330	4,826	4,080	3,545	3,234
Europe	South America	208	363	356	352	366	399	418	430	459	498	553
Europe	Caribbean	9	10	10	10	10	12	13	14	15	17	20
Mideast	Africa	0	0	0	0	0	0	0	0	0	0	1
Mideast	Asia	171	1,124	1,096	1,156	1,205	1,456	1,713	2,006	2,696	3,579	4,688
Mideast	Europe	9,927	17,021	18,571	19,206	19,771	23,593	27,047	30,997	40,690	53,160	68,812
Mideast	Mideast	185	696	815	813	813	826	842	870	939	1,019	1,098
Mideast	North America	373	630	587	567	578	544	523	529	540	543	533
Mideast	South America	17	70	79	79	80	83	86	91	102	116	130
Mideast	Caribbean	0	0	0	0	0	0	0	0	0	0	0
North America	Africa	0										
North America	Asia	944	1,531	3,718	4,280	4,542	5,504	6,425	7,300	9,292	11,805	15,225
North America	Europe	8,883	2,678	2,893	3,197	3,255	3,631	4,005	4,385	5,356	6,614	8,181
North America	Mideast	0	8	7	8	9	12	15	19	27	39	54
North America	North America	124	364	383	423	433	508	572	646	803	982	1,186
North America	South America	77	221	350	387	406	481	550	609	741	903	1,111
North America	Caribbean	1	2	2	2	2	2	3	3	4	4	5
South America	Africa	0	0	0	0	0	0	0	0	0	1	1
South America	Asia	179	404	426	451	467	571	672	808	1,001	1,252	1,552
South America	Europe	2,903	1,837	2,188	2,361	2,458	3,024	3,493	3,901	4,775	5,809	7,070
South America	Mideast	1	1	1	1	1	1	1	1	2	2	2
South America	North America	7,115	10,198	16,153	16,222	16,151	15,907	15,917	16,420	17,176	17,709	18,026
South America	South America	1,312	2,827	3,242	3,521	3,679	4,656	5,448	6,208	7,923	9,989	12,453
South America	Caribbean	222	85	95	101	104	120	132	140	153	169	187
Caribbean	Africa	0	0	0	0	0	0	0	0	0	0	0
Caribbean	Asia	30	72	66	68	70	80	88	95	104	112	120
Caribbean	Europe	2,621	4,465	4,480	4,571	4,674	5,330	5,793	6,154	6,613	6,924	7,187
Caribbean	Mideast	14	3	3	3	3	3	3	3	3	2	2
Caribbean	North America	4,714	6,510	19,054	19,168	19,201	19,559	19,803	19,930	19,972	19,880	19,677
Caribbean	South America	1,191	1,892	1,837	1,822	1,825	1,879	1,905	1,929	1,950	1,959	1,962
Caribbean	Caribbean	47	112	110	112	114	122	129	135	145	153	162
Total		**201,665**	**249,808**	**308,664**	**314,043**	**323,737**	**372,647**	**426,478**	**499,017**	**737,926**	**1,200,940**	**2,097,754**
Average Annual Growth Rate			**4.37%**	**7.31%**	**1.74%**	**3.09%**	**2.85%**	**2.74%**	**3.19%**	**3.99%**	**4.99%**	**5.74%**

Containerized WORLD Commodity Forecast For HI-TECH PRODUCTS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(TEUs)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	1,277	2,349	2,025	2,248	2,500	3,770	4,077	4,482	5,531	7,346	10,396
Africa	Asia	10,762	17,888	16,406	17,098	18,360	27,762	38,944	54,066	102,903	197,306	384,944
Africa	Europe	17,510	24,898	22,442	25,449	29,020	50,271	67,727	88,253	148,250	256,802	469,852
Africa	Mideast	818	2,055	1,906	2,061	2,260	3,607	5,216	7,076	11,930	20,047	34,017
Africa	North America	709	1,123	1,074	1,120	1,166	1,539	1,918	2,337	3,550	5,734	10,328
Africa	South America	27	244	226	261	301	538	728	928	1,430	2,108	3,001
Africa	Caribbean	11	29	31	32	35	54	64	75	99	131	168
Asia	Africa	58	308	261	294	333	570	851	1,279	2,890	6,581	14,761
Asia	Asia	591,119	979,325	919,970	1,032,661	1,143,883	1,845,117	2,388,212	3,069,980	7,531,774	15,715,423	31,821,115
Asia	Europe	40,838	55,498	58,800	66,182	74,668	122,256	172,457	255,967	558,043	1,215,817	2,660,222
Asia	Mideast	931	2,266	2,131	2,386	2,630	4,222	6,055	8,596	16,922	33,107	65,097
Asia	North America	52,708	54,448	61,796	66,612	71,560	98,755	132,467	181,754	357,338	727,354	1,498,687
Asia	South America	265	1,566	1,625	1,863	2,135	3,749	5,693	9,286	23,050	54,793	127,985
Asia	Caribbean	77	59	61	69	78	130	185	265	530	1,049	2,050
Europe	Africa	1,466	3,454	4,153	4,494	4,946	7,661	9,642	11,672	16,523	22,741	30,700
Europe	Asia	319,433	581,717	621,813	667,510	703,931	1,001,714	1,295,381	1,620,928	2,439,242	3,565,246	5,127,217
Europe	Europe	88,254	197,780	226,203	245,763	274,662	441,754	600,941	787,155	1,298,963	2,086,970	3,289,385
Europe	Mideast	5,173	23,982	31,164	33,258	36,344	58,677	80,486	104,938	167,220	254,805	377,994
Europe	North America	29,804	42,738	44,563	45,758	48,064	60,759	70,549	81,983	112,011	155,038	217,825
Europe	South America	1,179	2,740	3,051	3,365	3,791	6,479	9,204	12,479	20,926	32,954	49,597
Europe	Caribbean	350	253	278	298	326	503	623	752	1,075	1,524	2,152
Mideast	Africa	367	665	607	682	772	1,156	1,405	1,731	2,637	4,040	6,298
Mideast	Asia	39,722	51,436	46,504	49,928	54,531	80,825	109,606	148,610	270,012	489,143	894,285
Mideast	Europe	16,343	38,155	38,785	44,909	51,181	88,227	122,963	167,928	304,061	534,292	907,088
Mideast	Mideast	2,259	5,235	4,949	5,577	6,314	10,093	13,480	17,703	29,906	49,840	83,379
Mideast	North America	961	1,988	3,230	3,489	3,838	4,752	5,708	6,705	9,036	11,838	15,260
Mideast	South America	39	43	43	49	55	90	122	160	257	393	582
Mideast	Caribbean	13	13	13	14	16	28	42	67	161	381	908
North America	Africa	44	171	52	59	68	117	173	236	406	657	1,012
North America	Asia	438,296	726,059	782,915	835,223	907,165	1,410,219	1,869,345	2,366,939	3,586,508	5,144,430	7,046,912
North America	Europe	19,660	26,837	38,673	41,182	45,512	69,355	89,104	110,123	162,009	230,789	320,575
North America	Mideast	339	843	731	807	894	1,366	1,735	2,116	3,033	4,210	5,710
North America	North America	299	1,622	3,065	3,493	3,908	6,044	8,249	10,803	17,830	28,292	43,368
North America	South America	2,510	9,114	22,735	26,230	30,026	50,803	77,703	110,730	205,006	350,418	563,378
North America	Caribbean	181	203	1,263	1,382	1,571	2,293	2,816	3,357	4,675	6,391	8,612
South America	Africa	9	19	15	17	19	32	40	49	72	106	158
South America	Asia	42,142	52,367	53,052	58,774	65,011	102,020	133,350	167,352	261,933	416,237	692,185
South America	Europe	6,942	11,448	12,650	14,446	16,520	27,793	34,356	40,735	56,083	76,050	102,123
South America	Mideast	178	360	316	355	387	584	754	878	1,218	1,640	2,171
South America	North America	32,959	39,235	29,579	32,265	34,388	48,417	63,387	81,267	137,943	246,660	475,531
South America	South America	2,463	7,101	8,370	9,336	10,455	16,332	19,801	23,239	31,503	42,486	57,521
South America	Caribbean	403	655	773	831	895	1,231	1,473	1,722	2,308	3,047	3,960
Caribbean	Africa	2	4	4	4	5	8	9	10	11	13	15
Caribbean	Asia	4,282	3,278	2,956	3,160	3,411	5,094	6,930	9,559	18,993	38,658	77,398
Caribbean	Europe	3,350	3,166	2,823	3,175	3,564	5,745	6,992	8,584	13,911	24,572	42,742
Caribbean	Mideast	29	99	94	101	115	172	204	227	291	362	437
Caribbean	North America	2,784	4,413	6,245	6,642	7,084	10,052	14,538	22,690	55,631	134,987	310,462
Caribbean	South America	897	2,004	1,898	2,056	2,238	3,233	3,725	4,262	5,564	7,370	10,141
Caribbean	Caribbean	967	1,032	1,054	1,055	1,060	1,122	1,206	1,373	2,044	3,441	6,365
Total		**1,781,207**	**2,982,284**	**3,083,373**	**3,363,622**	**3,672,004**	**5,687,094**	**7,680,607**	**10,213,406**	**18,003,243**	**32,213,625**	**57,876,072**
Average Annual Growth Rate			**10.86%**	**1.12%**	**9.09%**	**9.17%**	**9.14%**	**6.19%**	**5.87%**	**5.83%**	**5.99%**	**6.03%**

Containerized WORLD Commodity Forecast For INTERMEDIATE MANUFACTURED PRODUCTS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(TEUs)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	51,651	61,679	63,313	66,712	70,067	89,265	107,744	136,990	235,362	442,088	899,315
Africa	Asia	60,504	153,770	165,833	176,454	188,591	282,814	397,697	578,394	1,260,712	2,770,304	6,015,742
Africa	Europe	144,724	159,799	171,828	189,036	207,307	321,271	419,615	531,403	810,136	1,207,214	1,786,590
Africa	Mideast	18,901	55,120	56,262	61,353	66,151	96,122	126,774	164,201	266,229	434,716	717,450
Africa	North America	3,396	3,781	4,480	4,350	4,247	5,104	5,868	6,554	7,989	9,540	11,227
Africa	South America	3,118	5,026	5,672	6,030	6,478	9,627	12,782	16,832	29,273	52,753	100,918
Africa	Caribbean	70	479	532	554	583	790	1,033	1,397	2,657	5,341	11,515
Asia	Africa	38,750	63,540	69,858	74,500	79,505	98,764	126,571	167,232	294,688	519,029	912,622
Asia	Asia	2,911,957	4,089,753	4,898,283	5,272,746	5,726,141	7,817,377	10,120,981	13,387,698	24,507,627	47,085,572	92,622,636
Asia	Europe	431,484	446,168	523,839	561,120	606,911	897,026	1,239,144	1,778,019	3,770,366	8,220,488	17,799,804
Asia	Mideast	106,211	121,614	136,471	143,151	148,502	184,831	236,740	318,299	593,412	1,134,833	2,170,191
Asia	North America	317,317	251,747	314,732	329,486	342,869	420,609	518,940	621,854	938,173	1,519,201	2,599,357
Asia	South America	74,919	73,335	79,081	81,943	83,261	99,761	122,731	159,546	300,430	627,181	1,341,575
Asia	Caribbean	254	274	296	317	343	476	629	854	1,614	3,114	6,104
Europe	Africa	28,806	58,564	79,030	85,197	89,883	110,479	130,712	150,080	194,978	252,090	327,617
Europe	Asia	501,894	1,051,628	1,435,664	1,476,802	1,522,246	1,901,933	2,221,166	2,541,585	3,363,429	4,594,175	6,636,365
Europe	Europe	667,474	1,006,584	1,230,780	1,280,739	1,349,577	1,701,706	2,036,273	2,363,933	3,137,666	4,181,065	5,646,763
Europe	Mideast	72,317	201,631	260,630	280,951	299,496	377,409	458,804	544,725	756,989	1,065,149	1,577,095
Europe	North America	128,210	139,521	196,224	202,620	211,974	250,391	294,332	334,675	429,559	563,738	779,948
Europe	South America	43,321	77,996	102,408	107,633	111,589	124,454	141,543	155,197	179,881	202,163	228,979
Europe	Caribbean	3,058	1,612	2,077	2,151	2,227	2,561	2,919	3,247	4,033	5,088	6,556
Mideast	Africa	11,371	12,425	12,869	14,122	15,309	20,522	25,158	31,908	52,425	89,952	161,548
Mideast	Asia	201,258	359,198	376,129	402,515	431,023	587,261	731,866	957,014	1,717,551	3,234,725	6,143,023
Mideast	Europe	252,851	303,532	346,289	379,743	415,042	602,746	732,383	897,205	1,337,671	1,987,937	2,935,357
Mideast	Mideast	106,563	142,334	146,278	157,215	167,962	218,458	260,731	322,231	498,299	792,605	1,309,231
Mideast	North America	12,544	8,878	9,186	9,441	9,463	11,696	13,654	15,484	19,740	25,077	31,994
Mideast	South America	2,732	4,165	5,162	5,572	6,072	8,052	11,068	14,703	26,792	50,955	102,116
Mideast	Caribbean	89	225	264	279	298	381	444	542	857	1,439	2,541
North America	Africa	5,894	10,644	11,077	12,202	13,187	15,277	17,575	19,777	25,210	31,772	39,872
North America	Asia	607,675	1,221,115	1,579,920	1,661,592	1,804,609	2,486,980	3,141,395	3,781,586	5,391,208	7,568,571	10,465,324
North America	Europe	273,189	440,868	455,093	492,467	547,159	738,669	914,609	1,089,584	1,518,438	2,083,848	2,824,997
North America	Mideast	16,387	41,906	55,524	62,025	68,981	94,275	117,661	142,006	201,869	280,890	382,326
North America	North America	6,209	12,037	23,169	25,010	27,438	36,128	46,918	56,749	80,230	111,805	153,874
North America	South America	76,225	137,448	401,003	441,688	491,715	643,303	726,590	805,353	999,513	1,260,754	1,610,826
North America	Caribbean	4,683	7,874	9,174	10,458	11,879	17,520	23,903	30,670	48,350	73,200	107,449
South America	Africa	1,512	1,809	2,234	2,497	2,704	3,740	4,421	5,076	6,519	8,252	10,387
South America	Asia	59,321	105,576	130,232	140,665	151,672	215,417	273,392	356,251	642,141	1,248,853	2,559,445
South America	Europe	60,439	93,649	120,984	134,749	148,742	225,758	267,261	308,979	406,027	529,037	688,399
South America	Mideast	1,174	3,598	4,147	4,526	4,895	6,918	8,364	9,837	13,253	17,580	23,241
South America	North America	109,203	88,093	79,797	85,350	88,840	109,581	127,668	144,367	180,597	222,390	271,625
South America	South America	92,470	110,319	140,377	151,395	163,057	228,313	276,819	336,698	510,465	822,507	1,445,556
South America	Caribbean	9,714	21,220	26,845	29,037	31,282	41,923	47,384	52,841	65,193	81,620	106,314
Caribbean	Africa	273	403	415	445	472	602	668	740	918	1,166	1,503
Caribbean	Asia	17,163	35,391	37,499	40,341	43,366	63,275	95,221	145,338	339,812	777,750	1,705,755
Caribbean	Europe	35,710	34,556	36,296	39,084	43,684	61,062	67,514	72,920	82,494	92,163	103,030
Caribbean	Mideast	1,284	3,261	3,378	3,622	3,837	4,560	4,857	5,061	5,375	5,652	5,993
Caribbean	North America	39,252	39,381	39,382	41,750	44,126	56,769	69,517	87,862	161,104	330,188	624,474
Caribbean	South America	31,359	53,016	57,682	62,039	66,397	93,472	128,374	188,895	428,897	997,352	2,278,992
Caribbean	Caribbean	27,183	42,775	45,645	48,454	50,977	68,306	94,659	142,379	335,094	798,311	1,852,529
Total		**7,674,045**	**11,367,708**	**13,953,342**	**14,863,029**	**15,972,123**	**21,454,334**	**26,962,074**	**33,984,767**	**56,181,245**	**98,421,294**	**180,146,089**
Average Annual Growth Rate			**8.18%**	**7.07%**	**6.52%**	**7.46%**	**6.08%**	**4.68%**	**4.74%**	**5.16%**	**5.77%**	**6.23%**

Containerized WORLD Commodity Forecast For MATERIALS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(TEUs)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	20,756	27,126	28,501	28,532	28,553	29,548	32,765	39,692	68,856	139,170	307,957
Africa	Asia	71,678	102,812	105,811	107,940	111,491	150,866	208,593	313,609	734,374	1,717,872	4,002,541
Africa	Europe	134,261	185,806	197,402	203,226	207,767	243,862	277,699	307,298	373,113	460,536	576,925
Africa	Mideast	9,109	21,017	21,883	22,187	22,442	24,987	27,735	31,138	42,310	67,109	125,935
Africa	North America	10,891	9,736	10,769	11,005	11,230	14,602	21,454	35,451	93,910	237,715	597,675
Africa	South America	5,614	5,507	5,319	4,832	4,476	3,679	3,598	4,051	6,211	11,188	22,978
Africa	Caribbean	59	214	210	210	212	225	228	231	240	255	276
Asia	Africa	20,911	28,293	33,225	33,692	34,978	44,445	54,216	67,509	112,101	208,191	423,728
Asia	Asia	2,403,502	3,757,692	4,332,325	4,513,296	4,639,489	5,812,869	6,932,157	8,865,563	15,378,606	28,567,845	55,047,018
Asia	Europe	413,742	718,869	877,572	895,110	919,677	1,081,310	1,274,962	1,580,281	2,643,291	4,967,334	10,161,894
Asia	Mideast	10,757	23,314	24,731	25,334	26,013	32,538	40,446	53,369	100,140	204,631	443,537
Asia	North America	1,079,322	1,021,526	1,533,385	1,543,660	1,495,667	1,269,793	1,119,432	1,082,649	1,054,069	1,089,098	1,201,064
Asia	South America	58,944	67,688	94,773	94,277	94,992	102,449	107,867	123,160	170,731	265,376	472,600
Asia	Caribbean	1,811	2,455	3,212	3,098	3,066	3,847	4,260	4,844	6,427	8,766	12,422
Europe	Africa	48,620	67,599	85,876	90,215	92,468	88,374	90,423	95,127	105,837	118,721	135,944
Europe	Asia	485,303	767,729	956,767	949,854	950,332	1,079,367	1,193,125	1,367,916	2,028,191	3,426,461	6,580,307
Europe	Europe	575,359	804,404	983,110	980,173	967,737	954,123	950,464	967,378	1,043,615	1,195,140	1,463,354
Europe	Mideast	46,857	91,569	111,743	118,855	125,549	134,261	144,856	156,781	189,373	241,297	329,324
Europe	North America	309,835	309,488	335,180	351,134	357,631	294,176	272,476	281,815	313,705	363,221	441,757
Europe	South America	90,286	115,927	168,616	174,356	178,165	190,641	190,905	198,209	218,838	249,630	293,858
Europe	Caribbean	2,624	4,023	5,288	5,443	5,575	5,835	5,888	6,018	6,592	7,641	9,219
Mideast	Africa	6,275	8,143	8,879	9,084	9,335	10,268	11,374	13,050	17,918	25,963	40,119
Mideast	Asia	232,600	329,666	344,074	365,535	379,697	469,686	570,908	729,970	1,336,427	2,767,274	6,217,591
Mideast	Europe	189,390	258,172	301,690	317,106	333,009	408,667	467,778	540,518	724,752	981,427	1,354,431
Mideast	Mideast	40,011	61,673	64,637	67,509	69,784	76,632	85,138	95,221	122,523	166,287	234,351
Mideast	North America	33,360	40,301	33,597	33,655	33,541	33,746	33,986	35,253	38,492	42,795	48,539
Mideast	South America	13,234	10,656	11,863	12,038	12,286	12,627	13,104	14,087	16,802	20,683	25,944
Mideast	Caribbean	85	160	191	196	198	213	230	249	296	358	425
North America	Africa	1,912	2,807	4,956	4,828	4,928	5,776	6,529	7,133	8,469	10,047	11,907
North America	Asia	439,106	809,253	1,099,786	1,091,092	1,115,582	1,234,948	1,317,243	1,382,575	1,600,650	1,907,914	2,273,557
North America	Europe	148,548	270,737	395,881	383,231	382,272	410,792	423,363	438,765	489,460	561,739	654,284
North America	Mideast	7,978	24,886	33,436	36,202	38,283	44,735	47,415	50,947	60,542	73,579	90,389
North America	North America	16,295	21,847	51,862	49,636	49,025	44,305	41,497	40,967	40,181	40,510	42,361
North America	South America	62,606	108,325	307,264	483,957	480,569	466,269	442,880	452,309	468,959	486,297	515,370
North America	Caribbean	5,077	8,575	13,323	13,148	13,470	13,684	14,268	14,945	16,413	18,213	20,532
South America	Africa	4,045	3,534	4,587	4,770	4,883	5,717	6,313	6,837	7,787	9,184	12,222
South America	Asia	52,271	84,305	98,727	103,691	108,845	144,546	161,515	185,817	275,532	487,811	999,361
South America	Europe	51,430	74,196	100,613	105,875	110,735	137,364	156,054	173,761	212,142	260,419	322,317
South America	Mideast	1,190	1,077	1,341	1,442	1,515	2,110	2,304	2,446	2,762	3,848	7,088
South America	North America	147,431	156,965	162,397	163,254	162,331	164,862	167,101	171,438	185,938	206,654	233,965
South America	South America	55,076	86,840	108,600	112,166	116,048	136,971	158,007	187,282	282,232	466,808	824,083
South America	Caribbean	7,359	9,888	11,666	11,619	11,565	11,832	12,117	12,539	13,181	13,784	14,488
Caribbean	Africa	177	642	693	724	741	792	854	870	945	1,065	1,277
Caribbean	Asia	20,632	41,416	39,289	40,442	42,007	55,347	79,949	115,178	246,446	522,314	1,084,006
Caribbean	Europe	16,225	16,523	17,167	17,779	18,157	19,244	20,255	21,346	23,584	26,774	31,931
Caribbean	Mideast	172	372	388	394	396	393	404	413	448	550	823
Caribbean	North America	53,373	72,778	138,770	151,402	165,851	264,170	428,855	646,350	1,426,375	3,001,018	6,029,481
Caribbean	South America	14,685	30,517	28,475	29,643	30,767	36,475	45,423	57,816	101,500	187,326	345,699
Caribbean	Caribbean	9,328	16,128	15,315	15,750	16,146	18,598	22,252	28,057	50,766	93,711	157,051
Total		**7,430,111**	**10,683,177**	**13,515,167**	**13,782,618**	**13,989,475**	**15,794,567**	**17,690,644**	**21,008,231**	**32,462,052**	**55,931,552**	**104,243,903**
Average Annual Growth Rate			**7.53%**	**8.15%**	**1.98%**	**1.50%**	**2.46%**	**2.29%**	**3.50%**	**4.45%**	**5.59%**	**6.42%**

Containerized WORLD Commodity Forecast For ALL COMMODITIES
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(TEUs)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Africa	Africa	211,943	273,353	285,859	294,968	302,619	345,690	395,141	493,191	874,579	1,758,140	3,868,028
Africa	Asia	309,636	367,351	399,350	618,449	645,061	881,369	1,201,306	1,736,061	3,817,707	8,584,533	19,467,464
Africa	Europe	968,021	1,155,312	1,202,109	1,281,211	1,355,806	1,806,769	2,161,796	2,552,641	3,538,557	4,976,825	7,221,579
Africa	Mideast	102,197	188,910	195,813	207,595	220,033	310,959	441,774	663,578	1,527,660	3,534,332	7,899,605
Africa	North America	59,120	51,533	63,431	63,677	64,493	75,085	87,580	107,793	183,324	353,583	754,045
Africa	South America	40,468	55,081	57,535	59,885	61,227	74,093	85,718	101,230	151,165	248,493	458,401
Africa	Caribbean	2,367	4,471	4,647	4,753	4,838	5,589	6,841	9,331	20,014	46,133	101,031
Asia	Africa	150,665	230,294	255,274	267,992	283,645	361,725	440,843	553,156	916,316	1,613,705	2,961,716
Asia	Asia	13,173,210	19,976,221	22,981,778	24,403,160	25,845,049	34,223,230	42,764,231	55,281,685	97,774,721	183,913,722	347,757,385
Asia	Europe	2,684,122	3,393,464	3,850,026	4,069,864	4,331,414	5,902,173	7,492,387	9,877,564	18,321,955	36,366,845	74,151,269
Asia	Mideast	362,109	572,516	624,404	656,964	684,431	837,379	1,026,021	1,298,471	2,257,470	4,169,143	7,573,623
Asia	North America	3,775,267	3,586,181	4,552,811	4,699,748	4,760,613	5,105,829	5,461,351	6,066,559	7,949,128	11,404,531	17,854,683
Asia	South America	420,123	480,304	552,834	576,441	596,633	727,037	837,434	1,007,559	1,577,759	2,739,600	5,170,057
Asia	Caribbean	17,309	23,633	26,888	27,147	27,422	32,574	34,621	37,734	47,880	65,974	98,811
Europe	Africa	409,041	581,103	707,010	725,859	743,229	817,467	875,853	931,963	1,076,249	1,264,689	1,508,433
Europe	Asia	3,584,347	6,273,458	7,830,453	8,039,602	8,213,759	9,710,127	10,941,238	12,427,261	16,626,620	23,505,254	35,647,458
Europe	Europe	4,287,373	5,988,423	7,005,258	7,250,437	7,533,863	8,988,787	10,094,705	11,295,620	14,310,935	18,659,025	25,094,197
Europe	Mideast	523,922	852,180	1,000,619	1,057,859	1,114,997	1,346,604	1,544,029	1,749,219	2,268,986	3,034,457	4,269,282
Europe	North America	1,331,149	1,492,684	1,736,931	1,793,581	1,833,805	1,994,851	2,148,798	2,339,190	2,830,105	3,535,675	4,591,569
Europe	South America	703,214	940,148	1,191,972	1,244,537	1,288,407	1,553,657	1,676,825	1,728,379	2,034,577	2,466,409	3,162,815
Europe	Caribbean	105,059	124,638	153,969	160,943	165,278	178,607	187,559	196,966	219,161	250,357	296,640
Mideast	Africa	82,105	111,403	119,845	126,351	132,777	162,545	186,950	225,359	332,255	520,576	872,043
Mideast	Asia	1,034,303	1,548,868	1,605,255	1,697,581	1,791,456	2,307,932	2,802,970	3,553,775	6,084,820	11,230,701	22,045,905
Mideast	Europe	1,211,442	1,669,081	1,850,615	2,008,076	2,174,982	3,035,648	3,616,417	4,347,245	6,295,095	9,118,254	13,189,503
Mideast	Mideast	457,431	684,572	726,392	771,966	819,124	1,048,917	1,240,887	1,516,926	2,376,204	3,966,421	6,622,357
Mideast	North America	101,196	133,104	158,883	163,400	167,511	202,562	223,713	247,790	303,724	371,162	452,095
Mideast	South America	90,193	148,856	157,412	166,726	177,164	223,234	256,598	302,386	437,203	651,283	961,737
Mideast	Caribbean	5,819	11,867	12,844	12,955	13,179	13,572	13,801	15,026	18,243	23,902	32,844
North America	Africa	27,712	49,513	77,010	83,168	90,877	118,308	135,195	148,827	184,022	221,764	267,696
North America	Asia	3,843,635	6,801,526	8,949,767	9,327,872	10,040,316	13,779,467	16,457,973	19,215,082	26,120,288	35,065,417	46,195,584
North America	Europe	1,366,085	2,341,880	2,754,276	2,886,693	3,105,584	3,990,913	4,599,473	5,184,189	6,661,566	8,581,549	10,970,931
North America	Mideast	76,168	144,809	199,982	218,342	239,432	298,904	347,689	395,980	526,727	699,363	918,809
North America	North America	78,191	140,365	431,074	450,829	478,091	607,365	683,372	760,057	929,950	1,127,815	1,356,231
North America	South America	438,219	716,039	1,671,683	1,734,654	1,826,293	2,212,172	2,442,993	2,707,052	3,359,515	4,207,263	5,302,882
North America	Caribbean	94,721	212,906	269,826	279,818	294,217	337,673	380,365	422,673	528,325	658,388	814,279
South America	Africa	29,912	10,512	13,177	13,982	14,668	18,542	20,868	23,087	27,903	33,935	42,495
South America	Asia	333,869	500,527	596,892	643,345	690,617	959,427	1,151,339	1,396,445	2,179,858	3,724,561	6,952,992
South America	Europe	487,886	598,637	737,394	810,605	886,152	1,288,488	1,498,946	1,699,121	2,160,207	2,734,363	3,458,230
South America	Mideast	13,167	21,954	27,173	28,734	30,371	38,611	43,164	47,723	58,771	75,172	103,510
South America	North America	785,929	839,523	819,583	861,599	884,301	1,043,790	1,166,433	1,297,618	1,658,007	2,216,176	3,061,292
South America	South America	445,188	664,436	810,291	861,977	917,740	1,222,941	1,418,486	1,642,654	2,242,279	3,182,414	4,756,856
South America	Caribbean	50,693	79,890	94,153	99,072	103,105	124,193	135,347	146,741	171,250	202,574	247,223
Caribbean	Africa	1,935	3,877	4,155	4,403	4,589	5,453	6,039	6,793	9,259	13,965	23,053
Caribbean	Asia	80,892	142,759	144,888	152,750	161,239	218,991	310,581	449,139	977,402	2,132,790	4,533,282
Caribbean	Europe	217,987	223,964	230,483	247,352	262,678	328,642	350,338	370,921	413,247	468,542	550,282
Caribbean	Mideast	2,684	6,841	7,105	7,494	7,856	9,049	10,066	11,471	16,609	27,909	53,846
Caribbean	North America	232,594	335,278	405,205	428,003	453,200	594,343	792,354	1,054,069	1,985,399	3,870,237	7,448,769
Caribbean	South America	115,422	209,086	213,135	226,736	239,628	313,229	400,103	532,466	1,029,215	2,116,342	4,386,198
Caribbean	Caribbean	94,207	197,477	200,980	213,537	225,420	293,467	377,496	505,281	986,410	2,005,663	3,983,664
Total		**45,020,247**	**65,360,809**	**78,168,449**	**82,033,595**	**86,309,191**	**110,077,980**	**130,976,208**	**158,681,047**	**246,398,624**	**411,739,926**	**719,492,679**
Average Annual Growth Rate			**7.74%**	**6.15%**	**4.94%**	**5.21%**	**4.99%**	**3.54%**	**3.91%**	**4.50%**	**5.27%**	**5.74%**

Appendix B

U.S. COMMODITY FORECAST 1995-2050

U.S. Commodity by Origin (Metric Tonnes)

US Commodity Forecast For AGRICULTURE COMMODITIES
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	20,279	20,199	13,808	13,467	12,879	12,779	12,132	11,595	10,502	9,538	8,684
North Atlantic	Asia	401,155	824,826	642,028	689,342	714,603	757,691	796,002	831,861	908,404	982,645	1,050,103
North Atlantic	Europe	575,158	737,498	555,934	612,610	638,667	617,400	648,390	675,380	725,068	785,394	863,012
North Atlantic	Mideast	24,808	18,438	40,962	44,285	47,028	67,679	75,351	83,060	99,857	118,553	138,864
North Atlantic	North America	1,021	166,788	51,488	56,067	59,245	71,291	79,209	87,276	102,838	288	300
North Atlantic	South America	131,701	38,958	70,421	72,381	74,809	86,230	93,689	103,284	119,282	135,407	152,115
North Atlantic	Caribbean	33,618	5,924	6,308	6,816	7,292	9,427	10,372	11,158	12,551	13,823	15,005
South Atlantic	Africa	6,164	14,131	5,043	4,953	4,753	4,747	4,557	4,355	4,000	3,689	3,414
South Atlantic	Asia	1,190,572	830,775	872,149	947,057	977,702	994,540	1,039,523	1,083,632	1,188,789	1,300,533	1,417,730
South Atlantic	Europe	310,776	256,359	250,111	276,071	267,931	214,215	197,160	189,124	183,893	191,662	209,094
South Atlantic	Mideast	5,008	17,944	130,431	133,987	133,713	169,010	190,764	210,637	255,855	307,906	364,221
South Atlantic	North America	1,522	176,110	1,072	1,005	1,003	1,072	1,077	1,091	1,135	1,189	1,248
South Atlantic	South America	82,388	94,697	85,000	86,490	89,301	100,982	108,238	114,158	124,228	133,972	144,166
South Atlantic	Caribbean	28,230	20,452	21,234	22,291	23,335	27,481	29,576	30,953	32,843	34,202	35,242
Gulf Coast	Africa	1,281,092	504,206	778,783	773,261	767,351	766,797	771,973	772,215	759,553	740,251	721,094
Gulf Coast	Asia	5,622,737	9,736,445	8,971,731	9,173,090	9,332,269	10,214,501	10,691,492	11,147,125	12,206,644	10,884,876	11,816,150
Gulf Coast	Europe	4,865,973	2,651,146	2,144,705	2,326,875	2,384,188	2,642,649	2,856,867	3,019,814	3,326,991	3,639,240	3,962,937
Gulf Coast	Mideast	642,430	894,253	853,662	947,704	1,016,891	1,540,611	1,778,488	2,001,529	2,484,958	3,019,318	3,596,947
Gulf Coast	North America	6,934	21,919	6,587	6,233	6,251	6,840	7,075	7,434	8,156	8,983	9,848
Gulf Coast	South America	5,020,467	5,166,408	6,239,478	6,367,578	6,524,030	7,305,584	7,955,834	8,386,822	9,107,940	9,712,728	10,264,951
Gulf Coast	Caribbean	1,159,924	2,091,800	2,472,123	2,578,002	2,674,085	2,908,490	3,071,212	3,195,072	3,396,931	3,559,712	3,688,566
South Pacific	Africa	304	862	1,521	1,454	1,429	2,046	2,229	2,420	2,751	3,082	3,421
South Pacific	Asia	2,599,173	1,898,103	2,140,293	2,307,691	2,364,172	2,798,233	3,080,001	3,350,139	4,041,231	5,029,419	6,317,608
South Pacific	Europe	258,234	218,281	194,150	193,109	180,293	207,480	220,345	231,092	253,878	279,403	306,717
South Pacific	Mideast	15,703	36,746	40,507	41,818	42,234	55,487	62,605	69,915	86,263	104,872	125,063
South Pacific	North America	21,096	2,348	4,620	4,786	4,970	5,967	6,165	6,351	6,906	7,652	8,538
South Pacific	South America	106,660	86,480	61,300	63,521	67,007	83,880	93,893	104,108	124,097	144,871	166,836
South Pacific	Caribbean	12,017	23,735	35,773	38,275	40,599	50,195	54,594	58,116	64,230	69,658	74,574
North Pacific	Africa	1,032	667	12,201	11,902	11,731	12,465	13,107	13,472	13,722	13,808	13,888
North Pacific	Asia	15,737,280	8,554,550	10,050,964	10,885,349	11,176,236	13,106,043	13,917,229	14,206,221	15,172,814	13,218,325	14,581,691
North Pacific	Europe	266,769	198,682	73,001	80,069	82,348	80,540	83,497	87,003	93,097	100,056	107,872
North Pacific	Mideast	82	897	2,681	2,729	2,895	3,689	4,236	4,803	5,905	7,071	8,303
North Pacific	North America	412,493	240,889	132,537	119,289	107,378	162,337	185,295	204,133	240,607	278,232	317,513
North Pacific	South America	429,027	102,143	136,394	139,822	143,962	162,719	177,524	190,277	213,376	235,348	257,389
North Pacific	Caribbean	185	10,768	15,168	16,030	16,825	19,600	21,049	22,213	24,230	25,992	27,544
Great Lakes	Africa	154,018	20,666	307	301	295	318	334	339	347	350	356
Great Lakes	Asia	21	20,149	177,757	181,636	182,241	186,695	187,839	185,493	182,230	180,480	180,043
Great Lakes	Europe	513,667	1,141,518	802,350	854,715	895,382	990,209	1,073,603	1,133,987	1,244,757	1,357,643	1,476,564
Great Lakes	Mideast	21,385	58,183	102	109	117	162	190	215	267	322	380
Great Lakes	North America	212,486	350,461	620,550	660,215	686,004	847,517	945,411	1,041,594	1,227,818	178,207	203,341
Great Lakes	South America	16,423	13	5	6	6	5	4	5	5	5	5
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**42,190,014**	**37,255,416**	**38,715,236**	**40,742,391**	**41,763,451**	**47,295,608**	**50,548,127**	**52,879,469**	**58,058,949**	**56,818,705**	**62,641,336**
Average Annual Growth Rate			**-2.46%**	**1.29%**	**5.24%**	**2.51%**	**2.52%**	**1.34%**	**0.91%**	**0.94%**	**-0.22%**	**0.98%**

US Commodity Forecast For CAPITAL EQUIPMENT
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	48,721	35,546	50,360	51,060	53,632	62,232	66,946	70,095	75,953	81,173	86,474
North Atlantic	Asia	308,321	150,636	220,946	239,390	250,608	331,184	422,694	528,312	829,550	1,323,869	2,166,484
North Atlantic	Europe	592,145	459,440	504,147	523,356	544,441	675,553	770,312	856,215	1,066,149	1,360,235	1,756,021
North Atlantic	Mideast	70,105	49,936	39,291	40,728	42,925	51,539	57,171	61,733	70,395	78,215	85,808
North Atlantic	North America	893	5,272	8,645	9,792	9,695	10,128	9,443	9,218	9,014	8,806	8,662
North Atlantic	South America	246,504	151,551	116,759	127,525	128,971	152,965	169,179	180,258	205,062	232,902	263,466
North Atlantic	Caribbean	1,927	2,944	5,334	5,249	5,194	5,015	4,603	4,341	4,221	4,446	4,832
South Atlantic	Africa	19,344	13,233	29,775	31,663	34,357	37,514	37,275	37,595	38,805	40,532	43,009
South Atlantic	Asia	198,441	162,844	202,442	219,034	226,193	278,442	333,126	392,366	549,399	791,745	1,189,184
South Atlantic	Europe	210,016	330,074	412,936	416,403	425,246	518,340	586,309	643,228	776,251	952,446	1,168,365
South Atlantic	Mideast	26,657	23,362	15,840	16,317	17,109	20,755	23,453	25,578	29,535	33,061	36,470
South Atlantic	North America	4,384	9,129	12,182	13,562	14,124	16,465	17,658	18,479	20,224	21,779	23,167
South Atlantic	South America	452,380	372,815	284,752	304,107	311,163	364,303	404,880	434,939	505,773	591,236	688,808
South Atlantic	Caribbean	70,543	63,416	68,399	68,948	70,112	74,723	72,045	70,655	72,063	77,268	84,272
Gulf Coast	Africa	14,735	12,518	28,911	31,031	33,490	47,701	67,694	99,523	225,637	462,670	804,846
Gulf Coast	Asia	153,326	77,122	75,494	78,588	81,620	98,010	118,768	143,139	212,916	323,639	501,086
Gulf Coast	Europe	115,010	110,949	127,560	134,186	141,054	174,713	203,804	236,878	354,488	598,117	993,567
Gulf Coast	Mideast	6,422	4,369	8,126	8,550	9,214	11,045	12,601	13,944	16,850	19,937	23,180
Gulf Coast	North America	24,007	87,168	18,486	20,630	21,495	26,038	29,086	31,364	36,028	40,582	45,169
Gulf Coast	South America	341,585	280,557	220,064	232,247	234,236	266,234	291,198	310,868	357,940	413,057	472,951
Gulf Coast	Caribbean	28,103	19,823	34,193	35,492	37,092	42,891	44,293	45,435	49,541	56,498	65,197
South Pacific	Africa	322	705	1,091	1,093	1,109	1,339	1,520	1,643	1,867	2,058	2,236
South Pacific	Asia	998,630	748,883	690,620	744,366	781,478	983,112	1,222,955	1,507,775	2,330,863	3,740,100	6,362,081
South Pacific	Europe	37,218	31,683	35,618	36,961	38,564	46,302	52,054	57,725	72,523	94,872	126,016
South Pacific	Mideast	927	907	1,108	1,131	1,173	1,408	1,559	1,663	1,848	2,001	2,134
South Pacific	North America	528	4,082	850	950	1,015	1,299	1,537	1,695	1,979	2,218	2,427
South Pacific	South America	18,167	13,596	10,205	10,790	10,960	12,860	14,497	16,012	20,056	25,418	31,703
South Pacific	Caribbean	1,272	1,827	3,082	3,051	3,044	2,944	2,709	2,544	2,436	2,547	2,760
North Pacific	Africa	264	756	235	234	239	290	332	359	404	442	475
North Pacific	Asia	288,603	195,111	213,613	225,172	240,002	281,883	337,878	399,896	556,885	769,544	1,066,738
North Pacific	Europe	13,304	32,183	20,381	21,371	22,743	29,026	33,543	38,341	53,544	81,661	125,028
North Pacific	Mideast	103	108	85	89	94	118	140	159	196	232	270
North Pacific	North America	2,741	3,492	1,079	1,195	1,322	1,806	2,048	2,278	2,817	3,459	4,201
North Pacific	South America	5,922	4,270	2,267	2,494	2,420	2,716	2,989	3,190	3,625	4,047	4,400
North Pacific	Caribbean	145	67	29	32	36	55	65	73	89	107	128
Great Lakes	Africa	1,016	910	534	571	620	884	1,002	1,101	1,296	1,492	1,691
Great Lakes	Asia	4,127	6,270	5,820	6,183	6,426	8,124	10,214	12,738	19,914	31,738	52,477
Great Lakes	Europe	27,884	78,358	135,811	142,470	148,078	203,416	242,411	277,191	351,583	436,052	531,603
Great Lakes	Mideast	54	1,101	509	527	551	688	805	906	1,116	1,327	1,542
Great Lakes	North America	7,298	15,406	12,935	14,429	16,127	22,275	25,185	27,970	34,551	42,370	51,332
Great Lakes	South America	4,570	3,171	869	950	956	1,125	1,266	1,357	1,529	1,685	1,838
Great Lakes	Caribbean	23	56	6	7	7	9	9	9	10	10	11
Total		**4,346,686**	**3,565,644**	**3,621,389**	**3,821,925**	**3,968,940**	**4,867,469**	**5,697,254**	**6,568,787**	**8,964,925**	**12,755,596**	**18,882,105**
Average Annual Growth Rate			**-3.88%**	**0.52%**	**5.54%**	**3.85%**	**4.17%**	**3.20%**	**2.89%**	**3.16%**	**3.59%**	**4.00%**

US Commodity Forecast For CHEMICALS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	34,058	22,114	23,459	22,916	23,020	26,102	29,241	32,671	40,925	52,329	69,731
North Atlantic	Asia	438,207	501,294	750,199	770,768	792,456	909,146	1,066,620	1,299,566	2,109,364	3,844,663	7,635,934
North Atlantic	Europe	676,675	872,296	1,033,914	1,022,251	1,004,068	1,151,792	1,296,137	1,447,554	1,866,537	2,544,768	3,745,561
North Atlantic	Mideast	57,233	60,384	59,903	61,414	62,606	69,058	75,958	84,436	105,058	132,101	167,276
North Atlantic	North America	14,348	118,857	15,204	16,582	17,111	19,821	22,499	25,317	32,081	40,475	49,938
North Atlantic	South America	303,635	332,421	341,499	359,964	364,598	415,124	465,202	519,183	670,134	901,321	1,226,914
North Atlantic	Caribbean	6,461	10,261	13,994	14,389	14,784	16,978	19,518	22,433	30,178	39,962	50,675
South Atlantic	Africa	46,004	47,522	36,565	35,802	36,291	41,787	47,703	54,685	74,246	108,066	173,567
South Atlantic	Asia	960,824	608,258	837,219	856,857	876,880	993,386	1,133,973	1,335,550	1,986,195	3,272,314	5,933,115
South Atlantic	Europe	417,070	488,187	567,106	557,669	548,591	652,321	754,182	859,235	1,161,249	1,684,887	2,544,910
South Atlantic	Mideast	37,274	43,506	39,588	40,431	41,872	46,087	50,993	57,137	72,827	95,265	126,639
South Atlantic	North America	17,445	33,611	58,848	62,197	63,457	71,859	80,419	86,818	100,582	115,463	131,617
South Atlantic	South America	507,845	567,630	565,851	594,467	608,516	719,997	857,142	1,041,225	1,714,278	2,994,855	4,937,444
South Atlantic	Caribbean	37,945	42,635	74,896	77,416	79,919	93,635	109,299	127,065	174,470	235,587	304,043
Gulf Coast	Africa	292,215	263,737	212,351	211,873	212,416	246,448	289,064	357,578	612,248	1,197,106	2,621,066
Gulf Coast	Asia	6,292,718	5,539,673	6,383,593	6,893,966	6,956,071	6,724,650	6,759,657	7,072,752	8,267,826	10,573,781	14,885,686
Gulf Coast	Europe	2,665,434	3,699,956	3,431,091	3,402,812	3,316,833	3,648,363	3,990,429	4,327,404	5,236,315	6,635,623	9,113,669
Gulf Coast	Mideast	300,126	330,868	378,480	386,400	389,446	418,006	451,194	497,350	612,809	760,581	946,492
Gulf Coast	North America	2,062,819	3,211,703	3,857,196	4,131,600	4,244,860	4,854,819	5,470,584	6,094,515	7,549,660	9,305,447	11,257,021
Gulf Coast	South America	3,047,763	4,068,757	3,992,206	4,329,322	4,382,658	4,938,938	5,547,857	6,336,919	8,937,934	13,903,550	22,086,226
Gulf Coast	Caribbean	243,618	326,218	368,976	382,426	395,753	467,414	546,616	631,604	843,514	1,096,681	1,363,853
South Pacific	Africa	27,856	2,320	2,919	2,835	2,807	3,316	3,856	4,438	5,742	7,292	9,118
South Pacific	Asia	3,571,900	4,002,765	4,056,185	4,173,363	4,279,863	4,891,398	5,649,156	6,691,280	10,061,863	16,762,073	30,688,295
South Pacific	Europe	536,150	362,251	73,518	74,148	74,951	85,124	95,311	104,778	127,154	157,076	197,102
South Pacific	Mideast	1,943	1,188	881	897	911	1,064	1,211	1,389	1,841	2,477	3,361
South Pacific	North America	2,115	519	123	130	135	161	185	207	255	311	377
South Pacific	South America	364,404	410,105	424,274	479,200	485,900	549,720	598,108	637,341	716,928	804,667	903,168
South Pacific	Caribbean	25,286	18,540	29,372	31,087	32,693	40,680	48,292	53,899	64,022	74,210	85,149
North Pacific	Africa	20,046	436	348	344	347	395	429	461	528	604	687
North Pacific	Asia	2,256,146	2,038,771	2,018,590	2,078,090	2,093,159	2,432,621	2,784,292	3,163,275	4,190,080	5,864,905	8,835,774
North Pacific	Europe	89,824	167,265	491,102	501,892	517,386	591,472	663,026	724,423	853,531	997,658	1,160,541
North Pacific	Mideast	8,780	7,035	6,532	6,608	6,735	7,470	8,070	8,585	9,685	10,917	12,296
North Pacific	North America	75,963	154,146	39,247	40,598	42,760	52,788	63,293	72,286	89,672	107,587	126,683
North Pacific	South America	269,825	290,412	395,763	431,660	435,886	488,959	529,418	564,010	635,001	716,265	813,612
North Pacific	Caribbean	4,450	19,663	14,876	15,743	16,555	20,591	24,424	27,163	31,914	36,504	41,360
Great Lakes	Africa	414	353	207	205	200	214	227	244	281	326	377
Great Lakes	Asia	1,527	6,513	26,147	25,922	26,410	31,957	39,003	48,025	77,522	138,772	271,895
Great Lakes	Europe	20,407	56,180	131,958	131,074	129,386	147,090	165,376	184,022	231,871	302,080	416,128
Great Lakes	Mideast	73	216	1,689	1,737	1,774	2,068	2,343	2,677	3,544	4,741	6,381
Great Lakes	North America	43,142	85,752	90,986	92,902	95,455	110,359	127,536	142,427	172,781	205,400	240,957
Great Lakes	South America	816	427	993	1,042	1,056	1,242	1,418	1,593	2,017	2,566	3,249
Great Lakes	Caribbean	4	41	39	38	37	34	31	29	27	28	31
Total		**25,780,790**	**28,814,786**	**30,847,888**	**32,321,032**	**32,676,614**	**35,984,451**	**39,869,293**	**44,743,547**	**59,474,692**	**85,731,285**	**133,189,920**
Average Annual Growth Rate			**2.25%**	**2.30%**	**4.78%**	**1.10%**	**1.95%**	**2.07%**	**2.33%**	**2.89%**	**3.72%**	**4.50%**

US Commodity Forecast For CONSUMER GOODS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	7,961	6,073	7,399	7,014	7,343	8,696	10,002	11,415	15,820	24,202	39,128
North Atlantic	Asia	55,518	47,009	66,919	71,667	75,607	96,392	123,263	161,520	295,006	563,190	1,086,926
North Atlantic	Europe	106,662	117,045	129,032	133,622	138,109	162,146	186,805	223,821	357,957	649,569	1,275,914
North Atlantic	Mideast	9,431	12,556	10,213	10,581	11,219	14,251	17,315	20,443	28,519	40,189	56,035
North Atlantic	North America	202	213	1,648	1,656	1,678	1,743	1,753	1,792	1,966	2,226	2,574
North Atlantic	South America	49,801	57,729	43,256	45,530	47,293	57,171	65,874	73,564	91,771	115,464	145,583
North Atlantic	Caribbean	2,070	4,280	5,277	5,433	5,593	6,297	6,787	7,374	8,882	10,726	12,699
South Atlantic	Africa	1,854	2,631	1,634	1,574	1,636	2,028	2,399	2,856	4,355	7,446	13,254
South Atlantic	Asia	27,762	30,837	50,511	54,051	57,492	75,083	96,081	124,610	220,331	409,562	784,380
South Atlantic	Europe	37,118	41,515	42,680	43,949	45,163	51,760	57,354	64,832	87,724	129,881	210,790
South Atlantic	Mideast	3,348	4,360	3,124	3,280	3,558	4,708	5,894	7,114	10,334	15,207	22,034
South Atlantic	North America	2,209	3,779	2,540	2,708	2,835	3,516	4,158	4,794	6,248	8,110	10,520
South Atlantic	South America	138,610	139,867	101,620	103,978	105,171	111,240	118,852	123,480	138,785	162,845	195,956
South Atlantic	Caribbean	88,595	232,364	117,531	121,362	124,785	136,527	146,110	156,230	179,100	207,120	238,405
Gulf Coast	Africa	718	3,892	2,338	2,230	2,360	3,008	3,617	4,390	7,005	12,509	22,910
Gulf Coast	Asia	4,496	18,488	11,999	13,187	13,931	19,815	26,841	35,915	66,143	125,615	243,877
Gulf Coast	Europe	23,262	35,719	47,840	49,007	50,191	56,588	62,516	72,538	108,636	185,754	352,499
Gulf Coast	Mideast	1,219	1,432	2,060	2,157	2,320	3,017	3,713	4,426	6,286	8,975	12,565
Gulf Coast	North America	2,414	15,073	33,072	32,099	31,178	31,104	29,104	29,679	27,092	23,552	22,588
Gulf Coast	South America	38,395	38,059	36,446	38,492	40,102	49,002	56,376	62,350	75,974	92,987	113,963
Gulf Coast	Caribbean	16,255	57,777	48,448	49,979	51,342	55,919	59,641	63,195	69,933	76,790	83,457
South Pacific	Africa	161	348	497	478	494	630	754	898	1,337	2,174	3,679
South Pacific	Asia	328,138	334,382	322,317	346,256	366,063	460,445	583,180	754,915	1,348,123	2,530,131	4,823,449
South Pacific	Europe	15,048	13,514	11,974	12,458	12,888	14,493	16,512	20,295	34,321	65,886	139,492
South Pacific	Mideast	797	747	510	520	542	658	777	899	1,219	1,673	2,287
South Pacific	North America	145	9,980	720	787	830	1,039	1,222	1,395	1,778	2,254	2,873
South Pacific	South America	17,193	12,841	11,587	12,180	12,552	14,816	16,742	18,370	22,227	27,262	34,020
South Pacific	Caribbean	1,630	3,041	7,425	7,635	7,825	8,504	8,982	9,512	10,727	12,170	13,733
North Pacific	Africa	33	20	171	159	154	134	124	118	117	124	136
North Pacific	Asia	69,500	57,461	59,114	64,098	68,557	86,280	113,125	153,925	301,583	619,685	1,309,758
North Pacific	Europe	1,764	940	1,231	1,308	1,379	1,642	2,059	2,878	6,126	13,854	32,837
North Pacific	Mideast	2	55	36	38	40	55	70	86	129	195	288
North Pacific	North America	183	240	97	95	102	117	130	144	181	224	273
North Pacific	South America	271	319	191	202	204	238	278	317	415	544	709
North Pacific	Caribbean	28	19	40	44	49	68	73	78	89	101	115
Great Lakes	Africa	47	142	338	309	330	412	485	548	692	871	1,092
Great Lakes	Asia	910	1,771	1,813	1,967	2,059	2,714	3,508	4,621	8,460	16,251	31,543
Great Lakes	Europe	15,461	18,329	12,684	13,275	13,745	15,260	16,937	19,608	28,141	44,511	78,745
Great Lakes	Mideast	92	34	111	116	124	148	172	194	250	327	430
Great Lakes	North America	343	212	312	324	352	410	446	496	627	788	978
Great Lakes	South America	79	158	388	392	394	409	421	432	456	487	527
Great Lakes	Caribbean	9	16	197	203	207	220	233	244	257	262	260
Total		**1,069,731**	**1,325,265**	**1,197,340**	**1,256,400**	**1,307,796**	**1,558,707**	**1,850,687**	**2,246,315**	**3,575,121**	**6,211,692**	**11,423,280**
Average Annual Growth Rate			**4.38%**	**-3.33%**	**4.93%**	**4.09%**	**3.57%**	**3.49%**	**3.95%**	**4.76%**	**5.68%**	**6.28%**

US Commodity Forecast For EXTRACTIVE COMMODITIES
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	729,046	400,189	5,580	6,278	6,137	5,316	4,663	4,710	4,789	4,803	4,881
North Atlantic	Asia	10,061,416	2,890,596	3,079,853	3,350,787	3,394,015	3,638,628	3,726,498	3,904,351	4,307,099	4,614,133	4,856,724
North Atlantic	Europe	29,649,164	14,811,365	9,452,154	9,576,167	9,579,332	8,128,766	7,350,475	6,860,453	5,967,201	5,284,698	4,759,173
North Atlantic	Mideast	3,213,728	692,676	1,042,999	1,027,596	1,080,401	1,107,168	1,153,054	1,227,526	1,420,279	1,656,249	1,949,216
North Atlantic	North America	733,250	1,483,225	1,177,773	1,160,307	1,186,753	1,302,966	1,379,322	1,445,943	1,619,617	1,815,578	2,026,995
North Atlantic	South America	4,656,479	3,283,363	1,864,441	1,859,506	1,939,774	2,092,557	2,165,067	2,218,344	2,369,077	2,538,196	2,719,336
North Atlantic	Caribbean	1,913	1,552	24,071	21,524	21,349	21,900	22,261	21,795	21,282	21,030	21,402
South Atlantic	Africa	26,683	10,245	4,938	4,487	4,077	5,437	5,787	6,209	7,073	7,897	8,733
South Atlantic	Asia	1,555,724	1,991,209	2,201,466	2,279,460	2,344,860	2,414,181	2,457,878	2,493,016	2,645,695	2,869,544	3,204,501
South Atlantic	Europe	1,598,525	1,147,762	1,100,600	1,109,014	1,114,780	1,055,550	1,037,596	1,031,896	1,035,845	1,061,602	1,109,628
South Atlantic	Mideast	101,414	12,208	38,925	36,920	37,727	37,457	38,052	39,789	44,065	49,376	56,320
South Atlantic	North America	332,631	222,783	353,527	342,176	356,250	424,782	456,727	485,001	561,212	644,866	733,828
South Atlantic	South America	210,844	167,767	204,238	205,403	206,999	217,859	221,041	223,544	229,004	233,714	237,183
South Atlantic	Caribbean	9,010	16,149	21,410	21,696	21,970	22,535	22,986	23,236	23,707	24,338	25,198
Gulf Coast	Africa	5,370	1,482	10,563	10,693	10,803	11,375	11,650	12,088	13,140	14,445	15,906
Gulf Coast	Asia	3,941,703	301,094	380,980	421,548	435,345	464,010	461,474	493,701	580,760	708,159	905,774
Gulf Coast	Europe	8,073,669	3,520,689	2,365,911	2,440,712	2,455,159	2,233,705	2,119,302	2,045,577	1,828,470	1,744,302	1,676,933
Gulf Coast	Mideast	604,981	1,011,156	495,463	496,399	523,269	576,957	611,248	659,605	785,476	940,475	1,131,359
Gulf Coast	North America	342,465	592,271	495,677	542,892	577,070	662,610	693,127	737,377	858,030	989,606	1,129,711
Gulf Coast	South America	2,323,071	1,423,842	1,742,095	1,752,818	1,828,475	1,966,701	2,012,337	2,053,323	2,174,543	2,312,462	2,461,883
Gulf Coast	Caribbean	44,965	71,172	185,444	208,049	211,420	197,267	182,817	190,182	203,472	218,233	233,441
South Pacific	Africa	3,024	3,745	3,301	2,985	2,700	3,643	3,886	4,177	4,769	5,331	5,900
South Pacific	Asia	7,526,966	6,245,963	4,210,929	4,562,249	4,604,922	4,951,608	5,104,664	5,406,414	6,187,086	7,105,610	8,383,098
South Pacific	Europe	122,425	81,687	85,166	86,001	86,974	79,641	75,214	72,702	68,756	65,843	63,680
South Pacific	Mideast	1,208	712	40,396	40,381	40,484	44,422	46,799	49,737	57,000	66,244	77,493
South Pacific	North America	36,537	217,443	1,713	1,689	1,892	2,303	2,411	2,487	2,669	2,890	3,136
South Pacific	South America	169,165	134,795	127,760	137,712	136,789	141,183	143,202	143,973	145,067	145,839	146,398
South Pacific	Caribbean	32,711	8,585	12,221	13,561	13,757	12,815	11,850	12,298	13,123	14,048	15,023
North Pacific	Africa	0	0	20	18	16	22	24	26	29	33	37
North Pacific	Asia	1,526,016	984,473	1,564,019	1,700,052	1,735,337	1,911,674	2,014,051	2,164,026	2,591,797	3,192,971	4,140,897
North Pacific	Europe	21,370	12,667	8,936	9,177	9,302	8,464	8,051	7,798	7,331	6,899	6,504
North Pacific	Mideast	19	0	0	0	0	0	0	0	0	0	0
North Pacific	North America	1,024,545	29,859	273,678	261,765	279,435	346,980	363,054	374,513	401,935	435,162	472,273
North Pacific	South America	65,726	11,548	4,906	5,105	5,275	6,033	6,695	7,368	8,520	9,446	10,240
North Pacific	Caribbean	34,870	20	44	46	46	47	48	49	50	51	53
Great Lakes	Africa	15,235	153	2	2	2	2	2	3	3	3	4
Great Lakes	Asia	35,447	6,952	22,858	25,292	25,769	29,737	31,462	33,276	37,701	40,774	42,067
Great Lakes	Europe	312,673	71,637	71,401	71,403	71,407	63,684	59,085	56,446	52,364	49,466	47,373
Great Lakes	Mideast	43	96	97	93	90	132	142	156	191	235	292
Great Lakes	North America	16,158,056	14,039,639	23,102,411	22,607,673	23,197,596	24,662,802	25,680,534	26,489,740	28,426,460	30,773,701	33,395,638
Great Lakes	South America	3,110	12,915	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	61	0	0	0	0	0	0	0	0	0
Total		**95,305,198**	**55,915,748**	**55,777,962**	**56,399,637**	**57,547,760**	**58,852,921**	**59,684,534**	**61,002,855**	**64,704,685**	**69,668,254**	**76,078,230**
Average Annual Growth Rate			**-10.12%**	**-0.08%**	**1.11%**	**2.04%**	**0.45%**	**0.28%**	**0.44%**	**0.59%**	**0.74%**	**0.88%**

US Commodity Forecast For FOOD
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	11,751	18,770	61,733	61,516	60,362	56,007	51,405	50,412	50,177	51,826	54,790
North Atlantic	Asia	444,368	348,979	343,378	359,502	370,289	422,550	454,094	499,886	608,875	741,570	838,757
North Atlantic	Europe	775,348	514,378	454,066	463,427	467,800	463,841	442,056	444,559	478,135	529,565	586,135
North Atlantic	Mideast	48,463	89,146	75,273	77,035	79,719	99,539	111,072	123,872	153,109	185,280	218,383
North Atlantic	North America	5,246	8,564	37,188	38,425	40,390	52,162	57,703	63,855	76,247	88,929	101,625
North Atlantic	South America	191,494	243,338	245,963	269,082	286,433	389,447	430,348	468,556	548,338	632,268	718,680
North Atlantic	Caribbean	26,463	17,710	21,478	22,345	22,641	21,819	20,526	19,678	18,129	16,926	16,117
South Atlantic	Africa	53,669	27,658	37,003	36,960	35,663	31,113	27,603	27,063	26,926	27,721	29,168
South Atlantic	Asia	382,399	622,099	608,830	649,920	678,684	893,947	1,023,011	1,178,804	1,538,971	1,964,721	2,066,975
South Atlantic	Europe	1,211,911	1,626,388	1,001,701	1,063,120	1,086,820	1,145,980	1,122,548	1,153,361	1,277,708	1,436,629	1,600,856
South Atlantic	Mideast	28,758	53,678	80,376	78,250	79,937	121,369	134,304	152,933	196,044	244,655	295,722
South Atlantic	North America	13,976	29,132	21,426	22,243	23,483	34,364	39,741	44,919	55,869	67,442	79,261
South Atlantic	South America	385,921	272,499	223,669	229,767	238,373	305,705	338,481	372,412	446,025	526,997	613,147
South Atlantic	Caribbean	63,079	105,497	119,169	126,521	132,100	146,937	150,018	154,327	163,285	173,862	186,303
Gulf Coast	Africa	63,487	195,818	158,601	158,376	153,914	165,363	166,004	171,821	187,174	206,317	227,704
Gulf Coast	Asia	2,198,396	2,357,434	1,583,532	1,741,276	1,847,884	2,515,985	2,973,164	3,481,050	4,649,723	6,025,187	7,554,136
Gulf Coast	Europe	10,133,275	6,848,184	4,970,148	5,403,950	5,619,730	5,090,813	4,928,153	5,071,737	5,474,534	6,105,454	6,883,308
Gulf Coast	Mideast	379,052	794,862	603,612	668,271	704,980	1,151,025	1,372,714	1,595,970	2,085,426	2,618,401	3,170,475
Gulf Coast	North America	194,054	441,746	1,041,724	1,146,820	1,246,520	1,884,360	2,192,561	2,485,922	3,107,981	3,765,913	4,436,908
Gulf Coast	South America	1,442,361	1,154,370	939,609	965,551	1,005,276	1,387,626	1,577,073	1,759,044	2,139,115	2,539,926	2,955,603
Gulf Coast	Caribbean	456,957	726,987	807,800	890,250	954,675	1,159,450	1,228,123	1,293,428	1,430,462	1,580,238	1,741,228
South Pacific	Africa	1,114	1,591	2,080	1,966	1,893	2,418	2,674	2,912	3,371	3,842	4,327
South Pacific	Asia	4,092,793	4,410,222	4,164,795	4,349,853	4,502,159	5,344,136	5,762,539	6,255,830	7,280,801	8,441,173	9,482,595
South Pacific	Europe	201,689	244,303	247,292	250,625	247,604	262,251	263,312	268,855	285,403	305,963	329,084
South Pacific	Mideast	3,921	7,602	8,144	8,158	8,331	10,599	12,014	13,219	15,721	18,451	21,415
South Pacific	North America	5,491	11,983	18,479	20,374	21,414	26,169	29,305	31,915	37,171	42,799	48,827
South Pacific	South America	56,485	41,571	34,099	36,235	38,228	48,382	53,137	58,124	68,142	78,921	90,481
South Pacific	Caribbean	11,498	25,961	31,894	34,771	35,238	33,862	32,007	29,943	26,173	23,077	20,696
North Pacific	Africa	1,886	980	1,871	1,793	1,676	2,271	2,415	2,672	3,189	3,722	4,264
North Pacific	Asia	3,450,135	3,913,635	4,202,593	4,356,816	4,577,382	5,478,140	5,949,575	6,489,591	7,660,391	8,990,799	10,292,385
North Pacific	Europe	141,804	142,949	148,493	155,616	158,243	168,534	157,932	158,436	175,707	196,571	215,432
North Pacific	Mideast	882	2,397	2,785	2,759	2,807	3,093	3,367	3,700	4,384	5,119	5,910
North Pacific	North America	6,125	11,829	12,588	12,335	12,728	15,246	16,691	18,157	20,969	23,696	26,306
North Pacific	South America	30,806	27,026	16,966	17,741	17,945	19,046	20,066	21,455	24,309	27,380	30,836
North Pacific	Caribbean	1,239	7,998	2,172	2,362	2,397	2,315	2,202	2,074	1,829	1,618	1,446
Great Lakes	Africa	198	2,095	2,450	2,336	2,238	1,652	1,277	1,112	884	759	703
Great Lakes	Asia	736	13,360	9,950	10,732	11,566	16,587	19,910	23,527	31,712	40,469	49,073
Great Lakes	Europe	67,144	166,241	162,172	175,265	182,031	168,184	168,747	174,183	184,028	201,279	224,310
Great Lakes	Mideast	56	4,452	2,887	3,132	3,401	5,042	5,871	6,699	8,442	10,263	12,098
Great Lakes	North America	9,710	3,094	9,060	9,175	9,504	12,155	13,669	14,904	17,271	19,568	21,771
Great Lakes	South America	0	1,995	653	711	748	944	1,037	1,117	1,276	1,446	1,628
Great Lakes	Caribbean	0	890	562	576	589	591	578	572	550	524	502
Total		**26,594,141**	**25,539,410**	**22,518,263**	**23,925,935**	**24,973,796**	**29,161,021**	**31,359,026**	**34,192,605**	**40,563,975**	**47,967,267**	**55,259,369**
Average Annual Growth Rate			**-0.81%**	**-4.11%**	**6.25%**	**4.38%**	**3.15%**	**1.46%**	**1.75%**	**1.72%**	**1.69%**	**1.43%**

US Commodity Forecast For FUELS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	973	3,022	2,009	1,997	2,042	1,842	1,697	1,689	1,687	1,674	1,628
North Atlantic	Asia	49,098	31,712	115,582	113,447	111,253	92,644	77,190	67,889	52,091	38,854	29,161
North Atlantic	Europe	186,067	134,332	201,415	206,112	203,885	179,596	160,746	145,598	119,462	97,053	78,190
North Atlantic	Mideast	4,895	4,276	2,699	2,606	2,659	2,523	2,428	2,458	2,509	2,520	2,470
North Atlantic	North America	80,062	234,589	271,198	293,885	276,487	304,824	306,100	316,343	346,452	402,024	484,736
North Atlantic	South America	20,637	33,920	38,303	38,364	37,543	34,766	32,943	33,338	33,895	33,915	33,190
North Atlantic	Caribbean	368	235	343	345	345	352	356	359	359	358	354
South Atlantic	Africa	531	589	222	221	226	205	190	189	189	188	183
South Atlantic	Asia	6,465	8,093	8,311	8,257	8,213	7,399	6,864	6,766	7,238	8,820	11,922
South Atlantic	Europe	5,003	32,672	6,574	6,720	6,552	5,517	4,782	4,277	3,485	2,886	2,468
South Atlantic	Mideast	532	3,863	8,539	8,247	8,416	8,116	7,854	7,964	8,153	8,211	8,068
South Atlantic	North America	85	573	229	227	230	210	196	195	194	190	182
South Atlantic	South America	20,453	40,118	69,710	72,020	73,065	79,082	85,001	89,375	94,193	96,812	98,144
South Atlantic	Caribbean	9,007	6,706	6,886	6,928	6,940	7,072	7,161	7,208	7,223	7,190	7,115
Gulf Coast	Africa	23,126	15,093	32,195	32,015	32,725	29,690	27,468	27,364	27,368	27,180	26,503
Gulf Coast	Asia	2,257,429	958,805	1,904,146	1,878,657	1,843,357	1,544,704	1,307,706	1,192,327	1,019,579	928,355	962,276
Gulf Coast	Europe	2,029,402	1,288,718	327,263	351,455	348,164	274,764	227,817	193,782	139,544	95,938	62,004
Gulf Coast	Mideast	535,211	365,416	426,485	411,930	420,369	405,476	392,461	397,941	407,416	410,336	403,205
Gulf Coast	North America	2,254,934	10,085,410	6,693,780	6,726,094	6,730,980	6,340,950	5,988,144	6,014,522	6,089,099	6,196,350	6,299,861
Gulf Coast	South America	2,695,421	1,726,769	3,355,593	3,452,169	3,496,910	3,761,943	4,036,478	4,267,741	4,570,971	4,787,532	4,957,404
Gulf Coast	Caribbean	638,851	803,983	1,434,774	1,443,526	1,446,085	1,473,465	1,492,065	1,501,796	1,505,072	1,498,055	1,482,557
South Pacific	Africa	33	85	52	52	53	48	44	44	44	44	42
South Pacific	Asia	4,336,194	1,650,298	1,394,121	1,367,385	1,345,251	1,148,904	988,064	887,567	746,564	685,128	730,544
South Pacific	Europe	2,758	2,351	5,340	5,591	5,502	4,519	3,924	3,572	3,050	2,684	2,473
South Pacific	Mideast	258	457	8,207	7,927	8,090	7,816	7,569	7,676	7,861	7,920	7,784
South Pacific	North America	1,180,025	1,838,240	463,457	464,846	465,883	437,125	412,080	413,542	417,629	423,021	427,069
South Pacific	South America	112,422	125,174	240,990	250,973	256,752	289,188	321,597	347,871	388,974	425,515	461,828
South Pacific	Caribbean	56,609	545	269,384	271,027	271,508	276,649	280,141	281,968	282,583	281,265	278,356
North Pacific	Africa	0	83	1,192	1,185	1,212	1,093	1,007	1,002	1,001	993	966
North Pacific	Asia	655,516	188,257	349,101	344,754	345,879	278,664	228,183	194,519	138,600	91,057	52,686
North Pacific	Europe	1,021	2,670	2,084	2,085	2,021	1,877	1,854	1,958	2,201	2,504	2,897
North Pacific	Mideast	0	0	0	0	0	0	0	0	0	0	0
North Pacific	North America	695,281	614,904	1,167,693	1,284,234	1,193,800	1,354,750	1,373,980	1,426,172	1,579,709	1,864,176	2,289,569
North Pacific	South America	133,726	4,735	319,511	333,911	342,185	389,524	438,333	482,118	559,812	635,966	716,667
North Pacific	Caribbean	0	16	405,427	407,900	408,623	416,360	421,616	424,365	425,291	423,308	418,929
Great Lakes	Africa	0	17	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	62	258	1,517	1,494	1,468	1,281	1,131	1,031	912	897	1,010
Great Lakes	Europe	810	4,802	8,697	9,239	9,134	7,302	6,102	5,247	3,855	2,703	1,772
Great Lakes	Mideast	0	15	44	42	43	39	37	38	38	38	37
Great Lakes	North America	241,821	56,290	244,307	268,809	249,790	283,710	287,820	298,790	331,064	390,865	480,303
Great Lakes	South America	1	38	62	63	63	58	55	55	56	55	53
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**18,235,089**	**20,268,109**	**19,787,444**	**20,076,740**	**19,963,702**	**19,454,045**	**18,939,184**	**19,056,655**	**19,325,427**	**19,882,580**	**20,824,605**
Average Annual Growth Rate			**2.14%**	**-0.80%**	**1.46%**	**-0.56%**	**-0.52%**	**-0.54%**	**0.12%**	**0.14%**	**0.28%**	**0.46%**

US Commodity Forecast For HI-TECH PRODUCTS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	2,221	1,519	1,700	1,755	1,794	2,389	3,077	4,042	7,397	14,680	31,933
North Atlantic	Asia	16,535	19,915	39,675	42,982	46,587	67,600	95,762	140,818	310,097	691,118	1,555,760
North Atlantic	Europe	48,496	55,916	63,404	63,582	64,224	76,340	86,389	100,669	146,620	233,170	402,527
North Atlantic	Mideast	3,134	5,697	5,878	6,021	6,319	8,296	10,054	11,874	16,142	21,420	27,881
North Atlantic	North America	91	209	27	30	33	47	62	77	119	175	246
North Atlantic	South America	18,694	30,894	24,018	26,075	27,075	34,901	42,838	50,022	67,751	92,136	128,400
North Atlantic	Caribbean	242	254	798	836	879	1,195	1,779	2,856	7,218	17,702	40,854
South Atlantic	Africa	670	620	840	867	895	1,096	1,342	1,679	2,871	5,446	11,476
South Atlantic	Asia	11,691	6,464	8,091	8,815	9,570	14,183	20,556	30,671	68,911	154,537	345,059
South Atlantic	Europe	9,866	14,340	14,828	14,935	15,702	18,552	20,516	22,887	29,753	41,051	61,962
South Atlantic	Mideast	652	935	898	942	1,019	1,470	1,959	2,489	3,867	5,711	8,058
South Atlantic	North America	208	1,110	887	1,005	1,091	1,639	2,129	2,590	3,646	4,785	5,958
South Atlantic	South America	67,882	74,563	47,542	51,509	54,518	76,153	103,697	142,155	279,278	577,847	1,263,198
South Atlantic	Caribbean	8,545	11,261	12,706	13,793	15,051	24,108	40,031	68,431	182,904	456,335	1,056,921
Gulf Coast	Africa	335	824	533	550	561	708	836	955	1,223	1,519	1,844
Gulf Coast	Asia	1,895	2,295	2,599	2,837	3,135	5,180	8,290	13,659	35,003	85,823	207,386
Gulf Coast	Europe	9,125	19,898	15,356	15,399	16,029	18,972	21,442	24,826	36,353	59,076	105,153
Gulf Coast	Mideast	378	387	528	553	593	814	1,019	1,238	1,817	2,627	3,738
Gulf Coast	North America	268	694	947	1,061	1,150	1,734	2,302	2,853	4,122	5,545	7,080
Gulf Coast	South America	9,405	10,389	9,281	10,125	10,837	14,683	18,994	22,707	30,555	39,462	53,240
Gulf Coast	Caribbean	615	1,054	1,164	1,250	1,351	2,046	3,160	4,961	11,952	27,987	62,314
South Pacific	Africa	173	120	177	189	201	259	315	360	443	508	561
South Pacific	Asia	143,502	138,608	140,981	152,613	163,872	228,217	310,233	431,714	870,076	1,816,121	3,847,997
South Pacific	Europe	12,565	10,455	12,154	12,102	12,546	14,671	16,049	17,743	22,986	32,186	48,892
South Pacific	Mideast	337	398	404	428	459	631	800	977	1,401	1,913	2,519
South Pacific	North America	163	586	1,114	1,267	1,364	1,782	2,076	2,263	2,606	2,903	3,209
South Pacific	South America	12,420	9,282	5,338	5,698	5,944	7,619	9,553	11,749	18,112	29,154	50,555
South Pacific	Caribbean	246	352	1,425	1,594	1,793	3,110	5,103	7,794	17,510	37,690	77,713
North Pacific	Africa	0	21	10	10	11	14	17	20	26	34	42
North Pacific	Asia	32,561	17,879	20,577	22,253	24,151	32,646	43,801	60,155	116,089	229,440	463,335
North Pacific	Europe	335	1,995	276	281	294	335	377	436	634	1,020	1,668
North Pacific	Mideast	10	24	13	13	13	19	22	26	36	48	64
North Pacific	North America	92	17	55	55	52	70	83	100	141	191	252
North Pacific	South America	394	8,154	94	100	105	144	199	285	587	1,183	2,322
North Pacific	Caribbean	31	6	11	13	14	29	57	114	355	954	2,305
Great Lakes	Africa	2	451	14	15	16	18	20	21	25	30	34
Great Lakes	Asia	97	7,725	1,875	2,032	2,271	3,466	4,786	6,618	13,558	28,641	60,605
Great Lakes	Europe	3,400	4,603	7,339	7,313	7,479	8,275	8,826	9,582	11,586	14,265	17,840
Great Lakes	Mideast	3	494	13	13	14	19	23	27	35	45	56
Great Lakes	North America	117	73	91	94	100	133	152	172	217	269	330
Great Lakes	South America	3	423	97	102	106	132	155	176	221	267	313
Great Lakes	Caribbean	3	0	2	2	2	2	3	3	3	4	4
Total		**417,404**	**460,907**	**443,758**	**471,113**	**499,219**	**673,696**	**888,884**	**1,202,794**	**2,324,245**	**4,735,019**	**9,961,602**
Average Annual Growth Rate			**2.00%**	**-1.26%**	**6.16%**	**5.97%**	**6.18%**	**5.70%**	**6.24%**	**6.81%**	**7.38%**	**7.72%**

US Commodity Forecast For INTERMEDIATE MANUFACTURED PRODUCTS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	26,036	17,707	24,149	23,020	22,015	25,493	28,322	30,460	34,551	38,426	42,092
North Atlantic	Asia	454,102	230,244	586,826	612,532	631,792	780,079	964,164	1,133,082	1,602,459	2,357,316	3,627,117
North Atlantic	Europe	398,776	346,877	612,512	634,322	684,982	886,125	1,114,587	1,332,533	1,842,878	2,545,381	3,621,816
North Atlantic	Mideast	63,609	44,968	57,308	58,600	56,968	70,524	79,906	86,713	101,176	117,027	134,705
North Atlantic	North America	2,082	1,057	2,936	3,108	3,215	3,553	3,918	4,097	4,324	4,479	4,622
North Atlantic	South America	192,105	132,582	115,913	124,756	125,137	136,588	148,071	157,383	176,763	197,717	221,176
North Atlantic	Caribbean	3,181	5,951	5,419	5,381	5,361	5,699	6,861	9,201	20,511	48,517	98,125
South Atlantic	Africa	4,952	5,977	7,495	6,949	6,436	7,536	8,331	8,939	10,127	11,230	12,211
South Atlantic	Asia	137,086	124,286	232,012	243,856	253,060	299,011	360,735	419,706	597,438	912,015	1,493,962
South Atlantic	Europe	123,269	153,037	241,250	250,442	254,556	307,969	363,776	422,231	575,462	813,414	1,217,583
South Atlantic	Mideast	13,801	20,287	19,172	19,335	18,893	22,314	25,138	27,370	32,507	39,021	47,394
South Atlantic	North America	3,120	11,244	8,270	9,099	9,479	11,442	13,271	14,292	16,059	17,778	19,728
South Atlantic	South America	307,934	267,566	204,406	217,402	221,826	255,124	285,606	308,951	355,802	405,132	458,936
South Atlantic	Caribbean	60,998	75,223	65,769	67,923	69,992	85,355	111,432	156,478	361,469	860,804	1,742,808
Gulf Coast	Africa	26,799	15,962	14,227	14,531	14,482	14,579	14,266	14,174	13,941	13,842	13,904
Gulf Coast	Asia	1,123,149	45,780	349,192	360,442	368,857	451,373	549,718	628,781	848,838	1,206,045	1,834,248
Gulf Coast	Europe	294,190	131,715	253,810	262,070	281,116	371,384	473,003	564,088	763,999	1,007,285	1,311,438
Gulf Coast	Mideast	18,518	13,603	7,844	7,786	7,470	8,667	9,618	10,639	13,292	17,129	22,653
Gulf Coast	North America	10,067	32,415	23,381	25,624	26,530	32,272	37,949	41,412	47,351	52,717	58,107
Gulf Coast	South America	433,064	221,229	145,590	155,279	157,793	173,616	188,054	199,684	222,543	246,463	273,277
Gulf Coast	Caribbean	37,009	39,738	39,778	41,734	43,108	49,450	58,871	74,357	147,553	331,354	659,483
South Pacific	Africa	174	446	450	439	428	473	515	548	611	663	701
South Pacific	Asia	1,205,794	762,621	647,532	683,902	712,796	860,769	1,058,009	1,278,401	1,970,393	3,275,254	5,780,712
South Pacific	Europe	27,298	18,374	33,849	34,779	36,009	42,819	50,585	57,512	72,927	92,104	118,120
South Pacific	Mideast	2,160	1,193	1,470	1,464	1,439	1,645	1,816	1,976	2,355	2,817	3,371
South Pacific	North America	5,336	9,048	2,967	3,153	3,262	3,714	4,189	4,434	4,811	5,144	5,495
South Pacific	South America	31,673	26,985	20,968	21,900	22,260	25,231	28,573	32,063	40,860	51,356	62,445
South Pacific	Caribbean	2,726	4,883	7,737	8,083	8,482	11,448	16,828	26,519	71,416	181,649	376,878
North Pacific	Africa	0	241	228	231	235	273	313	347	414	482	553
North Pacific	Asia	666,019	228,015	221,330	236,793	247,254	277,079	320,600	371,912	545,147	880,776	1,518,321
North Pacific	Europe	10,995	3,930	3,070	3,182	3,400	4,378	5,352	6,801	12,185	23,151	44,501
North Pacific	Mideast	140	10	9	10	10	12	13	15	18	22	26
North Pacific	North America	18,730	1,048	23,695	23,869	24,817	30,251	35,331	39,669	48,514	58,054	68,427
North Pacific	South America	3,035	1,581	637	669	670	750	856	940	1,110	1,284	1,472
North Pacific	Caribbean	94	138	31	34	37	57	91	152	433	1,123	2,347
Great Lakes	Africa	17	90	135	126	117	138	150	156	165	170	174
Great Lakes	Asia	286,880	2,241	90,531	92,944	94,989	114,858	137,642	153,709	196,518	260,188	358,494
Great Lakes	Europe	380,901	75,643	246,711	260,183	291,041	418,129	577,407	730,886	1,078,368	1,510,773	2,045,905
Great Lakes	Mideast	7,430	6,952	521	532	534	679	793	877	1,067	1,293	1,559
Great Lakes	North America	165,650	200,393	212,720	213,946	222,883	270,763	315,173	353,027	430,603	515,005	607,535
Great Lakes	South America	39	168	284	305	306	340	383	423	518	626	749
Great Lakes	Caribbean	0	4	11	12	14	22	36	60	172	446	932
Total		**6,548,938**	**3,281,453**	**4,532,148**	**4,730,747**	**4,934,054**	**6,061,980**	**7,400,251**	**8,705,000**	**12,267,647**	**18,105,474**	**27,914,101**
Average Annual Growth Rate			**-12.91%**	**11.36%**	**4.38%**	**4.30%**	**4.20%**	**4.07%**	**3.30%**	**3.49%**	**3.97%**	**4.42%**

US Commodity Forecast For MATERIALS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	35,824	22,945	31,245	31,080	29,769	30,329	31,326	33,212	39,097	50,607	76,010
North Atlantic	Asia	1,732,030	1,916,239	2,991,739	3,000,188	2,883,470	2,386,401	2,059,354	1,968,685	1,812,441	1,723,885	1,690,951
North Atlantic	Europe	951,442	626,457	636,976	665,197	655,489	496,734	434,311	437,976	511,170	749,294	1,354,279
North Atlantic	Mideast	102,457	117,499	97,924	100,654	103,886	89,353	80,358	78,874	76,694	75,794	76,470
North Atlantic	North America	32,339	59,933	57,713	61,816	57,199	40,036	32,632	30,085	26,806	25,751	26,434
North Atlantic	South America	337,261	321,874	278,748	279,307	271,317	253,332	250,001	258,647	280,760	304,025	327,166
North Atlantic	Caribbean	24,285	31,591	59,344	63,327	67,868	98,209	148,862	216,786	455,560	932,594	1,849,819
South Atlantic	Africa	37,282	21,405	19,426	19,925	19,744	22,695	28,436	39,922	87,466	203,744	495,852
South Atlantic	Asia	1,847,438	1,689,100	1,716,703	1,759,043	1,719,038	1,528,343	1,429,130	1,488,952	1,681,301	1,954,595	2,256,682
South Atlantic	Europe	1,986,556	1,794,724	1,792,772	1,892,319	1,897,550	1,440,903	1,264,470	1,273,945	1,346,946	1,505,476	1,757,949
South Atlantic	Mideast	237,334	164,923	207,905	208,966	207,084	203,360	199,293	204,976	219,650	237,380	258,609
South Atlantic	North America	15,757	49,733	17,466	17,713	18,048	18,176	19,235	20,004	21,398	23,362	25,753
South Atlantic	South America	1,216,341	1,063,065	890,935	894,551	885,177	869,056	873,976	919,603	1,039,128	1,178,543	1,330,921
South Atlantic	Caribbean	182,146	210,974	361,414	401,040	446,480	753,833	1,268,437	1,945,824	4,372,220	9,284,261	18,791,817
Gulf Coast	Africa	47,017	20,102	26,865	26,351	24,966	24,765	25,827	28,590	40,514	69,159	139,389
Gulf Coast	Asia	938,946	517,897	420,200	418,639	394,086	309,147	259,312	249,717	243,592	252,569	271,734
Gulf Coast	Europe	1,318,705	861,809	677,221	717,825	716,322	545,432	484,017	490,344	525,337	596,879	707,975
Gulf Coast	Mideast	125,560	74,681	46,813	47,072	46,493	48,631	50,367	53,667	61,255	70,215	80,854
Gulf Coast	North America	16,250	66,654	243,765	238,295	240,469	234,091	230,474	233,053	239,506	248,661	259,032
Gulf Coast	South America	377,752	243,237	228,137	224,125	218,077	200,616	194,239	196,317	208,415	226,344	246,071
Gulf Coast	Caribbean	212,233	285,378	415,562	434,565	455,772	593,240	809,622	1,090,029	2,056,505	3,939,900	7,506,373
South Pacific	Africa	999	1,557	1,982	1,880	1,820	1,683	1,549	1,412	1,311	1,136	984
South Pacific	Asia	3,682,974	4,449,715	5,642,423	5,628,499	5,394,918	4,493,619	3,842,196	3,614,166	3,240,504	3,057,024	3,050,604
South Pacific	Europe	142,194	46,345	31,568	33,254	32,134	21,881	17,233	15,690	13,201	11,586	10,806
South Pacific	Mideast	3,032	8,311	1,240	1,218	1,188	1,191	1,169	1,146	1,155	1,218	1,331
South Pacific	North America	1,761	2,467	1,347	1,337	1,363	1,447	1,550	1,644	1,834	2,089	2,422
South Pacific	South America	122,145	113,535	109,351	105,055	100,532	82,920	70,797	63,240	53,990	49,810	48,257
South Pacific	Caribbean	6,000	6,316	24,074	25,947	28,100	42,511	66,881	99,820	216,143	449,950	901,142
North Pacific	Africa	930	734	418	426	437	502	617	869	1,956	4,699	11,639
North Pacific	Asia	3,152,193	2,469,544	2,316,535	2,382,239	2,316,982	2,094,201	1,970,605	2,018,827	2,188,208	2,394,051	2,557,953
North Pacific	Europe	111,341	73,748	61,756	64,441	61,993	36,818	24,956	21,100	15,183	11,917	11,794
North Pacific	Mideast	70	20	1,428	1,345	1,244	1,023	927	806	598	448	347
North Pacific	North America	1,391	885	10,288	9,983	9,710	8,431	8,157	8,330	9,057	10,223	11,608
North Pacific	South America	23,732	13,727	8,733	8,620	8,439	7,689	7,236	7,285	7,491	7,791	8,165
North Pacific	Caribbean	0	1,170	2,060	2,097	2,135	2,350	2,628	2,982	3,981	5,509	7,934
Great Lakes	Africa	133	133	648	614	602	591	602	580	518	474	453
Great Lakes	Asia	1,645	15,763	30,589	29,980	28,879	25,443	22,878	22,340	22,017	23,079	25,445
Great Lakes	Europe	6,233	44,098	54,092	56,606	55,380	42,193	36,404	34,384	31,480	30,632	31,686
Great Lakes	Mideast	0	368	385	387	389	469	510	559	680	835	1,030
Great Lakes	North America	3,531	805	538	560	560	535	559	574	610	669	752
Great Lakes	South America	241	761	285	291	282	248	232	220	203	195	189
Great Lakes	Caribbean	0	0	355	385	420	656	1,058	1,605	3,540	7,437	14,968
Total		**19,035,502**	**17,410,221**	**19,518,968**	**19,857,158**	**19,405,813**	**17,053,081**	**16,252,425**	**17,176,786**	**21,159,419**	**29,723,808**	**46,229,648**
Average Annual Growth Rate			**-1.77%**	**3.88%**	**1.73%**	**-2.27%**	**-2.55%**	**-0.96%**	**1.11%**	**2.11%**	**3.46%**	**4.52%**

US Commodity Forecast For ALL COMMODITIES
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	916,871	548,084	221,442	220,103	218,992	231,185	238,810	250,300	280,898	329,257	415,351
North Atlantic	Asia	13,960,750	6,961,449	8,837,144	9,250,606	9,270,680	9,482,315	9,785,641	10,535,969	12,835,386	16,881,243	24,537,916
North Atlantic	Europe	33,959,934	18,675,604	13,643,554	13,900,644	13,980,998	12,838,292	12,490,208	12,524,759	13,081,176	14,779,128	18,442,629
North Atlantic	Mideast	3,597,865	1,095,576	1,432,449	1,429,521	1,493,730	1,379,931	1,662,666	1,780,991	2,073,737	2,427,349	2,857,108
North Atlantic	North America	869,534	2,078,706	1,623,821	1,641,668	1,651,805	1,806,570	1,892,641	1,984,001	2,219,464	2,388,733	2,706,130
North Atlantic	South America	6,148,312	4,626,630	3,139,320	3,202,490	3,302,950	3,653,081	3,863,212	4,062,578	4,562,833	5,183,353	5,936,026
North Atlantic	Caribbean	100,528	80,703	142,365	145,643	151,307	186,891	241,927	315,981	578,891	1,106,083	2,109,882
South Atlantic	Africa	197,153	144,011	142,940	143,401	144,078	154,159	163,624	183,492	256,057	415,959	790,866
South Atlantic	Asia	6,318,402	6,073,964	6,737,734	7,026,350	7,151,692	7,498,514	7,900,876	8,554,073	10,484,268	13,638,385	18,705,511
South Atlantic	Europe	5,910,111	5,885,058	5,430,558	5,630,642	5,662,891	5,411,108	5,408,690	5,665,013	6,478,314	7,819,933	9,883,605
South Atlantic	Mideast	454,779	345,066	544,798	546,675	549,330	634,646	677,705	735,986	872,838	1,035,794	1,223,534
South Atlantic	North America	391,338	537,203	476,446	471,935	490,000	583,525	634,611	678,184	786,567	904,965	1,031,263
South Atlantic	South America	3,390,596	3,060,587	2,677,723	2,759,693	2,794,110	3,099,502	3,396,914	3,769,843	4,926,495	6,901,953	9,967,905
South Atlantic	Caribbean	558,100	784,677	869,413	927,918	990,685	1,372,204	1,957,095	2,740,407	5,569,284	11,360,967	22,472,124
Gulf Coast	Africa	1,754,896	1,033,634	1,265,369	1,260,911	1,253,069	1,310,434	1,378,398	1,488,698	1,887,804	2,745,000	4,595,166
Gulf Coast	Asia	22,534,794	19,555,035	20,083,467	20,982,229	21,276,557	22,347,376	23,156,422	24,458,167	28,131,025	31,114,050	39,182,352
Gulf Coast	Europe	29,528,045	19,168,784	14,360,905	15,104,291	15,328,787	15,057,383	15,367,352	16,046,989	17,794,666	20,667,667	25,169,483
Gulf Coast	Mideast	2,613,897	3,491,026	2,823,074	2,976,822	3,121,045	4,164,248	4,683,426	5,236,308	6,475,586	7,867,993	9,391,467
Gulf Coast	North America	4,914,212	14,555,052	12,414,616	12,871,348	13,126,503	14,074,818	14,680,405	15,678,132	17,967,023	20,637,355	23,525,324
Gulf Coast	South America	15,729,282	14,333,617	16,908,499	17,527,707	17,898,394	20,064,945	21,878,441	23,595,774	27,825,928	34,274,512	43,885,569
Gulf Coast	Caribbean	2,838,530	4,423,930	5,808,261	6,065,273	6,270,681	6,949,632	7,496,419	8,090,060	9,714,935	12,385,447	16,886,469
South Pacific	Africa	34,159	11,778	14,069	13,371	12,934	15,857	17,342	18,851	22,244	26,130	30,969
South Pacific	Asia	28,486,063	24,641,560	23,410,196	24,316,177	24,515,495	26,160,441	27,600,996	30,178,203	38,077,504	52,442,033	79,466,983
South Pacific	Europe	1,355,579	1,029,245	730,629	739,029	727,466	779,181	810,539	849,964	954,200	1,107,602	1,342,382
South Pacific	Mideast	30,287	58,241	102,867	103,941	104,853	124,921	136,319	148,596	176,665	209,584	246,758
South Pacific	North America	1,253,197	2,096,695	495,389	499,319	502,128	481,006	460,719	465,932	477,638	491,282	504,373
South Pacific	South America	1,010,733	974,363	1,045,873	1,123,265	1,136,925	1,255,800	1,350,098	1,432,853	1,598,452	1,782,813	1,995,689
South Pacific	Caribbean	149,995	93,784	422,386	435,032	443,040	482,718	527,387	582,412	768,363	1,146,266	1,846,025
North Pacific	Africa	24,192	3,939	16,695	16,302	16,059	17,458	18,384	19,345	21,388	24,940	32,687
North Pacific	Asia	27,833,968	18,647,696	21,016,436	22,295,615	22,824,938	25,979,234	27,679,340	29,222,349	33,461,595	36,251,553	44,819,538
North Pacific	Europe	658,528	637,029	810,330	839,423	859,109	925,086	980,647	1,049,175	1,219,540	1,435,293	1,709,073
North Pacific	Mideast	10,089	10,544	13,570	13,589	13,840	15,479	16,845	18,180	20,951	24,052	27,505
North Pacific	North America	2,237,545	1,057,309	1,660,956	1,753,418	1,672,103	1,972,776	2,048,062	2,145,782	2,393,602	2,781,005	3,317,107
North Pacific	South America	962,465	463,915	885,460	940,325	957,092	1,077,819	1,183,594	1,277,244	1,454,246	1,639,254	1,845,812
North Pacific	Caribbean	41,041	39,866	439,859	444,300	446,717	461,472	472,252	479,263	488,261	495,267	502,160
Great Lakes	Africa	171,081	25,009	4,635	4,479	4,420	4,229	4,099	4,103	4,212	4,477	4,884
Great Lakes	Asia	331,452	81,003	368,856	378,181	382,078	420,862	458,372	491,377	590,543	761,288	1,072,652
Great Lakes	Europe	1,348,580	1,661,411	1,633,213	1,721,543	1,803,064	2,063,743	2,354,898	2,625,535	3,218,035	3,949,404	4,871,924
Great Lakes	Mideast	29,136	71,912	6,358	6,688	7,039	9,445	10,887	12,349	15,629	19,426	23,805
Great Lakes	North America	16,842,153	14,752,127	24,293,911	23,868,126	24,478,372	26,210,660	27,396,484	28,369,693	30,642,002	32,126,843	35,002,936
Great Lakes	South America	25,281	20,067	3,636	3,862	3,917	4,503	4,972	5,378	6,281	7,331	8,551
Great Lakes	Caribbean	39	1,069	1,173	1,223	1,277	1,533	1,947	2,522	4,559	8,711	16,707
Total		**239,523,492**	**193,836,959**	**196,960,396**	**203,603,079**	**207,041,145**	**220,962,980**	**232,489,665**	**247,774,814**	**290,419,084**	**351,599,680**	**462,404,197**
Average Annual Growth Rate			**-4.14%**	**0.53%**	**3.37%**	**1.69%**	**1.31%**	**1.02%**	**1.28%**	**1.60%**	**1.93%**	**2.78%**

U.S. Commodity by Destination (Metric Tonnes)

US Commodity Forecast For AGRICULTURE COMMODITIES
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	38,516	51,716	64,318	60,867	61,146	62,245	62,100	61,741	61,124	61,033	62,218
North Atlantic	Asia	242,608	300,866	366,963	370,194	390,024	405,389	412,643	351,366	380,851	416,764	458,008
North Atlantic	Europe	130,033	359,837	461,520	451,251	455,857	505,062	523,705	503,840	542,665	589,110	640,483
North Atlantic	Mideast	19,610	15,438	22,745	24,799	26,712	31,225	34,032	33,704	37,741	42,560	48,215
North Atlantic	North America	184,449	163,480	168,050	193,294	217,542	270,502	320,716	369,284	478,837	605,774	750,440
North Atlantic	South America	254,096	566,728	798,943	802,732	823,628	893,202	967,016	1,010,570	1,215,026	1,466,084	1,755,515
North Atlantic	Caribbean	11,474	43,782	63,065	61,474	60,524	52,819	49,122	44,187	34,823	27,333	21,882
South Atlantic	Africa	5,579	5,159	1,463	1,402	1,446	1,463	1,467	1,401	1,370	1,341	1,314
South Atlantic	Asia	117,457	80,651	93,625	93,637	93,898	85,456	80,831	69,975	70,767	74,572	79,930
South Atlantic	Europe	80,032	356,721	549,162	534,774	537,434	666,498	714,199	712,777	746,776	806,321	878,643
South Atlantic	Mideast	1,755	6,329	833	881	918	897	882	748	710	678	648
South Atlantic	North America	86,675	67,008	90,834	100,328	109,116	119,572	124,925	127,019	128,289	126,614	122,642
South Atlantic	South America	581,569	625,696	721,164	723,222	751,346	833,247	866,308	880,852	922,497	951,813	967,894
South Atlantic	Caribbean	92,784	166,280	128,066	126,918	125,619	117,829	114,788	110,780	104,154	97,276	88,681
Gulf Coast	Africa	2,227	4,427	1,596	1,632	1,665	1,725	1,746	1,682	1,786	1,948	2,164
Gulf Coast	Asia	91,338	68,256	67,746	69,064	67,440	53,870	46,560	42,256	39,727	39,549	40,191
Gulf Coast	Europe	116,123	264,133	632,247	705,241	728,226	819,310	906,546	958,956	1,093,104	1,257,984	1,373,739
Gulf Coast	Mideast	3,467	150	699	762	847	1,058	1,164	1,195	1,388	1,601	1,836
Gulf Coast	North America	102,135	125,164	39,823	36,645	32,406	17,975	10,751	6,516	2,536	1,065	545
Gulf Coast	South America	345,298	679,891	875,146	876,611	896,951	931,456	933,839	929,222	931,659	926,899	909,371
Gulf Coast	Caribbean	94,455	117,802	63,746	60,305	58,192	46,060	38,482	31,475	21,465	15,282	11,553
South Pacific	Africa	1,061	1,227	991	1,069	1,171	1,270	1,354	925	1,100	1,312	1,548
South Pacific	Asia	449,237	978,858	707,291	719,212	759,811	830,887	892,840	866,268	1,010,156	1,172,362	1,349,244
South Pacific	Europe	21,962	26,438	64,786	62,376	61,150	75,568	78,450	77,269	83,750	93,122	103,644
South Pacific	Mideast	1,093	713	1,100	1,179	1,221	1,301	1,331	1,229	1,302	1,431	1,603
South Pacific	North America	248,237	192,606	252,825	289,678	326,716	408,273	485,129	538,716	700,724	887,492	1,099,902
South Pacific	South America	300,748	231,036	284,846	290,632	299,005	309,065	326,208	331,999	368,804	415,777	472,799
South Pacific	Caribbean	25,132	161,462	319,639	344,057	355,911	286,966	276,568	246,293	177,017	113,903	65,386
North Pacific	Africa	303	119	93	88	80	51	35	24	12	6	3
North Pacific	Asia	130,898	204,215	219,056	215,872	226,920	250,730	274,983	277,106	330,290	387,945	449,984
North Pacific	Europe	277	7,517	35,636	35,577	35,615	35,869	35,861	35,474	42,255	42,398	42,597
North Pacific	Mideast	40	22	49	53	55	62	65	67	73	81	92
North Pacific	North America	407,050	1,070,168	1,617,746	1,883,038	2,140,972	2,718,917	3,253,318	3,765,604	4,903,911	6,213,694	7,702,064
North Pacific	South America	397,715	95,928	115,391	113,428	117,840	131,644	147,969	164,580	203,579	249,167	301,260
North Pacific	Caribbean	4,745	10,775	14,314	13,974	13,761	11,907	11,012	9,822	7,508	5,612	4,196
Great Lakes	Africa	0	18	23	23	24	23	22	22	21	21	21
Great Lakes	Asia	72	350	218	214	225	242	256	115	123	136	154
Great Lakes	Europe	605	141	140,556	151,731	159,302	182,502	208,043	231,398	281,259	336,106	385,517
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	1,157,221	468,493	179,366	204,405	215,215	229,608	242,457	254,405	267,706	263,878	239,021
Great Lakes	South America	0	135	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	21	22	0	0	0	0	0	0	0	0	0
Total		**5,748,100**	**7,519,753**	**9,165,680**	**9,622,639**	**10,155,929**	**11,391,749**	**12,447,723**	**13,050,863**	**15,196,885**	**17,696,040**	**20,434,943**
Average Annual Growth Rate			**5.52%**	**6.82%**	**4.99%**	**5.54%**	**2.32%**	**1.79%**	**0.95%**	**1.53%**	**1.53%**	**1.45%**

US Commodity Forecast For CAPITAL EQUIPMENT
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	15,858	41,347	63,842	72,971	83,915	141,091	179,734	219,938	319,676	447,424	603,183
North Atlantic	Asia	855,795	1,331,893	1,658,329	1,854,829	2,074,751	3,112,559	3,747,260	4,354,058	5,784,208	7,521,007	9,532,054
North Atlantic	Europe	1,304,302	1,609,850	1,814,368	2,006,790	2,245,106	3,301,998	3,886,316	4,450,116	5,685,554	7,048,741	8,491,709
North Atlantic	Mideast	14,732	22,135	35,293	36,733	39,616	59,483	71,287	82,178	108,240	140,044	176,748
North Atlantic	North America	51,580	97,644	114,854	127,557	141,643	199,194	221,597	236,539	260,903	277,073	283,853
North Atlantic	South America	344,092	452,158	605,767	677,104	693,133	898,693	1,073,710	1,238,370	1,613,717	2,029,461	2,469,714
North Atlantic	Caribbean	31	75	77	87	97	140	168	196	271	381	534
South Atlantic	Africa	9,297	12,299	35,273	39,256	44,707	70,019	83,199	95,403	122,802	153,942	188,049
South Atlantic	Asia	626,225	1,086,061	1,304,233	1,462,510	1,633,887	2,507,329	3,147,477	3,827,352	5,641,052	8,262,432	11,910,329
South Atlantic	Europe	508,284	919,807	1,011,131	1,097,015	1,220,520	1,925,381	2,433,897	2,982,894	4,345,632	6,106,690	8,274,723
South Atlantic	Mideast	7,553	16,425	15,559	16,069	17,758	28,101	34,916	41,490	57,635	78,491	104,352
South Atlantic	North America	26,376	36,803	150,479	171,317	195,033	310,528	391,536	473,625	670,693	913,864	1,199,802
South Atlantic	South America	124,263	171,168	204,608	228,659	249,281	364,555	444,843	523,986	721,153	974,224	1,286,247
South Atlantic	Caribbean	105	706	463	525	589	922	1,139	1,356	1,878	2,530	3,314
Gulf Coast	Africa	3,968	5,565	4,067	4,533	5,061	6,434	7,235	7,907	9,406	11,064	12,805
Gulf Coast	Asia	54,165	124,636	111,590	125,931	142,637	201,857	251,960	308,084	467,672	707,438	1,046,986
Gulf Coast	Europe	234,118	421,948	432,993	483,938	548,528	783,725	967,018	1,170,997	1,688,192	2,372,427	3,233,404
Gulf Coast	Mideast	4,696	3,620	5,368	5,235	5,621	8,574	10,725	12,865	18,555	26,601	37,434
Gulf Coast	North America	13,341	11,213	2,621	3,039	3,500	4,111	4,833	5,615	7,630	10,301	13,660
Gulf Coast	South America	72,642	95,287	146,938	162,250	176,993	255,177	306,730	353,339	469,740	619,733	808,768
Gulf Coast	Caribbean	42	812	1,293	1,493	1,710	2,511	3,061	3,616	5,004	6,831	9,167
South Pacific	Africa	776	2,574	5,968	6,928	8,048	13,267	16,854	20,614	29,958	41,909	56,389
South Pacific	Asia	3,705,765	5,009,692	5,874,325	6,439,701	7,082,283	10,451,108	12,772,990	15,075,607	20,623,075	27,468,965	35,408,679
South Pacific	Europe	188,750	397,750	473,912	545,907	633,186	1,097,396	1,418,062	1,761,187	2,622,123	3,740,184	5,115,667
South Pacific	Mideast	1,807	3,164	3,851	4,197	4,804	8,551	11,235	14,381	22,881	35,198	52,321
South Pacific	North America	315	35,113	6,516	7,280	8,130	10,859	11,948	12,819	14,586	16,430	18,136
South Pacific	South America	3,463	3,191	10,440	11,620	12,890	19,238	24,079	29,168	42,233	60,231	84,613
South Pacific	Caribbean	53	92	67	76	85	132	166	201	290	408	561
North Pacific	Africa	35	45	173	190	211	335	407	474	630	817	1,036
North Pacific	Asia	1,685,293	1,991,378	2,246,159	2,517,403	2,816,308	4,357,194	5,368,215	6,361,726	8,715,062	11,567,228	14,842,148
North Pacific	Europe	13,573	23,179	20,365	21,983	24,389	31,392	37,115	43,233	59,357	81,685	111,012
North Pacific	Mideast	0	36	100	99	110	172	215	256	360	496	669
North Pacific	North America	875	1,058	1,362	1,551	1,758	2,028	2,109	2,228	2,616	3,262	4,043
North Pacific	South America	394	220	440	492	537	893	1,179	1,484	2,311	3,523	5,251
North Pacific	Caribbean	0	1	5	5	6	9	12	15	23	34	49
Great Lakes	Africa	36	111	146	165	187	257	289	308	347	380	401
Great Lakes	Asia	86,156	116,902	45,141	50,895	57,350	92,328	119,048	147,183	220,253	322,217	459,580
Great Lakes	Europe	58,394	28,037	16,930	18,728	20,947	30,381	37,435	44,607	61,780	83,457	109,997
Great Lakes	Mideast	3	86	888	814	891	1,435	1,840	2,245	3,291	4,728	6,594
Great Lakes	North America	26,440	3,021	1,852	2,122	2,413	3,221	4,169	5,129	7,619	10,989	15,311
Great Lakes	South America	2,156	3,986	48	53	55	73	90	104	140	187	246
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**10,045,751**	**14,081,087**	**16,427,831**	**18,208,047**	**20,198,675**	**30,302,451**	**37,096,099**	**43,912,893**	**60,428,549**	**81,153,028**	**105,979,539**
Average Annual Growth Rate			**6.99%**	**5.27%**	**10.84%**	**10.93%**	**8.45%**	**4.13%**	**3.43%**	**3.24%**	**2.99%**	**2.71%**

US Commodity Forecast For CHEMICALS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	16,903	51,152	59,752	60,575	64,800	75,119	87,998	97,547	122,625	156,455	201,840
North Atlantic	Asia	780,320	631,270	779,163	790,224	840,944	1,011,585	1,110,546	1,180,433	1,384,327	1,707,470	2,174,435
North Atlantic	Europe	1,985,095	2,158,581	2,104,335	2,080,047	2,169,180	2,585,104	2,640,366	2,585,183	2,720,788	3,088,085	3,577,085
North Atlantic	Mideast	116,298	153,288	178,453	186,867	198,605	233,241	263,741	291,335	352,809	424,049	507,126
North Atlantic	North America	259,950	189,121	164,186	158,524	163,664	154,615	146,756	131,952	107,973	88,815	72,452
North Atlantic	South America	449,903	1,025,559	1,141,387	1,151,433	1,227,052	1,346,863	1,455,209	1,475,390	1,527,142	1,588,728	1,658,464
North Atlantic	Caribbean	259	782	875	911	984	1,123	1,190	1,197	1,219	1,248	1,283
South Atlantic	Africa	25,135	69,457	31,003	32,193	35,166	41,325	47,497	51,166	58,893	67,048	75,587
South Atlantic	Asia	551,009	503,394	1,053,856	1,016,130	1,035,588	1,194,046	1,299,723	1,343,081	1,437,631	1,554,889	1,700,671
South Atlantic	Europe	1,807,382	1,727,901	2,149,439	2,070,158	2,112,268	2,461,185	2,571,138	2,552,082	2,628,713	2,872,993	3,257,414
South Atlantic	Mideast	67,397	40,263	47,789	49,566	52,738	60,876	67,578	72,132	82,924	96,717	113,773
South Atlantic	North America	912,854	375,985	104,213	101,196	104,184	107,410	107,214	100,453	88,605	79,265	72,768
South Atlantic	South America	320,457	420,278	590,282	562,337	572,140	614,649	645,124	647,116	664,316	703,593	761,759
South Atlantic	Caribbean	150	9,266	3,205	3,645	4,219	5,959	7,217	8,569	12,091	17,031	23,765
Gulf Coast	Africa	24,470	139,981	168,105	171,059	184,939	219,154	250,187	266,293	296,218	321,953	343,062
Gulf Coast	Asia	632,952	1,341,237	1,069,673	1,062,769	1,130,352	1,331,483	1,428,343	1,461,832	1,551,661	1,731,233	2,018,501
Gulf Coast	Europe	2,762,748	3,186,131	4,556,322	4,424,971	4,555,630	4,855,048	4,784,239	4,487,908	4,105,113	4,145,283	4,478,815
Gulf Coast	Mideast	42,162	68,350	60,243	62,548	64,885	73,388	80,552	89,481	108,897	130,558	155,265
Gulf Coast	North America	1,663,129	719,117	401,974	392,086	406,667	388,489	365,280	321,278	248,535	193,778	153,996
Gulf Coast	South America	493,705	1,980,741	2,169,444	2,149,475	2,269,480	2,429,503	2,557,707	2,520,936	2,434,272	2,344,802	2,253,670
Gulf Coast	Caribbean	2,653	10,013	7,044	7,470	8,183	9,939	11,377	12,719	16,437	21,865	29,373
South Pacific	Africa	179	184	366	364	373	424	468	504	588	688	807
South Pacific	Asia	978,304	2,298,855	2,398,841	2,414,433	2,534,094	3,021,932	3,411,950	3,706,955	4,496,679	5,653,022	7,195,031
South Pacific	Europe	271,369	406,170	403,265	380,816	373,334	329,089	284,073	242,628	203,999	202,990	221,785
South Pacific	Mideast	9,747	14,930	23,833	23,754	24,570	28,643	32,360	36,779	50,077	70,209	98,545
South Pacific	North America	1,040,040	1,072,328	600,181	577,193	593,258	600,719	585,380	531,068	429,584	339,889	263,618
South Pacific	South America	226,179	349,622	215,272	209,922	217,573	218,590	215,555	200,210	176,637	163,024	158,648
South Pacific	Caribbean	316	769	2,094	2,235	2,481	3,024	3,386	3,751	4,855	6,555	8,970
North Pacific	Africa	305	49	49	54	62	86	103	120	162	215	280
North Pacific	Asia	2,619,183	2,555,072	902,838	877,116	897,409	1,006,471	1,072,197	1,105,550	1,226,472	1,437,797	1,731,843
North Pacific	Europe	18,204	13,986	28,263	25,864	25,673	22,321	19,059	16,019	12,367	10,891	10,600
North Pacific	Mideast	47	442	3,279	3,583	3,875	5,578	7,009	8,535	12,455	17,940	25,562
North Pacific	North America	40,927	61,812	90,609	85,861	86,628	87,675	85,907	80,352	71,376	62,416	47,614
North Pacific	South America	623	3,797	4,857	4,817	4,830	3,998	3,130	2,193	2,460	2,518	2,592
North Pacific	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Africa	19	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	921	3,480	3,355	3,447	3,696	5,029	5,871	6,678	8,827	11,952	15,976
Great Lakes	Europe	48,739	29,664	19,627	19,405	20,276	26,990	27,620	26,382	27,495	32,554	40,601
Great Lakes	Mideast	60	1,084	196	212	230	307	386	474	704	1,037	1,522
Great Lakes	North America	565,204	405,503	314,540	283,220	275,218	217,835	171,889	131,954	80,801	61,204	51,879
Great Lakes	South America	36	0	10	10	11	12	13	13	13	13	13
Great Lakes	Caribbean	0	18	0	0	0	0	0	0	0	0	0
Total		**18,735,331**	**22,019,630**	**21,852,218**	**21,446,493**	**22,265,258**	**24,778,827**	**25,855,340**	**25,798,251**	**26,756,737**	**29,410,771**	**33,506,990**
Average Annual Growth Rate			**3.28%**	**-0.25%**	**-1.86%**	**3.82%**	**2.16%**	**0.85%**	**-0.04%**	**0.37%**	**0.95%**	**1.31%**

US Commodity Forecast For CONSUMER GOODS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	10,015	22,400	66,709	70,145	74,780	95,528	108,088	118,650	139,438	158,883	176,232
North Atlantic	Asia	585,501	1,060,939	1,917,686	2,015,867	2,199,872	3,159,305	3,714,799	4,322,121	5,796,260	7,627,561	9,802,869
North Atlantic	Europe	329,440	554,404	605,276	659,481	717,708	902,360	1,052,898	1,196,218	1,561,318	2,058,846	2,685,105
North Atlantic	Mideast	50,846	75,006	103,371	117,245	132,560	146,987	164,412	186,545	238,629	297,204	356,374
North Atlantic	North America	369	7,972	11,134	12,854	12,721	20,625	26,468	33,089	50,491	74,596	106,433
North Atlantic	South America	50,205	68,890	118,911	131,985	131,959	200,121	228,664	275,347	396,276	558,739	766,711
North Atlantic	Caribbean	672	10,575	14,928	15,120	15,523	16,635	17,193	17,737	19,192	20,683	22,243
South Atlantic	Africa	4,838	13,930	22,948	24,651	26,831	38,019	47,469	57,521	82,236	113,554	151,491
South Atlantic	Asia	341,000	800,253	1,417,207	1,538,103	1,728,195	2,782,629	3,560,933	4,488,046	7,021,996	10,720,842	15,896,412
South Atlantic	Europe	84,286	163,882	191,026	204,594	219,809	262,465	298,471	324,730	389,653	488,893	629,136
South Atlantic	Mideast	15,165	24,899	32,828	37,535	42,264	52,141	62,964	76,121	110,436	156,750	215,996
South Atlantic	North America	1,596	5,709	4,804	5,269	5,780	8,012	9,723	11,509	15,795	21,134	27,602
South Atlantic	South America	91,524	152,203	174,502	183,193	189,609	247,254	281,456	322,624	423,831	549,258	699,092
South Atlantic	Caribbean	126,588	377,422	382,873	393,220	411,603	488,245	562,999	641,495	834,406	1,059,572	1,312,505
Gulf Coast	Africa	805	1,605	2,576	2,822	3,035	4,327	5,219	6,141	8,335	10,994	14,082
Gulf Coast	Asia	4,505	8,617	54,021	57,374	64,534	101,983	127,361	157,355	238,076	353,715	513,161
Gulf Coast	Europe	38,119	80,804	88,776	96,604	105,474	137,123	161,708	182,861	233,414	305,219	402,430
Gulf Coast	Mideast	1,180	2,100	4,629	5,274	5,878	7,786	9,647	11,762	17,195	24,483	33,844
Gulf Coast	North America	1,975	57,239	75,990	79,932	85,723	112,647	132,953	152,461	196,513	247,110	303,418
Gulf Coast	South America	12,993	13,792	26,072	28,407	28,256	39,871	43,258	48,739	61,519	76,420	93,109
Gulf Coast	Caribbean	21,600	133,227	204,681	210,126	220,106	261,105	301,534	343,393	445,572	564,013	696,229
South Pacific	Africa	1,787	4,362	11,897	12,714	13,845	19,587	24,687	30,162	43,726	60,991	81,918
South Pacific	Asia	3,641,668	6,841,930	9,174,763	9,605,778	10,470,547	14,854,800	17,264,141	19,913,083	26,225,937	33,810,120	42,476,450
South Pacific	Europe	66,192	127,843	182,528	194,456	211,437	274,181	327,012	375,602	504,768	695,177	953,094
South Pacific	Mideast	3,312	9,056	12,766	14,531	16,523	25,482	27,362	32,732	45,776	61,741	76,205
South Pacific	North America	233	3,815	9,643	11,202	10,925	18,179	23,670	29,982	46,727	70,092	101,101
South Pacific	South America	5,923	8,014	15,455	16,788	17,422	23,243	25,947	29,535	38,291	49,185	62,204
South Pacific	Caribbean	10,773	13,878	59,864	61,488	64,423	76,467	88,281	100,573	130,656	165,645	204,829
North Pacific	Africa	57	105	664	718	777	1,106	1,377	1,663	2,361	3,232	4,271
North Pacific	Asia	943,734	1,314,139	1,534,556	1,606,742	1,751,092	2,481,495	2,882,500	3,325,198	4,382,929	5,654,818	7,106,183
North Pacific	Europe	1,748	6,023	13,961	14,869	16,021	21,708	26,371	31,052	41,932	54,874	69,619
North Pacific	Mideast	11	23	716	816	872	1,273	1,575	1,927	2,815	3,977	5,410
North Pacific	North America	82	172	1,097	1,158	1,241	1,632	1,929	2,220	2,890	3,677	4,574
North Pacific	South America	350	5,659	4,086	4,704	5,047	7,765	9,556	11,501	16,337	22,615	30,448
North Pacific	Caribbean	56	22	46	52	55	70	79	94	133	184	247
Great Lakes	Africa	3	0	280	298	321	429	501	569	716	876	1,045
Great Lakes	Asia	4,053	8,470	17,027	18,711	21,447	34,999	48,584	66,176	118,048	204,136	341,969
Great Lakes	Europe	4,252	4,603	3,752	4,093	4,246	5,343	6,055	6,678	8,063	9,694	11,519
Great Lakes	Mideast	20	360	21	25	29	30	38	49	79	126	195
Great Lakes	North America	56	7,996	759	705	654	526	417	378	427	578	803
Great Lakes	South America	1	0	4	4	3	3	2	2	1	1	0
Great Lakes	Caribbean	0	0	3	3	3	3	3	3	3	3	3
Total		**6,457,535**	**11,992,336**	**16,564,837**	**17,459,653**	**19,029,150**	**26,933,489**	**31,678,307**	**36,933,646**	**49,893,197**	**66,360,210**	**86,436,562**
Average Annual Growth Rate			**13.18%**	**11.37%**	**5.40%**	**8.99%**	**7.20%**	**3.30%**	**3.12%**	**3.05%**	**2.89%**	**2.68%**

US Commodity Forecast For EXTRACTIVE COMMODITIES
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	8,719,816	8,827,098	11,545,488	13,520,923	14,909,958	19,932,877	21,829,984	23,068,001	25,939,661	29,241,591	32,942,639
North Atlantic	Asia	2,374,497	860,198	2,160,438	2,116,148	2,213,285	2,180,751	2,127,594	2,073,400	2,037,910	2,092,915	2,230,012
North Atlantic	Europe	551,974	1,383,592	2,440,124	2,549,924	2,676,260	3,099,234	3,165,558	3,233,855	3,621,956	4,279,035	5,180,922
North Atlantic	Mideast	52,488	68,478	42,724	41,878	45,720	49,647	51,572	51,908	53,591	56,252	59,751
North Atlantic	North America	9,947,409	15,997,174	16,886,101	18,716,034	19,584,850	23,561,476	26,203,138	28,483,555	34,219,007	41,592,118	50,763,431
North Atlantic	South America	15,581,320	15,279,966	18,375,113	19,105,458	19,900,026	21,470,388	21,595,667	21,199,515	20,652,145	20,344,566	20,223,838
North Atlantic	Caribbean	21	156	0	0	0	0	0	0	0	0	0
South Atlantic	Africa	113,696	203,384	166,107	170,908	187,508	229,766	249,537	262,164	292,440	328,347	369,609
South Atlantic	Asia	32,911	77,036	73,561	79,002	87,136	110,000	111,109	108,822	105,047	101,798	99,061
South Atlantic	Europe	383,478	1,055,159	1,113,453	1,080,303	1,089,614	1,136,136	1,051,992	988,332	932,623	931,509	964,237
South Atlantic	Mideast	167,535	151,396	53,701	61,624	71,034	73,163	78,583	81,565	88,892	97,651	107,724
South Atlantic	North America	4,605,812	5,641,583	7,184,349	7,286,056	6,830,167	6,731,769	6,547,375	6,322,979	5,885,893	5,462,275	5,053,911
South Atlantic	South America	3,022,743	3,495,940	4,763,605	4,789,088	5,057,859	5,028,583	5,021,212	4,987,305	4,985,633	5,068,661	5,248,512
South Atlantic	Caribbean	5,417	11,042	10,616	11,447	11,623	10,824	9,980	9,249	7,847	6,564	5,417
Gulf Coast	Africa	7,014,515	6,820,674	6,563,675	7,457,535	8,047,364	9,512,488	9,262,681	8,709,724	7,778,001	6,996,481	6,326,580
Gulf Coast	Asia	3,045,621	4,506,369	4,254,407	4,288,722	4,470,843	4,982,637	5,012,000	4,957,128	4,918,179	4,912,070	4,961,764
Gulf Coast	Europe	1,285,523	1,890,891	7,040,489	7,837,309	8,327,364	9,483,005	9,769,896	9,767,252	9,886,997	10,056,568	10,202,803
Gulf Coast	Mideast	54,175	57,848	54,610	62,021	65,951	71,245	74,140	76,323	82,051	89,203	97,627
Gulf Coast	North America	53,258,114	70,502,250	85,163,944	96,140,189	102,160,088	118,931,564	125,967,652	129,199,495	137,846,862	148,730,873	161,595,131
Gulf Coast	South America	71,872,198	79,002,849	77,308,880	85,458,278	91,312,861	103,888,709	107,886,443	108,499,982	110,456,139	112,676,106	114,796,510
Gulf Coast	Caribbean	445,043	1,087,378	1,252,006	1,421,506	1,518,163	1,775,559	1,884,936	1,936,143	2,073,197	2,245,926	2,450,305
South Pacific	Africa	26,207	13,817	1,016,806	1,192,862	1,316,188	1,763,191	1,932,115	2,042,510	2,298,386	2,592,452	2,921,971
South Pacific	Asia	1,198,753	2,581,330	1,708,281	1,934,061	2,070,449	2,477,380	2,629,453	2,725,304	3,027,174	3,401,930	3,844,378
South Pacific	Europe	13,322	115,689	106,460	103,958	101,755	104,880	100,346	94,752	87,707	84,081	82,376
South Pacific	Mideast	283	6,679	6,028	6,830	7,676	8,130	8,822	9,241	10,261	11,494	12,886
South Pacific	North America	1,450,680	4,164,402	6,267,693	6,786,882	6,860,639	7,831,288	8,450,723	8,937,154	10,081,409	11,441,397	13,028,466
South Pacific	South America	3,707,459	6,194,350	7,825,405	8,906,619	9,546,465	11,458,314	12,396,816	12,958,445	14,289,125	15,839,498	17,591,419
South Pacific	Caribbean	1,092	2,771	4,154	4,597	4,788	5,056	5,283	5,550	6,047	6,496	6,873
North Pacific	Africa	36	682	21	20	23	25	24	23	19	16	15
North Pacific	Asia	397,862	607,311	165,930	185,011	193,970	223,638	230,551	232,964	248,330	268,385	292,624
North Pacific	Europe	52,840	8	40,864	40,850	40,840	40,873	40,861	40,845	40,817	40,793	40,771
North Pacific	Mideast	0	0	21	22	22	27	31	34	41	49	58
North Pacific	North America	4,308,508	4,501,314	3,837,396	3,976,170	3,823,591	4,162,095	4,511,354	4,875,546	5,721,704	6,740,397	7,955,238
North Pacific	South America	274,174	1,323,861	1,819,093	2,071,299	2,218,308	2,627,666	2,819,894	2,923,180	3,174,537	3,470,980	3,807,134
North Pacific	Caribbean	0	20	0	0	0	0	0	0	0	0	0
Great Lakes	Africa	138,194	122,249	129,521	129,521	129,521	129,521	129,521	129,521	129,521	129,521	129,521
Great Lakes	Asia	130,634	335,225	98,819	103,411	112,352	147,481	159,649	168,582	190,280	216,213	246,683
Great Lakes	Europe	60,371	104,148	63,073	58,804	62,925	72,248	68,648	63,228	54,439	47,251	41,253
Great Lakes	Mideast	0	5,588	0	0	0	0	0	0	0	0	0
Great Lakes	North America	8,738,391	11,627,750	13,876,322	14,589,360	14,706,136	16,095,668	16,377,549	16,379,601	16,531,247	16,845,009	17,314,061
Great Lakes	South America	1,013,064	483,585	712,511	688,402	775,809	972,550	1,032,691	1,060,902	1,136,329	1,231,321	1,343,664
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**204,046,176**	**249,111,241**	**284,131,790**	**312,973,036**	**330,539,131**	**380,379,852**	**398,795,381**	**406,664,080**	**428,891,448**	**457,677,794**	**492,339,174**
Average Annual Growth Rate			**4.07%**	**4.48%**	**10.15%**	**5.61%**	**2.85%**	**0.95%**	**0.39%**	**0.53%**	**0.65%**	**0.73%**

US Commodity Forecast For FOOD
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	92,959	211,980	147,726	161,094	179,195	245,963	269,365	291,077	334,369	377,430	420,159
North Atlantic	Asia	1,189,953	1,561,971	2,205,338	2,161,040	2,305,051	2,805,875	2,974,542	3,151,073	3,509,849	3,885,261	4,270,013
North Atlantic	Europe	1,862,472	2,638,430	2,922,352	3,124,204	3,417,543	3,695,908	3,759,208	3,818,355	3,912,304	3,938,888	3,897,763
North Atlantic	Mideast	173,959	118,030	147,473	164,311	185,475	220,197	239,143	255,713	288,396	319,704	348,642
North Atlantic	North America	74,462	36,092	23,041	23,993	25,699	33,756	37,030	40,593	48,463	57,348	67,457
North Atlantic	South America	1,040,660	978,494	1,120,988	1,181,237	1,223,187	1,466,317	1,540,747	1,616,439	1,767,228	1,906,263	2,039,914
North Atlantic	Caribbean	129,697	275,940	209,410	211,215	219,978	283,146	320,271	356,647	431,772	508,488	586,986
South Atlantic	Africa	27,737	12,385	27,750	31,857	36,997	50,627	56,660	62,812	75,765	89,377	103,253
South Atlantic	Asia	264,998	309,041	490,689	491,394	507,388	567,315	586,034	610,373	660,889	719,815	791,793
South Atlantic	Europe	398,638	727,655	735,015	802,898	897,271	1,007,391	1,095,521	1,197,227	1,423,675	1,659,578	1,895,320
South Atlantic	Mideast	13,290	16,368	20,154	22,567	25,821	38,928	42,994	47,067	56,453	67,131	78,747
South Atlantic	North America	25,899	32,157	20,219	19,755	20,185	24,460	26,913	29,520	34,658	39,497	44,405
South Atlantic	South America	344,773	449,490	779,184	810,049	841,629	1,015,152	1,070,175	1,121,629	1,213,825	1,286,437	1,347,398
South Atlantic	Caribbean	50,415	102,374	177,483	176,102	182,643	199,979	197,024	192,993	181,251	164,804	147,468
Gulf Coast	Africa	38,544	37,251	14,238	16,726	19,646	26,635	30,542	34,592	43,086	51,947	60,919
Gulf Coast	Asia	391,094	332,100	515,448	538,009	546,822	607,176	620,484	640,538	680,776	729,728	786,696
Gulf Coast	Europe	239,664	317,037	526,204	574,844	641,696	695,242	747,197	807,815	937,162	1,062,418	1,173,661
Gulf Coast	Mideast	9,947	2,696	12,645	14,129	15,643	17,780	18,455	18,918	19,832	20,944	22,402
Gulf Coast	North America	121,297	100,988	288,157	284,700	293,267	380,300	412,196	439,973	488,264	527,267	557,252
Gulf Coast	South America	322,218	215,433	301,899	319,169	342,453	426,126	461,354	493,229	554,733	613,827	670,528
Gulf Coast	Caribbean	318,856	173,819	235,719	232,387	237,923	275,972	278,665	276,113	263,760	244,954	222,749
South Pacific	Africa	1,182	3,311	4,269	4,917	5,714	7,790	8,697	9,598	11,446	13,338	15,234
South Pacific	Asia	1,520,765	2,322,274	2,657,934	2,625,648	2,776,645	3,249,539	3,431,344	3,629,176	4,052,878	4,514,406	4,998,806
South Pacific	Europe	450,360	697,124	736,240	804,540	896,276	1,006,562	1,089,156	1,179,689	1,373,552	1,565,327	1,740,933
South Pacific	Mideast	3,580	6,596	11,792	13,358	15,276	17,888	21,147	24,555	32,545	42,341	54,144
South Pacific	North America	15,793	61,719	28,266	26,960	26,714	28,792	28,488	27,987	26,308	23,973	21,289
South Pacific	South America	97,362	279,539	411,468	430,259	461,055	559,575	621,730	684,783	818,314	961,049	1,111,124
South Pacific	Caribbean	125,069	106,717	294,265	299,369	315,509	409,505	466,316	521,598	635,551	753,055	872,298
North Pacific	Africa	167	121	294	347	410	555	644	738	937	1,145	1,356
North Pacific	Asia	272,536	219,250	257,143	249,527	269,677	327,503	352,933	378,891	432,835	489,432	547,849
North Pacific	Europe	26,938	36,348	46,719	49,765	55,980	66,937	72,572	78,984	92,671	107,892	124,063
North Pacific	Mideast	9	208	502	540	601	679	801	923	1,212	1,570	2,010
North Pacific	North America	11,978	3,885	11,228	11,814	13,321	16,736	17,298	17,970	18,924	19,409	19,489
North Pacific	South America	49,288	56,527	23,120	24,529	26,350	29,001	30,996	33,312	38,046	42,731	47,311
North Pacific	Caribbean	26,734	21,482	7,766	8,738	9,888	11,893	13,433	14,980	18,071	21,121	24,077
Great Lakes	Africa	44	154	43	46	49	72	76	87	107	136	169
Great Lakes	Asia	272	300	521	511	545	645	737	838	1,094	1,441	1,906
Great Lakes	Europe	6,680	4,438	4,214	4,353	4,598	5,260	5,668	6,089	7,115	8,438	10,086
Great Lakes	Mideast	15	189	70	79	91	111	134	159	219	292	380
Great Lakes	North America	21,123	3,304	2,306	2,508	2,815	3,445	3,861	4,266	5,102	5,970	6,855
Great Lakes	South America	62	80	41	37	33	30	28	25	21	18	16
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**9,761,487**	**12,473,295**	**15,419,333**	**15,919,524**	**17,047,059**	**19,826,761**	**20,950,577**	**22,117,346**	**24,493,457**	**26,844,189**	**29,132,918**
Average Annual Growth Rate			**5.03%**	**7.32%**	**3.24%**	**7.08%**	**3.07%**	**1.11%**	**1.09%**	**1.03%**	**0.92%**	**0.82%**

US Commodity Forecast For FUELS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	602,545	122,844	56,269	63,896	67,000	75,799	83,689	90,162	104,812	124,383	153,926
North Atlantic	Asia	966,418	654,622	607,680	699,660	744,153	902,924	1,055,166	1,204,899	1,558,721	2,004,722	2,560,268
North Atlantic	Europe	3,475,074	10,805,138	16,689,691	18,739,982	19,555,461	22,796,456	26,309,227	29,991,496	39,718,192	52,816,520	69,556,232
North Atlantic	Mideast	49,219	74,285	292,013	336,560	358,172	431,805	492,501	544,490	645,098	741,592	831,943
North Atlantic	North America	6,941,295	7,772,683	13,265,700	15,027,987	15,720,640	17,558,781	19,116,230	20,276,648	22,731,057	25,804,197	30,253,780
North Atlantic	South America	9,053,769	12,317,973	8,834,668	10,180,181	10,831,453	13,093,420	15,165,754	17,050,338	21,099,906	25,780,572	31,618,706
North Atlantic	Caribbean	0	0	0	0	0	0	0	0	0	0	0
South Atlantic	Africa	9	36,821	0	0	0	0	0	0	0	0	0
South Atlantic	Asia	3,005	106,936	115,308	133,675	143,112	178,158	210,594	242,161	313,545	398,652	499,289
South Atlantic	Europe	440,812	1,345,240	2,115,500	2,407,430	2,535,398	2,972,294	3,348,585	3,669,275	4,355,655	5,128,781	6,037,013
South Atlantic	Mideast	15	266	28,140	32,246	34,122	39,955	44,249	47,488	52,960	57,214	60,192
South Atlantic	North America	128,074	113,839	384,454	446,663	479,198	607,239	750,031	902,561	1,302,229	1,902,481	2,870,447
South Atlantic	South America	2,754,225	3,783,086	5,172,531	5,947,389	6,316,669	7,604,549	8,807,213	9,957,729	12,600,480	15,817,648	19,694,459
South Atlantic	Caribbean	0	0	24	27	29	31	33	34	36	39	43
Gulf Coast	Africa	9	336,269	598,765	680,226	713,633	809,253	895,361	966,687	1,128,383	1,343,460	1,664,899
Gulf Coast	Asia	2,576,714	1,402,845	729,351	832,339	877,379	1,017,725	1,139,220	1,246,146	1,485,468	1,776,810	2,136,767
Gulf Coast	Europe	2,263,081	9,301,031	9,999,387	11,106,465	11,409,974	12,393,943	13,279,373	13,896,156	15,477,459	17,452,869	19,875,100
Gulf Coast	Mideast	0	324,646	213,516	251,861	274,311	371,061	474,313	586,944	867,420	1,235,310	1,702,579
Gulf Coast	North America	1,236,190	2,677,591	3,449,782	3,938,710	4,152,470	4,821,426	5,456,621	6,018,787	7,314,520	9,051,650	11,662,994
Gulf Coast	South America	4,474,175	4,556,511	4,760,409	5,432,031	5,726,188	6,666,498	7,542,744	8,366,793	10,348,524	12,940,606	16,305,919
Gulf Coast	Caribbean	232	3,496	536	605	631	690	734	760	806	860	942
South Pacific	Africa	1	9,652	0	0	0	0	0	0	0	0	0
South Pacific	Asia	684,634	3,548,969	1,498,733	1,741,346	1,868,320	2,356,655	2,847,015	3,341,170	4,507,448	5,986,721	7,897,967
South Pacific	Europe	138,273	641,375	276,830	308,133	314,236	340,463	375,425	411,359	517,903	668,039	863,453
South Pacific	Mideast	0	34,167	0	0	0	0	0	0	0	0	0
South Pacific	North America	335,183	333,556	1,249,392	1,411,314	1,472,758	1,635,631	1,791,076	1,933,901	2,329,243	2,972,069	4,069,395
South Pacific	South America	1,283,650	2,084,240	1,037,151	1,192,953	1,266,948	1,517,578	1,743,939	1,944,945	2,371,907	2,869,033	3,514,225
South Pacific	Caribbean	0	0	0	0	0	0	0	0	0	0	0
North Pacific	Africa	0	0	0	0	0	0	0	0	0	0	0
North Pacific	Asia	178,127	169,778	405,028	471,038	505,884	639,605	767,421	895,144	1,190,023	1,548,734	1,979,194
North Pacific	Europe	3	10	62	72	76	90	101	110	127	141	152
North Pacific	Mideast	157,436	627,895	472,816	547,373	585,241	730,485	891,256	1,061,937	1,510,385	2,186,545	3,280,139
North Pacific	North America	0	0	0	0	0	0	0	0	0	0	0
North Pacific	South America	47,059	72,840	96,004	110,586	117,618	142,278	166,444	189,234	241,612	309,317	405,980
North Pacific	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	26	4	86	98	104	118	128	134	143	148	150
Great Lakes	Europe	143	293	128	136	130	107	94	83	74	71	71
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	96,962	264,664	378,354	428,694	448,533	501,406	546,306	579,882	650,877	739,619	867,862
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**37,886,356**	**63,523,567**	**72,728,311**	**82,469,678**	**86,519,837**	**100,206,422**	**113,300,844**	**125,417,453**	**154,425,014**	**191,658,804**	**240,364,087**
Average Annual Growth Rate			**10.89%**	**4.61%**	**13.39%**	**4.91%**	**2.98%**	**2.49%**	**2.05%**	**2.10%**	**2.18%**	**2.29%**

US Commodity Forecast For HI-TECH PRODUCTS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	20	107	507	581	666	1,078	1,370	1,697	2,500	3,550	4,895
North Atlantic	Asia	75,794	133,689	173,579	181,701	202,192	331,083	463,544	622,930	1,082,758	1,810,450	2,915,688
North Atlantic	Europe	57,898	41,750	67,566	71,451	78,991	116,141	140,543	165,374	222,805	292,550	376,494
North Atlantic	Mideast	1,315	2,742	2,458	2,756	3,098	4,773	5,791	6,874	9,436	12,647	16,628
North Atlantic	North America	22	291	404	455	499	784	1,108	1,490	2,575	4,276	6,935
North Atlantic	South America	1,833	3,851	2,544	2,899	3,281	5,553	7,410	9,557	15,422	24,117	36,584
North Atlantic	Caribbean	1	0	1	1	1	1	1	2	3	4	5
South Atlantic	Africa	124	15	66	73	82	117	133	149	183	223	272
South Atlantic	Asia	76,133	134,293	189,844	197,241	214,470	333,312	447,498	578,107	937,859	1,475,081	2,249,690
South Atlantic	Europe	14,621	26,772	23,639	24,749	27,720	45,236	60,247	77,549	124,129	191,391	285,294
South Atlantic	Mideast	165	1,099	579	641	709	1,077	1,357	1,677	2,509	3,674	5,263
South Atlantic	North America	144	834	697	779	864	1,266	1,726	2,245	3,630	5,551	8,093
South Atlantic	South America	3,189	4,417	12,114	13,414	15,268	23,443	29,807	36,559	53,450	75,715	104,303
South Atlantic	Caribbean	24	15	33	37	41	59	67	76	91	107	122
Gulf Coast	Africa	7	66	0	0	0	0	0	0	0	1	1
Gulf Coast	Asia	1,132	3,752	6,727	6,978	7,877	13,237	18,821	25,169	42,153	66,563	100,510
Gulf Coast	Europe	4,762	9,796	8,401	8,690	9,538	14,853	18,955	23,594	35,694	52,440	74,948
Gulf Coast	Mideast	199	583	493	533	578	794	921	1,031	1,266	1,512	1,758
Gulf Coast	North America	2	825	70	78	88	128	163	202	303	447	646
Gulf Coast	South America	169	1,165	1,029	1,148	1,300	2,051	2,703	3,436	5,371	8,092	11,786
Gulf Coast	Caribbean	4	0	164	181	207	311	385	462	648	886	1,184
South Pacific	Africa	25	2	9	10	11	18	21	24	29	35	40
South Pacific	Asia	1,566,598	2,779,869	2,990,764	3,159,696	3,440,372	5,378,913	7,107,179	8,968,260	13,462,112	18,984,373	25,332,878
South Pacific	Europe	6,173	7,810	8,325	8,405	9,189	14,235	18,288	22,693	34,105	49,860	71,004
South Pacific	Mideast	57	54	190	207	228	326	386	443	570	715	879
South Pacific	North America	107	894	1,202	1,387	1,574	2,648	3,965	5,597	10,291	17,570	28,284
South Pacific	South America	86	221	3,464	4,054	4,743	8,058	12,686	18,588	36,029	63,849	105,704
South Pacific	Caribbean	2	7	4	5	6	12	17	23	41	69	110
North Pacific	Africa	0	0	0	0	0	0	0	0	0	0	0
North Pacific	Asia	252,016	357,089	290,187	305,075	332,513	509,482	674,566	849,570	1,267,615	1,776,116	2,357,942
North Pacific	Europe	175	385	110	120	126	187	239	291	430	624	887
North Pacific	Mideast	0	0	20	21	23	31	36	40	49	58	67
North Pacific	North America	10	20	9	10	11	17	24	31	52	83	128
North Pacific	South America	5	8	0	0	0	0	0	0	1	1	2
North Pacific	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	8,543	3,806	2,610	2,701	3,041	5,007	7,361	10,337	19,417	34,597	58,605
Great Lakes	Europe	1,325	992	787	801	885	1,307	1,656	2,039	3,078	4,582	6,703
Great Lakes	Mideast	0	1	0	0	0	0	0	0	0	0	0
Great Lakes	North America	2	30	23	26	29	50	77	110	211	374	622
Great Lakes	South America	0	0	2	2	2	4	6	9	17	29	46
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**2,072,684**	**3,517,251**	**3,788,620**	**3,996,906**	**4,360,222**	**6,815,592**	**9,029,058**	**11,436,233**	**17,376,832**	**24,962,211**	**34,164,998**
Average Annual Growth Rate			**11.16%**	**2.51%**	**5.50%**	**9.09%**	**9.35%**	**5.79%**	**4.84%**	**4.27%**	**3.69%**	**3.19%**

US Commodity Forecast For INTERMEDIATE MANUFACTURED PRODUCTS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	199,169	261,754	237,220	259,667	267,395	208,535	173,102	148,005	128,029	119,637	118,056
North Atlantic	Asia	1,005,659	2,541,699	2,009,207	2,123,838	2,333,659	3,221,687	3,930,236	4,612,456	6,318,394	8,560,432	11,440,307
North Atlantic	Europe	4,061,639	6,416,149	3,491,875	3,863,125	4,341,013	6,066,265	7,511,805	8,936,035	12,445,279	16,977,345	22,830,128
North Atlantic	Mideast	97,058	555,137	595,422	675,683	765,225	978,092	1,128,164	1,278,823	1,665,182	2,216,701	2,999,609
North Atlantic	North America	71,633	120,594	125,786	142,355	160,378	207,295	249,484	288,687	379,961	493,020	631,773
North Atlantic	South America	672,537	3,232,193	2,893,714	3,220,016	3,644,217	5,149,763	6,836,068	8,670,528	13,746,113	21,466,865	32,952,024
North Atlantic	Caribbean	239	3,288	1,628	1,849	2,090	2,648	3,025	3,337	4,021	4,792	5,623
South Atlantic	Africa	49,394	112,430	99,277	111,322	118,453	111,223	108,435	108,056	120,234	137,888	157,191
South Atlantic	Asia	690,735	2,793,812	1,520,772	1,651,010	1,848,856	2,787,391	3,778,184	4,921,148	8,291,515	13,801,940	22,540,166
South Atlantic	Europe	2,445,142	4,316,806	4,222,685	4,525,842	4,940,527	6,789,821	7,794,122	8,761,505	11,421,797	15,244,508	20,482,316
South Atlantic	Mideast	99,471	432,104	887,420	1,010,729	1,150,836	1,450,903	1,636,377	1,801,987	2,170,372	2,593,253	3,060,252
South Atlantic	North America	11,008	65,203	34,917	39,073	43,836	56,304	65,603	74,502	95,562	122,773	157,627
South Atlantic	South America	2,065,184	3,461,586	4,699,182	5,278,139	5,974,972	8,132,617	9,836,410	11,449,746	15,226,804	19,815,828	25,321,418
South Atlantic	Caribbean	15,176	18,793	18,610	21,456	24,719	35,753	47,235	59,684	92,809	140,735	208,187
Gulf Coast	Africa	537,335	1,014,293	736,794	839,996	884,859	705,056	583,262	479,678	389,338	387,804	447,184
Gulf Coast	Asia	1,756,034	8,300,799	4,040,095	4,629,249	5,366,351	8,363,122	10,542,757	12,845,795	18,806,354	27,141,823	38,596,776
Gulf Coast	Europe	6,754,057	8,261,170	3,750,737	4,094,900	4,543,478	6,685,853	8,588,670	10,384,595	14,876,746	20,920,144	28,973,780
Gulf Coast	Mideast	567,653	1,321,404	904,784	1,025,962	1,163,132	1,500,903	1,905,431	2,283,921	3,194,018	4,325,207	5,646,191
Gulf Coast	North America	998,447	1,033,970	589,908	663,111	749,554	1,004,075	1,299,440	1,798,032	2,850,218	4,348,296	6,410,158
Gulf Coast	South America	4,146,420	6,410,065	5,405,693	6,094,589	6,934,324	9,635,901	12,626,436	15,438,853	22,253,661	30,866,067	41,376,831
Gulf Coast	Caribbean	5,488	15,458	30,395	35,122	40,573	57,050	80,777	107,038	180,684	292,361	453,887
South Pacific	Africa	35,723	42,843	21,484	22,894	24,085	25,115	27,056	29,138	34,109	35,376	32,503
South Pacific	Asia	4,924,796	12,483,717	12,374,569	13,236,948	14,574,590	20,258,312	24,445,819	28,434,414	38,236,566	50,893,223	66,705,796
South Pacific	Europe	613,230	1,114,997	907,405	1,042,158	1,199,639	1,707,779	2,082,369	2,479,055	3,503,649	4,927,946	6,879,887
South Pacific	Mideast	5,482	98,127	249,920	291,152	339,036	488,389	645,559	826,064	1,339,641	2,145,270	3,369,063
South Pacific	North America	541,378	554,834	635,996	722,126	820,166	1,102,398	1,544,682	1,992,510	3,182,397	4,885,807	7,233,011
South Pacific	South America	838,682	782,322	910,972	1,029,296	1,175,314	1,644,712	2,160,338	2,637,589	3,775,505	5,178,798	6,820,545
South Pacific	Caribbean	1,995	815	783	882	990	1,331	1,518	1,674	2,031	2,490	3,102
North Pacific	Africa	269	6,745	6,581	7,119	7,475	7,265	7,532	7,853	8,844	8,675	7,175
North Pacific	Asia	1,679,349	2,781,248	2,804,285	3,026,206	3,342,354	4,671,974	5,812,770	6,916,940	9,661,191	13,276,116	17,917,909
North Pacific	Europe	47,557	216,553	148,241	156,724	171,900	235,295	302,844	364,317	499,081	646,199	842,982
North Pacific	Mideast	0	423	7,536	8,453	9,565	13,364	17,002	20,938	30,412	43,720	63,996
North Pacific	North America	372,552	556,057	1,093,572	1,250,397	1,420,252	1,913,134	2,415,228	2,932,951	4,256,728	6,077,165	8,517,428
North Pacific	South America	248,890	76,840	121,065	139,851	161,575	230,806	309,565	381,024	548,769	749,089	971,635
North Pacific	Caribbean	0	21	42	48	54	80	111	145	239	381	586
Great Lakes	Africa	24	3,077	744	799	907	994	1,080	1,159	1,300	1,420	1,532
Great Lakes	Asia	128,506	254,799	22,800	25,522	28,985	43,608	61,799	82,417	143,163	242,291	399,028
Great Lakes	Europe	1,918,118	2,224,251	932,625	1,057,180	1,199,635	1,706,697	2,278,845	2,801,619	4,077,419	5,734,812	7,835,762
Great Lakes	Mideast	106	10,463	7,640	8,856	10,259	15,215	23,366	33,059	63,138	114,661	198,226
Great Lakes	North America	1,992,621	1,948,791	1,997,003	2,212,716	2,443,134	2,913,140	3,094,978	3,222,610	3,464,546	3,698,553	3,921,596
Great Lakes	South America	218,496	350,982	157,867	175,489	199,548	279,571	364,551	444,829	630,342	847,305	1,087,474
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**39,817,253**	**74,196,613**	**58,697,251**	**64,721,849**	**72,427,909**	**100,409,438**	**124,422,033**	**148,062,718**	**208,116,165**	**289,486,714**	**397,618,719**
Average Annual Growth Rate			**13.26%**	**-7.51%**	**10.26%**	**11.91%**	**6.75%**	**4.38%**	**3.54%**	**3.46%**	**3.36%**	**3.22%**

US Commodity Forecast For MATERIALS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	14,329	14,524	18,312	16,978	16,405	17,539	18,318	18,969	20,749	23,008	25,542
North Atlantic	Asia	502,197	819,450	1,109,117	1,155,331	1,215,434	1,446,426	1,583,039	1,693,893	1,974,061	2,308,235	2,606,974
North Atlantic	Europe	1,406,655	1,905,316	2,440,549	2,471,838	2,582,976	2,786,401	2,923,025	3,101,161	3,585,250	4,170,108	4,797,294
North Atlantic	Mideast	17,869	57,503	81,219	88,415	94,459	112,389	119,897	129,547	154,855	189,426	234,722
North Atlantic	North America	203,993	231,627	218,115	247,256	266,925	323,937	354,738	373,464	412,427	453,337	494,190
North Atlantic	South America	650,638	776,527	1,064,723	1,059,265	1,084,236	1,305,306	1,412,559	1,537,039	1,863,415	2,301,259	2,863,861
North Atlantic	Caribbean	320	1,951	2,986	3,051	3,237	3,585	4,064	4,513	5,643	7,220	9,421
South Atlantic	Africa	9,943	18,239	22,177	21,004	20,709	19,603	19,818	20,898	24,379	29,682	36,915
South Atlantic	Asia	319,023	573,118	784,418	802,536	836,801	978,850	1,074,583	1,175,574	1,445,707	1,795,414	2,154,977
South Atlantic	Europe	325,525	529,342	820,288	810,163	825,978	876,551	886,941	903,556	984,639	1,115,876	1,297,671
South Atlantic	Mideast	16,638	55,958	72,061	77,337	83,634	100,778	108,972	118,818	145,541	182,803	231,825
South Atlantic	North America	139,294	215,366	179,630	203,745	220,039	267,261	292,867	308,467	340,824	374,779	408,737
South Atlantic	South America	341,617	604,189	755,214	775,586	821,176	1,116,162	1,209,670	1,266,553	1,360,381	1,445,408	1,529,887
South Atlantic	Caribbean	44,069	43,794	58,746	55,191	54,753	60,518	65,677	69,921	78,288	87,437	97,902
Gulf Coast	Africa	64,353	9,123	16,442	14,850	13,986	14,977	15,392	15,755	16,964	18,608	20,449
Gulf Coast	Asia	173,809	182,301	169,965	182,738	194,923	237,430	257,922	270,673	296,066	324,110	348,598
Gulf Coast	Europe	160,111	250,158	278,310	260,973	253,376	280,825	287,683	292,475	315,474	350,560	395,602
Gulf Coast	Mideast	2,274	4,859	6,648	7,016	7,668	9,652	10,733	11,865	14,750	18,631	23,655
Gulf Coast	North America	34,790	14,943	28,966	28,379	28,922	26,906	26,619	27,349	29,433	32,633	37,446
Gulf Coast	South America	242,888	445,157	937,517	921,107	921,851	1,012,301	983,627	958,202	932,975	941,358	966,703
Gulf Coast	Caribbean	6,182	5,627	11,137	10,577	10,556	10,792	11,178	11,697	12,721	13,848	15,219
South Pacific	Africa	58	892	1,512	1,463	1,493	2,031	2,518	2,979	4,110	5,650	7,754
South Pacific	Asia	1,613,487	3,127,114	3,953,390	3,935,955	4,039,334	4,528,705	4,836,673	5,099,424	5,941,797	7,089,929	8,481,047
South Pacific	Europe	149,991	237,986	210,268	201,090	198,435	215,378	220,524	225,855	255,647	305,211	374,323
South Pacific	Mideast	1,250	8,080	12,506	12,777	13,187	16,105	17,411	18,612	21,391	24,857	29,161
South Pacific	North America	355,743	305,498	261,487	296,824	320,690	389,913	427,350	450,164	497,403	546,832	596,134
South Pacific	South America	109,358	116,715	123,403	116,245	115,588	152,050	173,676	190,530	226,182	267,828	317,910
South Pacific	Caribbean	1,795	1,682	4,384	4,297	4,423	4,955	5,487	5,860	6,635	7,516	8,537
North Pacific	Africa	26	27	200	190	189	195	208	230	285	359	464
North Pacific	Asia	366,802	638,755	844,631	825,850	831,166	879,631	914,522	954,155	1,104,560	1,315,264	1,573,458
North Pacific	Europe	3,150	9,926	7,060	6,592	6,514	7,654	8,470	9,379	11,824	15,186	19,712
North Pacific	Mideast	0	422	984	920	917	1,308	1,590	1,832	2,367	3,014	3,806
North Pacific	North America	393,996	179,816	52,272	47,391	42,943	31,606	24,980	18,508	11,615	9,543	9,316
North Pacific	South America	10,122	36,584	22,022	20,238	19,707	26,454	31,094	34,930	43,327	53,329	65,396
North Pacific	Caribbean	0	120	117	114	117	132	147	157	178	202	230
Great Lakes	Africa	2	70	18	17	17	21	24	26	29	32	35
Great Lakes	Asia	1,608	4,006	9,473	8,915	8,486	7,410	7,132	8,270	11,273	13,246	12,259
Great Lakes	Europe	17,783	25,795	146,388	134,194	123,121	85,563	57,298	39,975	18,440	9,197	5,369
Great Lakes	Mideast	2	127	67	67	71	92	103	112	135	163	200
Great Lakes	North America	6,651	57	4,323	3,944	3,600	2,781	2,296	1,680	840	461	330
Great Lakes	South America	134	53	3	3	3	4	5	6	8	11	14
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**7,708,477**	**11,452,795**	**14,731,049**	**14,830,422**	**15,288,045**	**17,360,179**	**18,398,832**	**19,373,071**	**22,172,589**	**25,851,571**	**30,103,047**
Average Annual Growth Rate			**8.24%**	**8.75%**	**0.67%**	**3.09%**	**2.57%**	**1.17%**	**1.04%**	**1.36%**	**1.55%**	**1.53%**

US Commodity Forecast For ALL COMMODITIES
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	9,710,130	9,604,922	12,260,142	14,287,698	15,725,261	20,855,774	22,813,749	24,115,787	27,172,984	30,713,394	34,708,691
North Atlantic	Asia	8,578,743	9,896,597	12,987,501	13,468,830	14,519,365	18,577,584	21,119,369	23,566,628	29,827,339	37,934,816	47,990,628
North Atlantic	Europe	15,164,582	27,873,047	33,037,656	36,018,092	38,240,094	45,854,928	51,912,651	57,981,634	74,016,111	95,259,228	122,033,214
North Atlantic	Mideast	593,395	1,142,043	1,501,171	1,675,248	1,849,642	2,267,838	2,570,539	2,861,117	3,553,976	4,440,180	5,579,757
North Atlantic	North America	17,735,161	24,616,678	30,977,371	34,650,309	36,294,560	42,330,964	46,677,265	50,235,302	58,691,693	69,450,554	83,430,744
North Atlantic	South America	28,099,053	34,702,337	34,956,757	37,512,311	39,562,170	45,829,627	50,282,806	54,083,094	63,896,391	77,466,655	96,385,331
North Atlantic	Caribbean	142,715	336,549	292,969	293,707	302,434	360,097	395,034	427,815	496,945	570,148	647,978
South Atlantic	Africa	245,751	484,120	406,065	432,665	471,899	562,162	614,214	659,569	778,302	921,403	1,083,681
South Atlantic	Asia	3,022,497	6,464,596	7,043,515	7,465,238	8,129,331	11,524,486	14,296,967	17,364,640	25,926,009	38,905,434	57,922,317
South Atlantic	Europe	6,488,200	11,169,284	12,931,340	13,557,925	14,406,539	18,142,957	20,255,114	22,169,927	27,355,293	34,546,540	44,001,769
South Atlantic	Mideast	388,985	745,107	1,159,064	1,309,197	1,479,834	1,846,819	2,078,875	2,289,092	2,768,434	3,334,361	3,978,774
South Atlantic	North America	5,937,732	6,554,488	8,154,597	8,374,182	8,008,402	8,233,821	8,317,913	8,352,880	8,566,179	9,048,233	9,966,034
South Atlantic	South America	9,649,545	13,168,052	17,872,386	19,311,076	20,789,950	24,980,210	28,212,218	31,194,100	38,172,370	46,688,585	56,960,970
South Atlantic	Caribbean	334,728	729,691	780,118	788,568	815,837	920,119	1,006,159	1,094,158	1,312,853	1,576,094	1,887,404
Gulf Coast	Africa	7,686,232	8,369,253	8,106,259	9,189,378	9,874,187	11,300,051	11,051,626	10,488,459	9,671,516	9,144,260	8,892,144
Gulf Coast	Asia	8,727,364	16,270,911	11,019,025	11,793,172	12,869,158	16,910,519	19,445,429	21,954,977	28,526,131	37,783,039	50,549,949
Gulf Coast	Europe	13,858,305	23,983,099	27,313,865	29,593,935	31,123,283	36,148,929	39,511,285	41,972,608	48,649,355	57,975,912	70,184,283
Gulf Coast	Mideast	685,753	1,786,257	1,263,634	1,435,341	1,604,515	2,062,241	2,586,079	3,094,306	4,325,372	5,874,048	7,722,591
Gulf Coast	North America	57,429,421	75,243,298	90,041,237	101,566,871	107,912,685	125,687,622	133,776,510	137,969,709	148,984,815	163,143,420	180,735,244
Gulf Coast	South America	81,982,708	93,400,891	91,933,028	101,443,064	108,610,657	125,287,594	133,344,841	137,612,732	148,448,592	162,013,909	178,193,194
Gulf Coast	Caribbean	894,555	1,547,631	1,806,722	1,979,773	2,096,243	2,439,989	2,611,129	2,723,417	3,020,295	3,406,825	3,890,607
South Pacific	Africa	66,999	78,865	1,063,302	1,243,221	1,370,928	1,832,693	2,013,769	2,136,454	2,423,453	2,751,751	3,118,165
South Pacific	Asia	20,284,006	41,972,608	43,338,892	45,812,779	49,616,445	67,408,232	79,639,406	91,759,661	121,583,822	158,975,052	203,690,275
South Pacific	Europe	1,919,621	3,773,182	3,370,019	3,651,839	3,998,636	5,165,532	5,993,703	6,870,090	9,187,204	12,331,936	16,406,167
South Pacific	Mideast	26,612	181,565	321,986	367,986	422,521	594,615	765,613	964,036	1,524,444	2,393,258	3,694,806
South Pacific	North America	3,987,710	6,724,763	9,313,202	10,130,847	10,441,570	12,028,701	13,352,411	14,459,899	17,318,672	21,201,549	26,459,338
South Pacific	South America	6,572,908	10,049,249	10,837,875	12,208,388	13,117,002	15,910,423	17,700,974	19,025,792	22,143,026	25,868,273	30,239,189
South Pacific	Caribbean	166,227	288,194	685,254	717,008	748,616	787,447	847,022	885,522	963,124	1,056,137	1,170,664
North Pacific	Africa	1,198	7,893	8,074	8,726	9,226	9,620	10,329	11,126	13,249	14,466	14,600
North Pacific	Asia	8,525,799	10,838,233	9,669,812	10,279,840	11,167,292	15,347,721	18,350,658	21,297,244	28,559,308	37,721,834	48,799,133
North Pacific	Europe	164,465	313,934	341,281	352,413	377,134	462,325	543,493	619,702	800,861	1,000,683	1,262,394
North Pacific	Mideast	157,543	629,472	486,021	561,879	601,281	752,980	919,580	1,096,490	1,560,168	2,257,451	3,381,810
North Pacific	North America	5,535,978	6,374,301	6,705,291	7,257,390	7,530,717	8,933,842	10,312,148	11,695,412	14,989,817	19,129,645	24,259,894
North Pacific	South America	1,028,620	1,672,264	2,206,078	2,489,944	2,671,813	3,200,504	3,519,826	3,741,438	4,270,979	4,903,269	5,637,009
North Pacific	Caribbean	31,536	32,441	22,289	22,930	23,882	24,091	24,794	25,213	26,152	27,534	29,384
Great Lakes	Africa	138,323	125,679	130,775	130,869	131,027	131,317	131,513	131,692	132,041	132,385	132,723
Great Lakes	Asia	360,791	727,543	200,051	214,426	236,231	336,868	410,563	490,729	712,621	1,046,378	1,536,310
Great Lakes	Europe	2,116,412	2,422,363	1,328,080	1,449,425	1,596,065	2,116,398	2,691,363	3,222,097	4,539,162	6,266,163	8,446,878
Great Lakes	Mideast	206	17,898	8,882	10,053	11,571	17,191	25,868	36,098	67,566	121,007	207,118
Great Lakes	North America	12,604,672	14,729,609	16,754,846	17,727,701	18,097,746	19,967,680	20,443,999	20,580,016	21,009,377	21,626,634	22,418,339
Great Lakes	South America	1,233,949	838,821	870,486	864,000	975,465	1,252,247	1,397,586	1,505,890	1,766,871	2,078,884	2,431,474
Great Lakes	Caribbean	21	40	3	3	3	3	3	3	3	3	3
Total		**342,279,150**	**469,887,568**	**513,506,921**	**561,648,246**	**597,831,216**	**718,404,761**	**791,974,192**	**852,766,555**	**1,007,750,872**	**1,211,101,330**	**1,470,080,976**
Average Annual Growth Rate			**6.54%**	**3.00%**	**9.38%**	**6.44%**	**3.74%**	**1.97%**	**1.49%**	**1.68%**	**1.86%**	**1.96%**

Containerized U.S. Commodity by Origin (Metric Tonnes)

Containerized US Commodity Forecast For AGRICULTURE COMMODITIES
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	5,191	6,326	5,691	5,555	5,332	5,237	4,948	4,830	4,414	4,047	3,718
North Atlantic	Asia	306,726	177,022	171,956	189,626	200,714	222,602	244,831	268,741	312,908	347,163	367,800
North Atlantic	Europe	487,838	486,583	202,881	217,534	222,397	220,777	232,960	244,260	265,832	293,506	330,703
North Atlantic	Mideast	14,585	17,602	20,096	22,033	23,594	35,513	40,168	44,856	54,982	66,264	78,530
North Atlantic	North America	939	612	92	85	82	66	52	46	35	29	25
North Atlantic	South America	41,161	27,516	30,466	31,762	32,656	37,476	39,434	44,367	50,432	56,487	62,716
North Atlantic	Caribbean	3,058	4,288	4,828	5,241	5,625	7,380	8,139	8,776	9,904	10,938	11,903
South Atlantic	Africa	1,311	1,752	1,030	1,038	997	1,002	959	929	879	842	816
South Atlantic	Asia	178,945	128,982	718,200	783,559	806,675	803,767	834,998	867,926	946,940	1,030,991	1,120,111
South Atlantic	Europe	209,907	188,043	184,800	203,244	192,897	145,109	126,981	117,253	107,918	109,680	119,160
South Atlantic	Mideast	4,511	18,712	126,221	129,755	130,096	166,066	188,854	209,812	257,748	313,323	373,806
South Atlantic	North America	1,400	1,036	607	581	589	655	678	705	768	843	923
South Atlantic	South America	61,075	36,744	41,240	41,186	42,894	48,722	51,842	55,719	62,851	70,427	78,692
South Atlantic	Caribbean	8,948	6,969	18,146	18,987	19,826	23,173	24,874	25,904	27,137	27,880	28,344
Gulf Coast	Africa	3,262	2,051	4,696	4,870	4,779	5,005	5,092	5,311	5,562	5,818	6,113
Gulf Coast	Asia	86,867	27,095	110,988	117,891	120,350	132,114	147,682	160,595	190,542	227,954	271,609
Gulf Coast	Europe	338,066	308,562	308,248	322,815	320,552	333,668	348,879	364,180	392,425	425,398	463,158
Gulf Coast	Mideast	43,012	177,492	251,171	258,293	259,245	332,124	378,441	421,128	518,877	632,381	756,089
Gulf Coast	North America	518	5,075	4,367	4,206	4,266	4,834	5,160	5,597	6,430	7,374	8,364
Gulf Coast	South America	115,966	105,934	180,309	176,276	180,429	193,111	197,965	203,589	211,173	218,182	225,843
Gulf Coast	Caribbean	85,062	133,480	131,360	136,634	141,575	154,830	163,703	169,227	176,754	181,603	184,530
South Pacific	Africa	279	790	1,342	1,277	1,252	1,792	1,951	2,102	2,373	2,646	2,923
South Pacific	Asia	1,991,264	1,443,891	1,918,519	2,055,959	2,098,794	2,470,843	2,721,782	2,975,169	3,618,870	4,544,917	5,759,956
South Pacific	Europe	197,348	212,575	187,573	184,913	170,464	195,579	207,813	217,810	239,413	263,738	289,783
South Pacific	Mideast	13,868	39,039	39,489	40,580	40,946	53,125	59,988	66,951	82,609	100,511	119,950
South Pacific	North America	521	1,249	4,951	5,133	5,325	6,424	6,640	6,842	7,443	8,250	9,208
South Pacific	South America	41,179	82,565	49,227	51,433	54,498	69,651	78,881	88,089	106,072	124,649	144,154
South Pacific	Caribbean	10,784	21,640	22,314	24,140	25,846	33,560	36,871	39,529	44,167	48,333	52,173
North Pacific	Africa	480	287	10,447	10,187	10,038	10,697	11,273	11,559	11,774	11,848	11,916
North Pacific	Asia	1,703,450	1,195,791	1,037,960	1,154,855	1,195,536	1,494,182	1,642,943	1,766,372	2,084,266	2,323,956	2,930,546
North Pacific	Europe	67,180	46,672	45,964	49,989	50,718	50,162	51,696	53,852	57,803	62,504	67,731
North Pacific	Mideast	79	782	1,986	2,020	2,142	2,728	3,127	3,541	4,350	5,207	6,111
North Pacific	North America	436	3,910	152	141	135	182	201	217	250	283	318
North Pacific	South America	44,293	33,937	51,291	52,933	54,646	63,175	68,377	73,306	81,962	90,208	98,358
North Pacific	Caribbean	151	9,704	5,337	5,765	6,163	7,899	8,662	9,295	10,428	11,462	12,420
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	0	0	41	41	40	36	33	41	41	41	41
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**6,069,662**	**4,954,709**	**5,893,986**	**6,310,535**	**6,432,112**	**7,333,268**	**7,946,882**	**8,538,429**	**9,956,334**	**11,629,681**	**13,998,542**
Average Annual Growth Rate			**-3.98%**	**5.96%**	**7.07%**	**1.93%**	**2.66%**	**1.62%**	**1.45%**	**1.55%**	**1.57%**	**1.87%**

Containerized US Commodity Forecast For CAPITAL EQUIPMENT
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	46,227	28,228	38,105	37,256	38,380	46,166	51,906	55,382	61,768	67,547	73,327
North Atlantic	Asia	170,120	116,563	167,450	180,634	189,018	252,158	329,573	419,520	677,304	1,099,888	1,817,977
North Atlantic	Europe	347,995	308,291	303,096	316,458	328,772	403,752	463,960	520,794	658,427	849,919	1,108,129
North Atlantic	Mideast	33,975	36,521	31,646	32,473	33,821	41,178	46,891	51,260	59,540	67,223	74,847
North Atlantic	North America	357	781	513	546	548	668	724	768	864	982	1,132
North Atlantic	South America	171,959	127,940	95,497	103,909	105,721	125,479	140,100	149,995	172,264	197,651	225,560
North Atlantic	Caribbean	994	1,678	4,010	3,884	3,779	3,408	3,007	2,737	2,525	2,599	2,810
South Atlantic	Africa	6,551	5,699	7,453	7,511	7,796	9,197	10,164	10,893	12,483	14,349	16,572
South Atlantic	Asia	108,381	64,127	77,719	83,001	86,147	105,257	127,767	154,036	231,026	366,836	623,079
South Atlantic	Europe	141,497	200,360	167,691	175,531	182,860	223,872	254,988	283,077	349,571	438,372	552,947
South Atlantic	Mideast	13,805	21,226	13,341	13,655	14,206	17,240	19,756	21,625	25,025	28,005	30,847
South Atlantic	North America	2,405	6,636	7,408	8,206	8,667	10,609	12,023	12,937	14,710	16,286	17,718
South Atlantic	South America	305,722	313,707	234,172	251,881	257,096	300,732	335,134	358,475	409,855	468,798	535,495
South Atlantic	Caribbean	48,042	52,517	54,502	53,635	53,157	51,443	47,119	44,237	42,278	43,749	46,856
Gulf Coast	Africa	3,231	7,789	14,363	15,331	16,411	23,904	34,935	52,121	119,837	246,850	430,100
Gulf Coast	Asia	47,406	23,314	34,565	36,087	37,121	44,633	54,503	66,429	101,342	159,767	261,797
Gulf Coast	Europe	73,010	83,995	93,692	98,624	103,080	125,454	145,764	169,223	255,387	439,378	742,162
Gulf Coast	Mideast	2,943	3,483	5,755	6,001	6,387	7,683	8,787	9,707	11,632	13,603	15,612
Gulf Coast	North America	5,740	14,380	8,585	9,649	10,157	12,969	15,193	16,636	19,260	21,474	23,363
Gulf Coast	South America	177,545	155,859	140,415	150,906	153,380	179,824	200,268	214,750	245,952	279,626	314,973
Gulf Coast	Caribbean	19,856	16,727	23,772	24,274	24,977	28,872	29,943	31,000	34,467	39,838	46,564
South Pacific	Africa	164	415	772	771	780	936	1,063	1,145	1,284	1,390	1,477
South Pacific	Asia	756,639	686,615	649,248	698,208	733,543	927,107	1,165,594	1,444,738	2,246,361	3,609,129	6,135,901
South Pacific	Europe	21,555	22,355	20,779	21,674	22,666	27,090	30,712	34,416	44,628	61,111	84,959
South Pacific	Mideast	859	790	758	775	802	989	1,122	1,215	1,383	1,526	1,656
South Pacific	North America	188	3,307	638	720	772	1,042	1,285	1,448	1,732	1,968	2,174
South Pacific	South America	14,603	11,618	8,654	9,165	9,261	10,823	12,299	13,667	17,274	22,042	27,630
South Pacific	Caribbean	1,046	1,490	2,450	2,373	2,311	2,056	1,793	1,606	1,429	1,429	1,512
North Pacific	Africa	164	533	209	209	214	262	303	328	368	395	415
North Pacific	Asia	210,804	181,006	203,313	214,056	228,593	267,896	323,145	384,335	539,633	750,120	1,044,648
North Pacific	Europe	7,504	23,255	14,361	15,055	15,986	20,299	23,748	27,625	40,760	66,487	107,012
North Pacific	Mideast	97	115	77	80	85	108	129	148	185	222	260
North Pacific	North America	36	1,673	902	1,018	1,142	1,584	1,823	2,044	2,559	3,170	3,873
North Pacific	South America	5,307	3,853	1,932	2,132	2,072	2,334	2,575	2,752	3,131	3,494	3,795
North Pacific	Caribbean	59	55	24	26	29	44	52	59	73	88	107
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	0	0	3,182	3,347	3,627	5,707	7,020	7,339	8,117	8,946	9,720
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**2,746,787**	**2,526,898**	**2,431,049**	**2,579,059**	**2,683,364**	**3,282,776**	**3,905,172**	**4,568,466**	**6,414,430**	**9,394,260**	**14,387,005**
Average Annual Growth Rate			**-1.65%**	**-1.28%**	**6.09%**	**4.04%**	**4.11%**	**3.53%**	**3.19%**	**3.45%**	**3.89%**	**4.35%**

Containerized US Commodity Forecast For CHEMICALS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	25,565	19,506	20,510	19,960	20,264	23,200	26,207	29,376	36,634	45,863	58,120
North Atlantic	Asia	396,276	477,650	668,090	681,995	701,793	821,087	977,180	1,207,824	2,016,828	3,774,848	7,658,047
North Atlantic	Europe	652,648	784,611	848,285	834,339	817,114	944,291	1,062,593	1,179,662	1,479,943	1,909,481	2,560,074
North Atlantic	Mideast	53,316	47,284	41,069	41,879	42,818	48,066	53,580	60,352	77,179	100,066	130,829
North Atlantic	North America	1,864	1,735	4,553	4,968	5,123	5,914	6,698	7,522	9,516	12,012	14,833
North Atlantic	South America	229,899	274,335	250,432	263,054	266,637	307,637	348,443	391,806	514,597	704,338	968,727
North Atlantic	Caribbean	6,112	8,417	10,838	11,148	11,467	13,287	15,494	18,234	25,814	35,553	46,229
South Atlantic	Africa	21,985	34,424	22,078	21,485	22,002	25,357	29,207	33,569	44,974	62,556	91,419
South Atlantic	Asia	519,536	544,013	516,542	519,753	536,731	624,497	723,450	863,309	1,303,015	2,150,991	3,866,762
South Atlantic	Europe	329,087	428,183	448,567	434,989	423,410	504,302	577,308	652,239	868,182	1,233,974	1,803,927
South Atlantic	Mideast	24,765	38,798	27,539	28,107	29,224	32,294	35,868	40,301	51,602	67,910	90,910
South Atlantic	North America	12,998	17,249	54,815	57,792	58,840	65,956	73,161	78,089	88,339	98,757	109,528
South Atlantic	South America	343,730	439,761	461,516	484,839	497,388	597,048	723,283	895,292	1,538,482	2,772,288	4,636,931
South Atlantic	Caribbean	32,276	34,987	55,078	56,563	58,087	66,762	77,180	89,780	123,722	165,914	210,835
Gulf Coast	Africa	47,581	88,184	72,779	71,915	71,470	78,730	86,332	96,385	125,231	175,442	274,142
Gulf Coast	Asia	601,880	414,401	605,334	638,858	652,425	702,648	784,893	925,119	1,430,701	2,519,223	4,748,277
Gulf Coast	Europe	1,033,931	1,570,488	1,782,230	1,753,073	1,704,913	1,912,216	2,106,333	2,287,312	2,745,327	3,370,483	4,328,180
Gulf Coast	Mideast	94,160	128,779	189,486	193,547	198,034	212,176	228,828	250,709	302,874	368,617	450,967
Gulf Coast	North America	27,823	112,439	124,142	134,195	138,212	160,153	182,063	203,713	254,645	316,685	387,025
Gulf Coast	South America	1,142,551	1,456,189	1,403,320	1,490,913	1,508,371	1,711,900	1,950,901	2,250,010	3,260,077	5,149,613	8,127,454
Gulf Coast	Caribbean	191,081	223,545	266,860	276,233	285,709	337,488	396,389	464,265	636,366	836,568	1,038,341
South Pacific	Africa	3,093	2,194	3,010	2,920	2,888	3,430	4,011	4,640	6,050	7,729	9,710
South Pacific	Asia	3,083,603	3,123,704	3,379,096	3,446,899	3,561,297	4,165,142	4,910,123	5,946,840	9,336,719	16,185,852	30,608,347
South Pacific	Europe	49,874	29,790	23,497	23,458	23,350	27,559	31,830	36,219	47,381	63,334	86,073
South Pacific	Mideast	1,109	558	487	494	507	559	614	677	823	1,009	1,242
South Pacific	North America	466	137	74	78	82	101	120	137	174	218	269
South Pacific	South America	22,862	33,285	31,043	34,487	34,898	39,554	43,956	48,586	62,171	84,461	116,165
South Pacific	Caribbean	2,226	4,511	3,166	3,324	3,476	4,266	5,098	5,913	7,942	10,589	13,697
North Pacific	Africa	1,416	453	153	150	150	173	194	213	261	315	377
North Pacific	Asia	907,044	755,505	795,842	813,014	823,861	957,197	1,099,043	1,278,399	1,821,171	2,841,089	4,891,287
North Pacific	Europe	2,134	7,547	10,306	10,443	10,664	12,208	13,708	15,175	18,859	24,136	32,141
North Pacific	Mideast	635	437	724	734	748	835	909	979	1,135	1,318	1,529
North Pacific	North America	392	3,097	511	515	539	720	896	1,056	1,387	1,752	2,161
North Pacific	South America	17,047	11,052	14,294	15,905	16,119	18,336	20,365	22,337	27,621	36,362	50,025
North Pacific	Caribbean	408	1,522	1,122	1,180	1,235	1,515	1,791	2,013	2,473	3,014	3,637
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**9,881,372**	**10,918,770**	**12,138,289**	**12,373,202**	**12,529,844**	**14,426,603**	**16,598,049**	**19,388,055**	**28,268,216**	**45,132,360**	**77,418,216**
Average Annual Growth Rate			**2.02%**	**3.59%**	**1.94%**	**1.27%**	**2.86%**	**2.84%**	**3.16%**	**3.84%**	**4.79%**	**5.54%**

Containerized US Commodity Forecast For CONSUMER GOODS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	8,314	6,323	6,959	6,590	6,906	8,132	9,301	10,540	14,370	21,540	34,157
North Atlantic	Asia	54,205	46,151	62,238	66,813	70,491	90,860	117,120	154,390	284,059	542,899	1,043,642
North Atlantic	Europe	103,625	120,360	129,322	133,788	137,944	161,210	184,263	218,391	338,203	592,039	1,134,259
North Atlantic	Mideast	8,617	13,468	11,025	11,417	12,093	15,303	18,544	21,835	30,293	42,442	58,854
North Atlantic	North America	173	60	1,621	1,627	1,642	1,694	1,688	1,707	1,835	2,042	2,324
North Atlantic	South America	51,655	61,041	44,982	47,345	49,130	59,225	68,112	75,933	94,446	118,528	149,100
North Atlantic	Caribbean	1,529	4,586	5,717	5,887	6,061	6,824	7,347	7,973	9,569	11,512	13,584
South Atlantic	Africa	1,606	2,217	1,536	1,473	1,535	1,909	2,234	2,591	3,643	5,605	9,103
South Atlantic	Asia	25,521	24,925	40,260	43,085	45,745	57,973	72,735	93,165	162,537	300,910	572,247
South Atlantic	Europe	35,362	39,822	40,304	41,597	42,698	48,257	53,152	59,992	81,503	122,242	201,946
South Atlantic	Mideast	2,872	4,594	3,311	3,475	3,771	5,004	6,276	7,584	11,038	16,267	23,601
South Atlantic	North America	2,166	3,778	2,301	2,471	2,585	3,205	3,793	4,380	5,717	7,423	9,641
South Atlantic	South America	146,164	153,648	108,881	111,193	112,317	117,754	125,190	129,367	144,267	168,542	202,445
South Atlantic	Caribbean	100,173	264,682	133,350	137,686	141,552	154,780	165,663	177,126	202,974	234,617	269,947
Gulf Coast	Africa	472	3,579	2,279	2,162	2,290	2,907	3,435	4,030	5,845	9,313	15,536
Gulf Coast	Asia	3,398	9,586	5,263	5,674	5,955	8,097	10,428	13,354	22,424	38,662	68,095
Gulf Coast	Europe	21,014	32,466	41,771	42,988	44,002	49,119	54,372	63,542	97,476	171,882	335,007
Gulf Coast	Mideast	1,025	1,517	2,117	2,221	2,392	3,107	3,826	4,559	6,466	9,217	12,882
Gulf Coast	North America	1,701	14,191	29,928	29,065	28,230	28,166	26,359	26,885	24,551	21,349	20,486
Gulf Coast	South America	35,738	40,943	35,149	37,193	38,754	47,355	54,597	60,583	74,340	91,643	113,078
Gulf Coast	Caribbean	18,316	65,838	55,192	56,931	58,475	63,644	67,876	71,908	79,521	87,244	94,738
South Pacific	Africa	139	300	461	444	462	592	713	856	1,306	2,189	3,804
South Pacific	Asia	356,329	359,390	344,132	369,857	391,056	491,456	622,202	805,205	1,437,446	2,697,285	5,140,877
South Pacific	Europe	14,296	12,924	10,835	11,258	11,615	12,990	14,724	18,111	30,907	59,832	127,538
South Pacific	Mideast	850	801	471	481	502	614	725	840	1,140	1,562	2,128
South Pacific	North America	151	10,820	561	629	667	851	1,009	1,157	1,479	1,872	2,383
South Pacific	South America	18,881	13,896	11,969	12,615	13,013	15,434	17,473	19,171	23,161	28,342	35,324
South Pacific	Caribbean	1,818	3,356	8,363	8,599	8,811	9,562	10,092	10,672	11,977	13,499	15,126
North Pacific	Africa	28	21	153	144	139	114	101	91	81	76	73
North Pacific	Asia	75,669	61,862	63,533	68,909	73,692	92,602	121,286	164,861	322,462	661,744	1,396,987
North Pacific	Europe	1,726	922	1,122	1,191	1,256	1,495	1,880	2,647	5,719	13,082	31,248
North Pacific	Mideast	3	42	30	31	33	43	53	64	91	132	188
North Pacific	North America	163	196	40	42	46	55	61	68	88	111	139
North Pacific	South America	291	313	185	199	203	246	292	337	445	586	767
North Pacific	Caribbean	29	20	44	49	54	76	81	86	98	112	127
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	0	0	82	87	100	135	155	175	226	295	391
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**1,094,018**	**1,378,637**	**1,205,485**	**1,265,215**	**1,316,215**	**1,560,791**	**1,847,160**	**2,234,178**	**3,531,703**	**6,096,637**	**11,141,772**
Average Annual Growth Rate			**4.73%**	**-4.38%**	**4.95%**	**4.03%**	**3.47%**	**3.43%**	**3.88%**	**4.69%**	**5.61%**	**6.22%**

Containerized US Commodity Forecast For EXTRACTIVE COMMODITIES
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	7,059	3,882	200	208	203	255	271	293	333	372	412
North Atlantic	Asia	242,965	265,967	605,116	669,980	685,366	788,005	835,178	887,107	1,012,870	1,114,354	1,191,395
North Atlantic	Europe	144,642	80,821	93,647	92,242	92,751	89,859	85,900	83,012	78,089	73,859	70,142
North Atlantic	Mideast	4,812	8,441	3,923	3,744	3,869	3,442	3,434	3,535	3,774	4,053	4,402
North Atlantic	North America	117	435	622	600	617	732	791	845	990	1,148	1,316
North Atlantic	South America	35,550	29,716	66,265	66,653	67,030	69,180	70,808	71,669	74,185	77,389	81,124
North Atlantic	Caribbean	1,723	377	6,412	5,712	5,664	5,804	5,895	5,761	5,609	5,529	5,617
South Atlantic	Africa	7,989	2,867	2,024	1,835	1,665	2,229	2,375	2,550	2,909	3,253	3,603
South Atlantic	Asia	646,520	1,022,957	1,098,872	1,136,138	1,160,062	1,234,666	1,286,196	1,343,951	1,511,364	1,736,422	2,053,379
South Atlantic	Europe	328,948	264,524	350,855	355,086	357,062	328,616	316,552	309,747	299,781	294,498	293,582
South Atlantic	Mideast	11,928	7,595	10,728	10,349	10,066	14,393	15,452	16,921	20,619	25,327	31,279
South Atlantic	North America	333	4,834	12,241	11,812	12,133	14,408	15,571	16,626	19,495	22,619	25,928
South Atlantic	South America	86,552	74,222	84,943	85,325	85,760	90,606	91,732	92,746	95,422	97,771	99,497
South Atlantic	Caribbean	9,076	2,847	20,629	21,103	21,410	21,920	22,336	22,597	23,067	23,688	24,511
Gulf Coast	Africa	1,312	537	5,369	5,494	5,606	5,721	5,813	5,989	6,470	7,125	7,883
Gulf Coast	Asia	59,312	41,565	64,223	69,581	71,020	75,262	76,720	82,289	95,786	113,116	138,454
Gulf Coast	Europe	48,146	46,251	93,619	91,982	92,162	88,734	84,820	82,423	73,423	70,985	69,309
Gulf Coast	Mideast	770	298	250	251	251	283	299	320	372	438	520
Gulf Coast	North America	463	632	13,535	13,920	14,352	16,042	17,161	18,232	20,790	23,678	26,847
Gulf Coast	South America	119,724	58,999	33,324	34,140	34,729	37,943	39,507	41,209	44,193	46,590	48,526
Gulf Coast	Caribbean	26,605	4,028	31,069	31,954	32,429	33,063	33,561	33,995	34,775	35,783	37,080
South Pacific	Africa	2,965	812	707	647	592	776	823	881	998	1,108	1,220
South Pacific	Asia	928,510	1,117,200	1,088,788	1,194,018	1,207,092	1,334,434	1,391,352	1,468,343	1,663,584	1,855,935	2,065,924
South Pacific	Europe	70,813	55,729	51,297	51,703	52,200	47,346	44,449	42,763	40,197	38,375	37,047
South Pacific	Mideast	910	142	30,326	30,323	30,406	33,292	35,068	37,259	42,674	49,565	57,948
South Pacific	North America	26	177	12	12	13	16	17	17	18	20	22
South Pacific	South America	10,583	5,966	4,459	4,562	4,552	4,748	4,833	4,941	5,096	5,203	5,275
South Pacific	Caribbean	1,239	228	1,931	2,104	2,131	2,002	1,868	1,929	2,042	2,172	2,314
North Pacific	Africa	0	0	4	4	3	4	5	5	6	6	7
North Pacific	Asia	428,298	393,826	550,417	597,349	610,991	664,133	688,418	717,111	796,582	877,763	969,741
North Pacific	Europe	6,566	7,338	2,570	2,645	2,682	2,450	2,329	2,256	2,129	2,015	1,913
North Pacific	Mideast	14	0	0	0	0	0	0	0	0	0	0
North Pacific	North America	3,314	326	255	251	281	342	358	370	397	430	466
North Pacific	South America	2,399	2,284	1,285	1,348	1,377	1,538	1,673	1,809	2,042	2,229	2,387
North Pacific	Caribbean	0	4	9	9	9	9	9	10	10	10	10
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**3,240,185**	**3,505,826**	**4,329,925**	**4,593,085**	**4,666,537**	**5,012,254**	**5,181,573**	**5,399,508**	**5,980,092**	**6,613,030**	**7,359,080**
Average Annual Growth Rate			**1.59%**	**7.29%**	**6.08%**	**1.60%**	**1.44%**	**0.67%**	**0.83%**	**1.03%**	**1.01%**	**1.07%**

Containerized US Commodity Forecast For FOOD
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	12,333	12,024	19,785	19,452	19,017	19,529	19,267	19,959	21,808	24,156	26,819
North Atlantic	Asia	288,783	314,953	293,194	303,559	309,874	340,624	355,160	381,577	445,168	524,387	562,758
North Atlantic	Europe	560,196	425,663	366,901	366,604	363,694	346,924	325,312	322,296	338,072	368,903	404,371
North Atlantic	Mideast	47,223	94,785	71,425	72,761	74,637	91,735	101,499	112,609	138,400	167,027	196,582
North Atlantic	North America	2,962	3,301	4,019	3,880	4,012	4,341	4,417	4,911	5,912	6,920	7,896
North Atlantic	South America	158,508	140,448	116,908	124,427	129,794	167,210	185,309	202,463	238,949	278,389	320,043
North Atlantic	Caribbean	5,504	14,496	19,269	19,791	19,896	18,426	16,900	15,873	13,926	12,274	10,979
South Atlantic	Africa	13,237	17,109	6,831	7,195	7,401	9,003	9,392	10,400	12,554	14,856	17,227
South Atlantic	Asia	285,825	480,460	446,671	471,583	483,934	595,816	655,117	734,902	919,200	1,140,824	1,026,487
South Atlantic	Europe	248,170	220,020	204,012	206,532	202,907	198,811	188,263	186,498	192,463	204,067	216,769
South Atlantic	Mideast	14,153	48,876	59,496	57,279	57,461	83,125	89,951	101,099	128,058	159,278	192,421
South Atlantic	North America	7,053	13,024	10,433	10,885	11,565	16,255	18,740	21,165	26,305	31,755	37,340
South Atlantic	South America	234,530	158,264	121,052	125,910	131,432	166,154	183,426	201,064	239,513	282,153	327,892
South Atlantic	Caribbean	35,995	67,134	79,137	81,919	83,344	83,052	80,228	79,034	76,719	75,464	75,645
Gulf Coast	Africa	3,306	11,581	56,872	53,147	52,584	75,299	85,190	94,604	114,275	134,756	155,346
Gulf Coast	Asia	50,464	62,259	45,455	49,434	53,286	74,640	89,261	105,697	143,167	186,620	225,544
Gulf Coast	Europe	244,567	272,724	236,351	248,816	260,712	290,864	290,464	301,125	334,671	372,766	404,788
Gulf Coast	Mideast	14,798	10,093	27,242	26,619	27,726	47,741	54,348	63,111	82,366	103,406	125,276
Gulf Coast	North America	1,826	13,453	701,277	764,217	822,048	1,182,030	1,376,554	1,561,744	1,954,891	2,371,072	2,795,631
Gulf Coast	South America	359,003	139,775	174,869	181,842	189,298	265,924	305,030	342,641	422,173	506,564	593,763
Gulf Coast	Caribbean	85,324	165,872	192,138	203,838	211,578	228,609	229,626	233,625	242,617	254,299	268,940
South Pacific	Africa	849	1,083	1,819	1,669	1,548	1,905	2,107	2,287	2,631	2,986	3,358
South Pacific	Asia	3,749,682	4,183,361	3,889,010	4,049,306	4,174,935	4,865,982	5,189,171	5,582,214	6,373,210	7,273,112	8,038,026
South Pacific	Europe	187,483	235,129	234,232	236,302	232,233	246,787	247,355	252,077	267,080	285,840	306,900
South Pacific	Mideast	3,799	7,270	8,152	8,122	8,245	10,362	11,714	12,817	15,091	17,579	20,310
South Pacific	North America	2,794	11,250	17,015	18,838	19,681	23,029	25,609	27,714	31,914	36,463	41,436
South Pacific	South America	42,184	34,308	30,869	32,802	34,365	42,256	45,752	49,460	56,782	64,715	73,350
South Pacific	Caribbean	4,724	18,673	15,520	16,083	16,437	16,413	15,898	15,570	14,793	14,124	13,690
North Pacific	Africa	1,288	954	1,749	1,658	1,520	2,008	2,110	2,326	2,756	3,199	3,652
North Pacific	Asia	2,950,436	3,516,241	3,687,195	3,800,735	3,998,024	4,755,808	5,122,937	5,545,918	6,453,751	7,485,610	8,460,065
North Pacific	Europe	110,319	116,793	143,174	150,334	152,595	161,403	150,623	150,694	166,814	186,573	204,479
North Pacific	Mideast	830	2,046	2,624	2,595	2,622	3,002	3,316	3,632	4,281	4,983	5,746
North Pacific	North America	2,772	4,630	4,849	4,786	4,936	5,220	5,304	5,772	6,674	7,579	8,476
North Pacific	South America	28,265	26,211	16,920	17,730	17,917	19,042	20,081	21,461	24,299	27,352	30,798
North Pacific	Caribbean	78	3,716	1,045	1,073	1,103	1,122	1,107	1,105	1,076	1,039	1,009
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	0	0	315	344	387	530	605	696	890	1,099	1,312
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**9,758,962**	**10,847,982**	**11,307,824**	**11,742,067**	**12,182,749**	**14,460,980**	**15,507,144**	**16,770,137**	**19,513,249**	**22,632,188**	**25,205,123**
Average Annual Growth Rate			**2.14%**	**1.39%**	**3.84%**	**3.75%**	**3.49%**	**1.41%**	**1.58%**	**1.53%**	**1.49%**	**1.08%**

Containerized US Commodity Forecast For FUELS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	194	806	436	434	443	400	368	367	366	363	354
North Atlantic	Asia	7,773	11,017	66,795	65,798	64,343	53,023	43,688	38,466	29,135	20,555	13,278
North Atlantic	Europe	9,846	14,609	13,913	14,650	14,362	11,574	9,823	8,632	6,706	5,177	4,017
North Atlantic	Mideast	1,669	1,217	166	160	163	144	135	136	137	135	131
North Atlantic	North America	75	33	13	13	13	12	11	11	11	11	10
North Atlantic	South America	4,116	7,005	18,644	18,652	18,291	16,926	16,049	16,235	16,506	16,532	16,212
North Atlantic	Caribbean	0	179	5	5	5	5	5	5	5	5	5
South Atlantic	Africa	9	20	12	12	13	11	10	10	10	10	10
South Atlantic	Asia	455	1,213	872	859	836	695	576	513	413	335	278
South Atlantic	Europe	417	1,586	1,979	1,979	1,906	1,570	1,303	1,104	797	567	401
South Atlantic	Mideast	5	91	13	13	13	11	11	11	11	11	10
South Atlantic	North America	0	0	0	0	0	0	0	0	0	0	0
South Atlantic	South America	205	1,028	580	583	575	550	536	547	561	565	557
South Atlantic	Caribbean	80	72	116	116	117	119	120	121	121	121	120
Gulf Coast	Africa	395	520	1,781	1,770	1,811	1,633	1,505	1,497	1,496	1,484	1,444
Gulf Coast	Asia	4,033	5,968	8,994	8,729	8,500	6,728	5,271	4,461	3,179	2,133	1,303
Gulf Coast	Europe	3,651	6,308	7,430	7,861	7,743	6,206	5,238	4,579	3,529	2,693	2,059
Gulf Coast	Mideast	2,125	463	586	565	576	516	486	490	494	491	477
Gulf Coast	North America	60	7,014	5,319	5,272	5,336	4,875	4,541	4,531	4,498	4,408	4,222
Gulf Coast	South America	12,806	19,979	30,000	29,884	29,586	28,654	28,254	29,081	30,372	31,234	31,625
Gulf Coast	Caribbean	5,699	8,666	24,117	24,264	24,307	24,767	25,080	25,244	25,299	25,181	24,920
South Pacific	Africa	0	18	13	13	13	12	11	11	11	11	10
South Pacific	Asia	44,412	84,138	124,394	123,596	124,635	126,884	132,760	141,737	181,755	264,362	405,986
South Pacific	Europe	477	238	2,651	2,812	2,778	2,192	1,822	1,559	1,143	807	540
South Pacific	Mideast	0	0	0	0	0	0	0	0	0	0	0
South Pacific	North America	0	20	32	35	33	36	36	37	41	47	57
South Pacific	South America	48	1,926	5,851	5,833	5,789	5,427	5,196	5,256	5,337	5,350	5,263
South Pacific	Caribbean	0	467	7,859	7,907	7,921	8,071	8,173	8,226	8,244	8,206	8,121
North Pacific	Africa	0	17	294	293	299	270	249	247	247	245	239
North Pacific	Asia	17,343	1,883	23,664	23,336	23,502	19,431	16,311	13,532	9,164	5,788	3,335
North Pacific	Europe	65	275	90	90	87	81	80	85	95	109	126
North Pacific	Mideast	0	0	0	0	0	0	0	0	0	0	0
North Pacific	North America	0	382	623	686	637	724	735	763	845	998	1,226
North Pacific	South America	173	131	957	994	1,014	1,123	1,228	1,314	1,455	1,587	1,726
North Pacific	Caribbean	0	14	11,828	11,900	11,921	12,147	12,300	12,380	12,407	12,349	12,222
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**116,132**	**177,302**	**360,027**	**359,112**	**357,567**	**334,819**	**321,911**	**321,188**	**344,391**	**411,869**	**540,282**
Average Annual Growth Rate			**8.83%**	**26.63%**	**-0.25%**	**-0.43%**	**-1.31%**	**-0.78%**	**-0.04%**	**0.70%**	**1.81%**	**2.75%**

Containerized US Commodity Forecast For HI-TECH PRODUCTS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	2,289	1,504	1,348	1,387	1,411	1,779	2,126	2,511	3,577	5,374	8,957
North Atlantic	Asia	16,116	21,479	35,735	38,420	41,334	58,287	79,961	113,882	237,274	507,114	1,110,982
North Atlantic	Europe	47,409	56,749	57,271	57,242	57,638	67,699	75,437	86,334	120,467	182,411	302,919
North Atlantic	Mideast	2,875	6,256	5,920	6,054	6,343	8,307	10,036	11,840	16,052	21,268	27,668
North Atlantic	North America	70	15	15	17	19	28	38	48	78	122	180
North Atlantic	South America	19,486	34,438	25,749	27,908	28,945	37,191	45,428	52,654	69,533	90,422	120,289
North Atlantic	Caribbean	193	271	852	890	933	1,249	1,838	2,954	7,506	18,545	43,067
South Atlantic	Africa	612	615	594	625	656	855	1,095	1,434	2,658	5,387	11,927
South Atlantic	Asia	10,848	6,047	6,265	6,827	7,374	10,709	15,117	21,946	47,273	103,702	229,744
South Atlantic	Europe	9,967	14,650	13,302	13,407	14,140	16,714	18,498	20,618	26,801	37,096	56,754
South Atlantic	Mideast	570	941	821	860	928	1,342	1,795	2,288	3,559	5,230	7,311
South Atlantic	North America	195	1,090	910	1,036	1,124	1,697	2,216	2,704	3,821	5,019	6,240
South Atlantic	South America	73,566	80,139	48,683	52,688	55,576	76,183	100,920	132,958	241,440	466,130	972,250
South Atlantic	Caribbean	9,052	12,226	13,657	14,841	16,210	26,079	43,475	74,601	200,190	500,513	1,160,651
Gulf Coast	Africa	188	849	467	482	492	622	732	835	1,064	1,322	1,613
Gulf Coast	Asia	1,383	1,475	2,169	2,340	2,559	3,994	6,038	9,472	22,912	54,371	127,801
Gulf Coast	Europe	8,869	19,835	14,398	14,416	14,993	17,687	19,831	22,671	32,076	49,942	87,665
Gulf Coast	Mideast	336	366	365	382	412	554	693	837	1,216	1,745	2,471
Gulf Coast	North America	217	558	967	1,084	1,173	1,767	2,342	2,902	4,194	5,638	7,189
Gulf Coast	South America	10,019	11,100	10,095	11,029	11,822	16,067	20,813	24,786	32,807	40,929	51,995
Gulf Coast	Caribbean	658	1,139	1,250	1,343	1,451	2,202	3,409	5,370	12,993	30,508	68,049
South Pacific	Africa	168	44	93	97	101	134	164	191	243	293	342
South Pacific	Asia	155,549	151,852	145,104	156,926	168,253	233,022	314,001	432,175	854,114	1,755,301	3,663,732
South Pacific	Europe	12,369	10,176	9,615	9,583	9,893	11,753	12,953	14,335	18,187	24,039	33,802
South Pacific	Mideast	322	340	297	318	343	464	593	727	1,034	1,378	1,752
South Pacific	North America	170	558	1,187	1,351	1,455	1,901	2,215	2,413	2,779	3,094	3,416
South Pacific	South America	13,593	9,835	4,937	5,239	5,419	6,751	8,260	10,061	15,467	25,005	43,181
South Pacific	Caribbean	261	381	1,518	1,699	1,910	3,316	5,448	8,329	18,744	40,397	83,382
North Pacific	Africa	0	22	10	11	11	15	18	21	27	35	43
North Pacific	Asia	35,459	19,392	20,953	22,624	24,493	32,863	43,598	59,051	111,038	214,301	422,208
North Pacific	Europe	311	2,072	223	228	237	264	289	319	401	507	643
North Pacific	Mideast	10	18	5	5	5	7	8	10	13	17	21
North Pacific	North America	78	17	53	54	50	68	82	101	145	200	267
North Pacific	South America	443	7,353	99	106	111	151	207	293	592	1,168	2,236
North Pacific	Caribbean	33	7	12	14	16	32	63	126	392	1,054	2,546
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	0	0	59	60	64	80	94	109	150	204	274
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**433,681**	**473,808**	**425,001**	**451,593**	**477,895**	**641,832**	**839,831**	**1,121,907**	**2,110,817**	**4,199,781**	**8,663,568**
Average Annual Growth Rate			**1.79%**	**-3.56%**	**6.26%**	**5.82%**	**6.08%**	**5.52%**	**5.96%**	**6.52%**	**7.12%**	**7.51%**

Containerized US Commodity Forecast For INTERMEDIATE MANUFACTURED PRODUCTS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	15,027	15,200	21,820	20,791	19,878	22,988	25,557	27,541	31,400	35,082	38,541
North Atlantic	Asia	255,920	165,094	529,039	548,958	565,169	698,131	858,533	994,687	1,376,050	1,996,397	3,054,464
North Atlantic	Europe	256,167	320,794	526,562	546,168	588,573	759,809	950,498	1,133,391	1,560,001	2,147,988	3,056,315
North Atlantic	Mideast	57,131	41,552	49,700	50,887	49,665	61,377	69,955	76,311	89,855	104,642	120,969
North Atlantic	North America	1,757	290	180	193	203	251	298	330	390	449	509
North Atlantic	South America	177,405	101,042	88,925	95,575	96,145	106,754	117,771	126,925	146,549	168,125	192,221
North Atlantic	Caribbean	2,739	5,003	5,343	5,282	5,252	5,591	6,873	9,504	22,281	53,961	110,106
South Atlantic	Africa	3,386	5,023	5,161	4,778	4,423	5,247	5,891	6,450	7,599	8,714	9,723
South Atlantic	Asia	90,859	122,350	139,609	148,624	155,568	185,146	226,456	271,322	412,835	679,154	1,196,529
South Atlantic	Europe	118,393	146,571	188,131	193,401	196,726	234,859	270,400	306,521	398,746	537,157	766,077
South Atlantic	Mideast	11,943	17,861	16,704	16,801	16,369	19,161	21,605	23,613	28,261	34,165	41,756
South Atlantic	North America	2,850	3,579	2,371	2,603	2,765	3,555	4,468	5,205	6,806	8,701	10,988
South Atlantic	South America	264,175	242,307	192,308	204,830	208,773	239,442	268,398	290,883	336,213	384,317	437,739
South Atlantic	Caribbean	55,007	65,627	61,589	63,355	65,242	80,133	107,584	156,599	382,650	936,150	1,915,277
Gulf Coast	Africa	4,238	8,009	7,404	7,445	7,332	7,433	7,390	7,466	7,656	7,949	8,318
Gulf Coast	Asia	42,850	15,878	142,392	147,822	151,316	184,396	225,855	265,305	383,984	599,843	1,029,080
Gulf Coast	Europe	101,875	106,555	164,650	168,440	176,871	224,244	271,810	312,988	401,973	508,349	641,104
Gulf Coast	Mideast	12,176	10,813	6,993	6,903	6,575	7,605	8,519	9,576	12,385	16,522	22,527
Gulf Coast	North America	8,256	7,300	6,578	7,204	7,626	9,611	11,886	13,598	17,120	20,950	25,226
Gulf Coast	South America	175,657	165,389	109,359	116,757	118,171	129,840	140,603	149,411	166,804	185,179	205,953
Gulf Coast	Caribbean	30,562	38,402	34,592	36,142	37,308	43,470	53,561	70,927	153,100	358,407	724,164
South Pacific	Africa	144	428	284	276	267	288	309	326	362	398	433
South Pacific	Asia	1,127,543	640,412	564,788	598,096	625,570	757,003	935,854	1,142,042	1,804,306	3,084,425	5,593,008
South Pacific	Europe	18,733	16,422	23,900	24,502	25,217	29,977	35,431	40,234	51,087	64,930	84,234
South Pacific	Mideast	2,065	1,013	1,330	1,319	1,284	1,477	1,643	1,808	2,202	2,687	3,271
South Pacific	North America	2,397	5,816	1,181	1,270	1,320	1,601	1,885	2,056	2,370	2,686	3,023
South Pacific	South America	23,131	23,995	18,308	19,008	19,312	21,978	25,208	28,692	37,587	48,248	59,482
South Pacific	Caribbean	2,316	4,961	8,267	8,653	9,100	12,411	18,403	29,193	79,160	201,822	419,056
North Pacific	Africa	0	243	239	243	247	285	327	362	432	504	581
North Pacific	Asia	591,358	177,316	203,736	218,636	229,005	255,026	294,994	343,408	510,951	842,780	1,483,244
North Pacific	Europe	5,189	3,288	2,681	2,781	2,995	4,010	5,064	6,660	12,648	24,963	49,124
North Pacific	Mideast	118	9	7	7	8	9	10	12	14	17	21
North Pacific	North America	1,151	925	11,630	11,678	12,183	14,718	17,029	18,992	23,032	27,449	32,309
North Pacific	South America	2,116	1,085	605	635	638	721	835	924	1,107	1,296	1,500
North Pacific	Caribbean	93	114	34	37	40	63	101	169	482	1,250	2,611
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	42	0	0	0	0	0	0	0	0	0	0
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**3,464,770**	**2,480,665**	**3,136,402**	**3,280,103**	**3,407,135**	**4,128,610**	**4,991,004**	**5,873,427**	**8,468,397**	**13,095,639**	**21,339,483**
Average Annual Growth Rate			**-6.46%**	**8.13%**	**4.58%**	**3.87%**	**3.92%**	**3.87%**	**3.31%**	**3.73%**	**4.46%**	**5.00%**

Containerized US Commodity Forecast For MATERIALS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	33,471	22,889	31,119	30,741	29,167	30,152	31,568	33,815	40,732	53,996	83,011
North Atlantic	Asia	1,518,550	1,601,807	2,691,495	2,701,926	2,593,694	2,164,129	1,886,306	1,818,464	1,714,094	1,685,547	1,710,117
North Atlantic	Europe	857,512	575,967	502,524	527,648	524,784	417,214	377,268	381,816	430,798	579,030	941,941
North Atlantic	Mideast	90,285	103,665	65,269	66,307	67,239	58,857	53,675	53,271	53,399	55,105	58,659
North Atlantic	North America	15,950	8,400	17,701	17,277	17,172	15,599	15,235	15,911	17,143	18,502	20,046
North Atlantic	South America	301,199	304,779	254,988	257,114	250,051	234,629	232,235	239,724	259,651	280,364	300,377
North Atlantic	Caribbean	20,731	31,827	59,879	64,162	69,042	101,698	155,962	228,131	482,724	992,196	1,972,423
South Atlantic	Africa	8,203	12,915	11,124	11,360	11,380	14,709	21,243	33,951	87,270	218,788	550,406
South Atlantic	Asia	1,155,347	1,295,155	1,505,806	1,556,039	1,533,877	1,415,949	1,367,870	1,461,967	1,729,155	2,083,827	2,463,975
South Atlantic	Europe	785,911	988,212	1,021,710	1,086,543	1,116,632	951,725	906,929	951,193	1,071,288	1,246,819	1,488,299
South Atlantic	Mideast	134,884	154,743	172,825	172,012	167,969	167,286	165,053	170,517	184,899	202,717	224,333
South Atlantic	North America	17,736	54,604	18,552	18,857	19,233	19,443	20,654	21,592	23,329	25,648	28,384
South Atlantic	South America	709,528	625,448	529,911	534,966	527,704	518,211	519,031	541,989	605,651	678,822	758,799
South Atlantic	Caribbean	180,973	224,794	387,476	429,609	477,888	804,394	1,350,489	2,069,061	4,641,889	9,848,489	19,924,237
Gulf Coast	Africa	9,804	10,892	15,296	14,989	14,332	14,583	15,890	18,790	31,484	62,747	141,022
Gulf Coast	Asia	326,921	237,040	236,724	238,574	228,214	192,348	173,871	177,924	197,265	229,270	267,530
Gulf Coast	Europe	395,543	403,541	328,834	352,172	362,711	320,530	314,532	333,553	382,422	451,891	545,438
Gulf Coast	Mideast	51,653	66,448	39,550	39,469	38,513	41,294	43,457	46,757	54,374	63,458	74,313
Gulf Coast	North America	14,380	70,147	139,802	141,170	143,794	145,243	153,093	161,056	176,839	195,719	216,433
Gulf Coast	South America	222,932	167,393	147,053	144,983	141,043	130,954	127,433	129,178	137,238	148,180	159,743
Gulf Coast	Caribbean	231,294	318,033	464,921	485,442	508,305	656,100	887,740	1,187,580	2,218,064	4,220,275	8,005,117
South Pacific	Africa	858	1,640	2,051	1,942	1,875	1,728	1,588	1,443	1,339	1,153	992
South Pacific	Asia	3,772,932	3,629,618	5,760,506	5,740,190	5,500,586	4,602,978	3,952,103	3,726,523	3,360,141	3,200,826	3,232,707
South Pacific	Europe	78,044	25,693	12,599	13,409	13,224	10,277	9,003	8,575	7,937	7,673	7,841
South Pacific	Mideast	2,945	2,758	1,281	1,260	1,231	1,244	1,228	1,212	1,239	1,320	1,454
South Pacific	North America	894	2,141	1,352	1,350	1,384	1,509	1,645	1,759	1,993	2,300	2,690
South Pacific	South America	117,182	99,711	109,447	105,218	100,399	82,521	70,134	61,663	51,593	47,197	45,454
South Pacific	Caribbean	6,239	6,496	23,023	25,032	27,340	42,827	68,890	103,774	227,569	477,048	959,022
North Pacific	Africa	500	794	312	311	311	300	279	266	250	244	242
North Pacific	Asia	3,167,194	2,138,845	2,186,659	2,243,087	2,184,200	1,980,415	1,871,666	1,926,520	2,116,171	2,366,826	2,603,442
North Pacific	Europe	26,838	10,803	4,793	4,956	4,976	4,152	3,859	3,912	4,358	5,633	8,624
North Pacific	Mideast	68	18	1,294	1,220	1,130	931	845	735	546	410	319
North Pacific	North America	67	910	7,772	7,773	7,779	7,534	7,881	8,480	9,862	11,456	13,138
North Pacific	South America	12,491	12,742	7,381	7,315	7,139	6,526	6,162	6,173	6,344	6,621	6,956
North Pacific	Caribbean	0	1,297	2,282	2,324	2,367	2,609	2,918	3,305	4,398	6,057	8,671
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**14,269,058**	**13,212,162**	**16,763,311**	**17,046,747**	**16,696,685**	**15,160,598**	**14,817,735**	**15,930,581**	**20,333,451**	**29,476,153**	**46,826,158**
Average Annual Growth Rate			**-1.53%**	**8.26%**	**1.69%**	**-2.05%**	**-1.91%**	**-0.46%**	**1.46%**	**2.47%**	**3.78%**	**4.74%**

Containerized US Commodity Forecast For ALL COMMODITIES
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	155,673	116,687	145,972	142,372	141,002	157,838	171,520	184,613	215,401	258,341	327,416
North Atlantic	Asia	3,257,433	3,197,706	5,291,108	5,447,710	5,421,796	5,488,907	5,727,530	6,284,658	8,105,690	11,613,353	18,530,460
North Atlantic	Europe	3,467,878	3,174,448	3,044,402	3,106,671	3,148,029	3,423,110	3,768,017	4,178,586	5,276,538	7,002,312	9,912,869
North Atlantic	Mideast	314,488	370,792	300,239	307,715	314,243	363,922	397,917	436,004	523,612	628,225	751,472
North Atlantic	North America	24,263	15,661	29,329	29,206	29,430	29,306	29,953	32,099	36,775	42,217	48,271
North Atlantic	South America	1,190,937	1,108,259	992,857	1,036,398	1,044,398	1,161,705	1,263,689	1,371,771	1,637,112	1,988,224	2,436,367
North Atlantic	Caribbean	42,584	71,121	117,154	122,002	127,724	163,672	221,460	299,949	579,864	1,143,113	2,216,724
South Atlantic	Africa	64,889	82,641	57,843	57,313	57,867	69,520	82,572	102,778	174,979	334,360	710,805
South Atlantic	Asia	3,022,237	3,490,230	4,550,815	4,749,467	4,816,949	5,034,474	5,310,283	5,813,036	7,263,757	9,593,971	13,152,591
South Atlantic	Europe	2,207,659	2,491,972	2,621,351	2,712,309	2,731,237	2,653,835	2,714,374	2,888,243	3,397,050	4,224,472	5,499,863
South Atlantic	Mideast	219,435	313,436	430,999	432,305	430,103	505,921	544,622	593,771	710,820	852,232	1,016,274
South Atlantic	North America	47,137	105,832	109,640	114,242	117,501	135,782	151,304	163,403	189,291	217,052	246,690
South Atlantic	South America	2,225,247	2,125,267	1,823,287	1,893,402	1,919,515	2,155,403	2,399,493	2,699,039	3,674,255	5,389,813	8,050,297
South Atlantic	Caribbean	479,622	731,854	823,680	877,815	936,833	1,311,855	1,919,069	2,739,060	5,720,748	11,856,586	23,656,422
Gulf Coast	Africa	73,790	133,990	181,305	177,604	177,106	215,838	246,313	287,028	418,920	652,805	1,041,517
Gulf Coast	Asia	1,224,516	838,582	1,256,107	1,314,990	1,330,746	1,424,858	1,574,522	1,810,645	2,591,302	4,130,959	7,139,491
Gulf Coast	Europe	2,268,672	2,850,724	3,071,223	3,101,186	3,087,737	3,368,724	3,642,043	3,941,597	4,718,709	5,863,767	7,618,868
Gulf Coast	Mideast	222,998	399,751	523,515	534,251	540,111	653,083	727,685	807,194	991,057	1,209,878	1,461,134
Gulf Coast	North America	60,984	245,189	1,034,500	1,109,981	1,175,194	1,565,690	1,794,353	2,014,895	2,483,217	2,988,347	3,514,786
Gulf Coast	South America	2,371,941	2,321,560	2,263,894	2,373,924	2,405,583	2,741,573	3,065,370	3,445,239	4,625,130	6,697,741	9,872,953
Gulf Coast	Caribbean	694,456	975,730	1,225,270	1,277,055	1,326,114	1,573,046	1,890,889	2,293,140	3,613,954	6,069,706	10,492,443
South Pacific	Africa	8,658	7,723	10,552	10,055	9,780	11,593	12,739	13,882	16,595	19,903	24,271
South Pacific	Asia	15,966,463	15,420,181	17,864,484	18,433,056	18,585,761	19,974,852	21,334,942	23,664,986	30,876,508	44,471,145	70,644,464
South Pacific	Europe	650,993	621,031	576,980	579,615	563,639	611,551	636,091	666,099	747,960	869,678	1,058,717
South Pacific	Mideast	26,728	52,711	82,590	83,671	84,267	102,125	112,695	123,505	148,193	177,137	209,712
South Pacific	North America	7,606	35,473	27,002	29,414	30,732	36,510	40,461	43,581	49,944	56,919	64,677
South Pacific	South America	304,246	317,106	274,763	280,364	281,506	299,142	311,991	329,586	380,540	455,213	555,279
South Pacific	Caribbean	30,654	62,201	94,413	99,913	105,283	134,485	172,533	224,740	416,068	817,619	1,568,093
North Pacific	Africa	3,877	3,325	13,571	13,208	12,934	14,130	14,858	15,420	16,202	16,867	17,546
North Pacific	Asia	10,086,754	8,441,668	8,773,273	9,156,602	9,391,896	10,519,551	11,224,340	12,199,507	14,765,190	18,369,976	24,205,502
North Pacific	Europe	227,832	218,964	225,283	237,713	242,197	256,523	253,276	263,225	309,585	386,010	503,040
North Pacific	Mideast	1,852	3,467	6,748	6,692	6,773	7,663	8,397	9,120	10,615	12,304	14,194
North Pacific	North America	8,408	16,065	26,787	26,944	27,728	31,147	34,371	37,862	45,239	53,427	62,374
North Pacific	South America	112,825	98,961	94,949	99,296	101,235	113,193	121,795	130,705	148,999	170,904	198,548
North Pacific	Caribbean	852	16,452	21,736	22,377	22,936	25,515	27,085	28,547	31,837	36,435	43,361
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	42	0	3,679	3,878	4,218	6,488	7,907	8,359	9,423	10,585	11,738
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**51,074,627**	**50,476,759**	**57,991,298**	**60,000,717**	**60,750,104**	**66,342,530**	**71,956,461**	**80,145,876**	**104,921,079**	**148,681,598**	**226,879,229**
Average Annual Growth Rate			**-0.24%**	**4.73%**	**3.47%**	**1.25%**	**1.78%**	**1.64%**	**2.18%**	**2.73%**	**3.55%**	**4.32%**

Containerized U.S. Commodity by Destination (Metric Tonnes)

Containerized US Commodity Forecast For AGRICULTURE COMMODITIES
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	6,224	36,977	35,912	33,907	33,774	33,624	32,451	31,075	28,351	25,770	23,803
North Atlantic	Asia	188,112	221,765	275,877	282,460	302,723	318,067	325,100	266,233	295,281	331,041	372,837
North Atlantic	Europe	125,088	254,115	282,734	278,065	279,272	307,792	314,674	288,436	309,304	339,011	374,620
North Atlantic	Mideast	19,672	15,651	18,806	20,485	21,956	25,470	27,673	26,887	29,925	33,627	38,038
North Atlantic	North America	4,450	28,216	11,388	11,028	10,358	7,587	6,238	5,436	5,051	5,471	6,360
North Atlantic	South America	186,786	389,451	643,450	647,331	667,397	731,673	806,369	856,099	1,058,668	1,308,704	1,600,105
North Atlantic	Caribbean	12,116	40,946	62,501	60,935	59,969	52,247	48,531	43,573	34,152	26,571	20,979
South Atlantic	Africa	3,076	2,479	455	448	470	497	515	500	533	572	618
South Atlantic	Asia	90,915	66,223	66,620	67,448	67,459	60,466	56,756	47,742	49,571	54,369	60,810
South Atlantic	Europe	24,483	161,255	147,274	140,657	138,682	177,214	184,938	173,313	168,426	171,698	180,565
South Atlantic	Mideast	1,837	6,735	848	899	940	925	913	783	750	718	690
South Atlantic	North America	1,084	29,101	15,066	15,786	16,475	16,921	17,135	17,186	17,258	17,249	17,166
South Atlantic	South America	345,711	461,222	616,895	615,752	638,346	701,779	725,614	735,909	764,929	784,459	794,277
South Atlantic	Caribbean	89,427	171,819	133,322	133,052	132,205	126,024	124,402	121,121	114,935	107,734	98,261
Gulf Coast	Africa	2,106	2,289	992	1,027	1,064	1,164	1,191	1,165	1,222	1,303	1,410
Gulf Coast	Asia	58,166	36,992	46,460	47,057	45,008	34,088	28,229	24,317	22,090	22,253	23,472
Gulf Coast	Europe	6,510	18,559	92,496	96,403	96,213	106,141	108,670	103,799	99,596	96,678	90,830
Gulf Coast	Mideast	1,625	118	156	154	161	154	154	93	96	104	114
Gulf Coast	North America	88,494	132,200	42,909	39,481	34,887	19,260	11,442	6,855	2,540	937	355
Gulf Coast	South America	232,033	512,061	752,745	752,125	767,025	788,895	784,960	778,451	773,904	764,242	745,374
Gulf Coast	Caribbean	96,845	124,090	64,016	60,803	58,806	46,814	39,434	32,361	21,990	15,478	11,525
South Pacific	Africa	235	795	639	713	801	868	933	458	558	671	798
South Pacific	Asia	237,641	493,688	589,023	603,026	639,783	697,485	746,243	703,087	815,387	944,857	1,088,370
South Pacific	Europe	18,136	22,219	37,837	36,839	36,207	44,283	46,466	45,817	51,626	58,977	67,056
South Pacific	Mideast	954	683	858	920	945	999	1,018	943	981	1,062	1,177
South Pacific	North America	7,281	9,783	8,942	9,342	9,576	9,518	10,036	10,665	12,932	15,944	19,567
South Pacific	South America	102,015	161,209	182,780	190,728	193,721	188,072	186,057	175,912	171,223	171,459	176,088
South Pacific	Caribbean	22,750	179,382	290,667	312,251	322,696	260,459	250,767	223,328	160,619	103,594	59,764
North Pacific	Africa	57	30	30	28	26	16	11	8	4	2	1
North Pacific	Asia	55,300	115,688	148,496	146,455	154,318	170,847	186,678	179,190	211,735	246,368	282,887
North Pacific	Europe	145	3,037	6,292	6,265	6,293	6,438	6,465	6,118	7,188	7,359	7,566
North Pacific	Mideast	29	25	44	47	49	56	59	60	66	73	83
North Pacific	North America	19,565	28,954	30,264	34,864	39,279	48,972	58,134	67,011	86,932	109,997	136,274
North Pacific	South America	87,828	30,891	43,817	43,609	43,981	44,192	45,648	47,088	52,582	60,366	70,129
North Pacific	Caribbean	4,434	11,921	16,203	15,811	15,565	13,467	12,447	11,097	8,470	6,317	4,704
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0				
Great Lakes	Europe	8	5	26,494	25,792	27,156	31,515	36,230	40,931	51,168	62,531	75,129
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**2,141,139**	**3,770,574**	**4,693,308**	**4,731,992**	**4,863,585**	**5,073,988**	**5,232,579**	**5,073,045**	**5,430,043**	**5,897,568**	**6,451,802**
Average Annual Growth Rate			**11.98%**	**7.57%**	**0.82%**	**2.78%**	**0.85%**	**0.62%**	**-0.62%**	**0.68%**	**0.83%**	**0.90%**

Containerized US Commodity Forecast For CAPITAL EQUIPMENT
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	16,969	40,326	43,145	48,551	55,183	89,898	113,042	136,757	195,130	269,478	360,178
North Atlantic	Asia	218,858	349,822	525,180	574,744	626,507	882,131	1,059,602	1,236,834	1,676,830	2,244,553	2,930,990
North Atlantic	Europe	958,891	1,034,496	992,664	1,076,428	1,184,838	1,642,804	1,949,076	2,278,937	3,052,620	3,976,089	5,031,611
North Atlantic	Mideast	15,079	20,601	24,304	26,166	29,383	46,695	57,348	67,540	91,545	120,408	153,357
North Atlantic	North America	1,113	249	183	209	237	361	465	585	917	1,422	2,171
North Atlantic	South America	361,906	460,480	621,505	694,449	704,283	889,903	1,054,024	1,207,954	1,549,406	1,911,329	2,273,531
North Atlantic	Caribbean	4	42	33	38	42	56	63	69	86	112	150
South Atlantic	Africa	8,784	9,594	29,427	32,527	37,012	57,966	69,626	80,691	106,173	136,121	169,923
South Atlantic	Asia	219,017	376,794	505,760	567,193	630,096	963,655	1,244,990	1,559,228	2,440,625	3,788,520	5,749,955
South Atlantic	Europe	335,806	507,101	542,760	570,723	617,327	900,270	1,112,289	1,344,313	1,912,840	2,639,875	3,533,634
South Atlantic	Mideast	7,866	12,670	13,857	14,477	16,346	26,942	34,063	41,037	58,076	80,001	107,141
South Atlantic	North America	1,330	3,600	1,528	1,717	1,908	2,916	3,645	4,385	6,203	8,554	11,498
South Atlantic	South America	112,678	176,563	194,299	217,247	236,512	345,746	423,596	500,952	694,648	944,650	1,254,281
South Atlantic	Caribbean	95	664	385	436	486	788	983	1,178	1,645	2,231	2,949
Gulf Coast	Africa	3,730	5,162	4,263	4,751	5,299	6,708	7,535	8,227	9,774	11,496	13,317
Gulf Coast	Asia	26,171	47,611	51,492	58,661	66,589	103,014	132,560	164,242	251,271	379,359	559,614
Gulf Coast	Europe	192,581	253,668	257,581	286,393	320,651	429,272	518,128	619,808	876,414	1,213,656	1,636,551
Gulf Coast	Mideast	4,920	1,481	4,075	3,976	4,429	7,317	9,526	11,804	17,807	26,248	37,574
Gulf Coast	North America	288	2,737	733	845	966	1,205	1,430	1,669	2,274	3,066	4,054
Gulf Coast	South America	46,800	82,851	111,651	122,278	131,506	183,008	219,898	253,333	340,561	457,747	610,858
Gulf Coast	Caribbean	35	811	909	1,046	1,194	1,781	2,216	2,675	3,834	5,395	7,442
South Pacific	Africa	245	1,911	2,049	2,320	2,636	3,556	4,239	4,909	6,522	8,515	10,872
South Pacific	Asia	2,862,214	3,742,937	4,411,994	4,799,545	5,234,368	7,527,809	9,073,201	10,571,775	14,135,779	18,472,503	23,418,849
South Pacific	Europe	81,728	111,329	90,378	98,072	108,415	156,002	189,785	226,655	316,494	430,763	571,185
South Pacific	Mideast	1,803	2,814	3,439	3,760	4,316	7,558	10,129	12,916	20,363	30,964	45,401
South Pacific	North America	273	406	396	442	492	732	892	1,042	1,389	1,806	2,291
South Pacific	South America	1,782	2,895	9,759	10,882	12,079	17,921	22,375	27,093	39,214	55,952	78,733
South Pacific	Caribbean	44	76	60	69	78	119	150	184	271	387	542
North Pacific	Africa	12	44	166	182	202	326	399	467	623	812	1,033
North Pacific	Asia	1,190,450	1,170,010	1,317,954	1,459,085	1,608,484	2,393,922	2,911,622	3,407,944	4,570,613	5,961,628	7,531,440
North Pacific	Europe	11,494	15,179	11,674	12,956	14,519	19,482	23,294	27,768	39,157	54,322	73,664
North Pacific	Mideast	0	9	42	41	46	73	92	112	160	226	310
North Pacific	North America	241	68	699	785	872	1,252	1,412	1,516	1,708	1,881	2,029
North Pacific	South America	373	221	377	423	462	774	1,024	1,292	2,025	3,111	4,674
North Pacific	Caribbean	0	1	5	6	7	10	13	16	25	37	53
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	661	96	392	414	459	680	810	916	1,140	1,378	1,623
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**6,684,242**	**8,435,319**	**9,775,119**	**10,691,836**	**11,658,227**	**16,712,651**	**20,253,544**	**23,806,822**	**32,424,161**	**43,244,597**	**56,193,478**
Average Annual Growth Rate			**4.76%**	**5.04%**	**9.38%**	**9.04%**	**7.47%**	**3.92%**	**3.29%**	**3.14%**	**2.92%**	**2.65%**

Containerized US Commodity Forecast For CHEMICALS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	7,238	19,935	25,115	26,953	29,841	33,915	41,614	48,255	66,803	92,691	128,432
North Atlantic	Asia	302,263	441,012	603,981	614,671	652,936	767,652	832,255	869,793	980,898	1,160,856	1,423,132
North Atlantic	Europe	909,234	1,167,020	1,275,442	1,273,761	1,343,031	1,708,922	1,752,097	1,704,198	1,783,768	2,006,921	2,289,796
North Atlantic	Mideast	68,448	146,214	135,730	142,429	150,519	178,886	201,043	223,030	273,030	332,053	401,800
North Atlantic	North America	3,450	2,860	1,176	1,217	1,311	1,539	1,654	1,694	1,761	1,813	1,848
North Atlantic	South America	127,360	201,746	278,550	286,892	304,884	341,849	373,838	385,442	412,958	447,462	491,128
North Atlantic	Caribbean	281	624	416	455	508	662	737	782	872	959	1,044
South Atlantic	Africa	8,400	8,448	6,161	6,835	7,676	9,722	11,572	13,238	17,333	22,553	29,025
South Atlantic	Asia	204,437	276,015	334,182	325,952	329,069	336,392	345,275	347,207	375,662	444,755	560,481
South Atlantic	Europe	357,906	483,421	582,602	586,560	613,992	776,783	820,021	822,039	923,366	1,149,565	1,471,217
South Atlantic	Mideast	26,816	25,537	34,952	35,475	37,344	43,517	47,407	49,288	54,493	62,135	72,118
South Atlantic	North America	19,613	45,009	23,727	23,483	24,274	25,939	26,913	26,238	25,125	24,540	24,754
South Atlantic	South America	78,460	96,624	110,648	110,695	115,121	133,421	148,795	156,587	174,636	197,892	228,981
South Atlantic	Caribbean	160	9,643	3,117	3,580	4,166	5,974	7,284	8,708	12,402	17,569	24,599
Gulf Coast	Africa	5,838	13,494	24,621	25,553	27,811	35,528	40,859	45,198	55,233	67,460	82,025
Gulf Coast	Asia	65,596	91,680	89,167	89,249	94,478	108,781	115,361	116,014	117,848	122,966	131,631
Gulf Coast	Europe	478,456	671,249	742,138	774,559	843,740	1,123,954	1,199,224	1,192,255	1,266,917	1,494,236	1,839,556
Gulf Coast	Mideast	18,917	22,005	21,595	22,200	23,028	26,189	28,484	31,040	36,757	43,365	50,986
Gulf Coast	North America	88,670	59,452	79,283	78,236	81,600	84,556	85,228	80,331	71,328	63,972	58,946
Gulf Coast	South America	61,491	114,888	136,911	138,290	145,875	158,096	168,916	169,976	175,367	186,728	206,659
Gulf Coast	Caribbean	985	10,334	4,908	5,477	6,181	8,252	9,956	11,620	15,898	21,813	29,817
South Pacific	Africa	36	128	101	99	104	140	171	198	259	332	419
South Pacific	Asia	786,379	1,656,164	1,817,174	1,862,375	1,967,620	2,391,605	2,746,165	3,044,017	3,825,514	4,938,619	6,406,644
South Pacific	Europe	102,213	86,064	97,337	96,641	99,571	117,377	116,676	110,537	110,201	120,971	136,866
South Pacific	Mideast	5,888	10,215	13,854	14,928	16,123	22,548	27,917	33,663	48,613	69,685	98,948
South Pacific	North America	30,301	1,256	2,409	2,218	2,175	2,214	2,113	1,894	1,511	1,210	986
South Pacific	South America	4,300	7,240	27,909	27,084	27,642	31,199	34,118	35,254	37,957	41,495	45,968
South Pacific	Caribbean	100	478	1,442	1,608	1,838	2,485	2,941	3,429	4,740	6,618	9,201
North Pacific	Africa	82	42	32	36	41	57	68	79	107	141	184
North Pacific	Asia	268,387	343,733	510,818	508,419	526,284	613,639	675,189	717,445	837,186	1,018,217	1,261,431
North Pacific	Europe	1,282	3,021	5,092	5,109	5,552	7,028	7,515	7,704	8,113	8,268	8,224
North Pacific	Mideast	36	209	3,275	3,586	3,886	5,642	7,116	8,684	12,714	18,360	26,213
North Pacific	North America	1,217	709	644	586	572	579	546	484	378	291	215
North Pacific	South America	277	794	544	534	545	604	653	662	682	709	745
North Pacific	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	497	65	465	533	615	896	1,142	1,421	2,201	3,387	5,120
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**4,035,016**	**6,016,724**	**6,995,518**	**7,096,276**	**7,489,955**	**9,106,543**	**9,880,862**	**10,268,404**	**11,732,629**	**14,190,587**	**17,549,140**
Average Annual Growth Rate			**8.32%**	**5.15%**	**1.44%**	**5.55%**	**3.99%**	**1.65%**	**0.77%**	**1.34%**	**1.92%**	**2.15%**

Containerized US Commodity Forecast For CONSUMER GOODS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	5,948	16,365	31,453	33,285	35,659	46,281	52,560	57,984	69,064	80,069	90,809
North Atlantic	Asia	547,133	994,924	1,649,790	1,734,826	1,887,012	2,689,597	3,158,250	3,668,557	4,908,956	6,452,315	8,287,809
North Atlantic	Europe	344,261	573,988	559,436	608,216	660,607	823,744	963,051	1,093,195	1,429,328	1,896,446	2,491,639
North Atlantic	Mideast	53,673	80,429	96,704	109,635	123,826	132,889	147,977	167,056	212,106	262,443	312,651
North Atlantic	North America	277	8,548	11,593	13,442	13,240	21,700	27,964	35,088	53,875	79,982	114,543
North Atlantic	South America	51,781	73,478	112,804	125,238	125,228	189,953	217,117	261,231	375,382	528,455	724,117
North Atlantic	Caribbean	386	9,978	14,620	14,682	15,022	15,832	16,195	16,398	16,918	17,173	17,176
South Atlantic	Africa	5,358	7,433	8,130	8,814	9,602	13,649	16,684	19,847	27,472	36,956	48,320
South Atlantic	Asia	327,600	690,730	1,070,435	1,162,667	1,299,661	2,072,836	2,659,352	3,359,393	5,279,664	8,092,308	12,036,940
South Atlantic	Europe	85,983	171,057	185,000	197,373	211,256	253,337	289,159	312,960	370,820	460,045	586,230
South Atlantic	Mideast	16,907	26,797	33,451	38,270	43,228	51,445	61,534	73,869	106,007	149,108	203,784
South Atlantic	North America	997	6,175	5,025	5,511	6,043	8,384	10,178	12,055	16,565	22,193	29,020
South Atlantic	South America	84,464	119,656	138,778	145,855	150,627	197,706	223,712	255,970	335,778	436,170	557,609
South Atlantic	Caribbean	121,288	415,836	415,968	427,185	447,113	530,269	611,377	696,581	906,027	1,150,510	1,425,147
Gulf Coast	Africa	894	1,358	1,343	1,489	1,593	2,269	2,669	3,068	3,978	5,020	6,164
Gulf Coast	Asia	4,236	6,052	36,478	38,826	43,494	68,640	86,076	106,831	163,293	245,033	358,644
Gulf Coast	Europe	37,315	81,716	83,843	90,929	98,657	125,942	147,526	164,548	203,968	260,585	338,015
Gulf Coast	Mideast	1,179	2,192	4,469	5,094	5,693	7,284	8,947	10,837	15,676	22,123	30,342
Gulf Coast	North America	1,450	65,563	78,519	82,597	88,578	116,405	137,394	157,561	203,104	255,423	313,658
Gulf Coast	South America	12,079	14,583	24,006	26,140	26,064	36,723	39,927	45,037	57,067	71,267	87,366
Gulf Coast	Caribbean	20,776	146,770	222,263	228,175	239,009	283,524	327,417	372,867	483,818	612,433	756,007
South Pacific	Africa	329	1,409	4,325	4,653	5,065	7,209	9,027	10,967	15,743	21,781	29,066
South Pacific	Asia	3,739,714	6,926,365	8,315,090	8,700,335	9,450,863	13,275,531	15,359,194	17,644,166	23,070,471	29,545,958	36,884,206
South Pacific	Europe	70,707	127,905	149,122	158,986	172,866	220,505	260,644	295,701	390,948	537,095	739,417
South Pacific	Mideast	3,397	9,984	12,529	14,301	16,296	25,551	27,013	32,470	45,815	62,211	76,578
South Pacific	North America	212	4,171	10,400	12,095	11,768	19,666	25,652	32,542	50,845	76,417	110,385
South Pacific	South America	4,935	8,348	14,899	16,124	16,673	22,082	24,559	27,909	36,093	46,297	58,502
South Pacific	Caribbean	12,343	15,282	47,373	48,675	50,996	60,536	69,857	79,596	103,478	131,311	162,537
North Pacific	Africa	12	85	281	310	332	475	573	673	907	1,184	1,497
North Pacific	Asia	964,917	1,342,935	1,391,539	1,456,624	1,581,908	2,219,637	2,566,475	2,949,098	3,860,990	4,950,503	6,183,156
North Pacific	Europe	1,787	4,685	7,562	8,088	8,677	11,642	14,014	16,363	21,773	28,192	35,466
North Pacific	Mideast	11	25	785	895	957	1,397	1,729	2,116	3,092	4,372	5,948
North Pacific	North America	35	98	129	140	147	197	240	290	418	590	812
North Pacific	South America	380	6,222	4,371	5,036	5,398	8,331	10,269	12,377	17,627	24,451	32,976
North Pacific	Caribbean	64	25	50	56	60	76	86	102	145	201	270
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	35	25	82	89	92	99	99	103	113	128	153
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**6,520,861**	**11,961,193**	**14,742,646**	**15,524,657**	**16,853,307**	**23,561,345**	**27,574,496**	**31,995,407**	**42,857,324**	**56,566,750**	**73,136,959**
Average Annual Growth Rate			**12.90%**	**7.22%**	**5.30%**	**8.56%**	**6.93%**	**3.20%**	**3.02%**	**2.97%**	**2.81%**	**2.60%**

Containerized US Commodity Forecast For EXTRACTIVE COMMODITIES
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	9,732	4,167	15,381	16,039	15,896	18,050	18,596	18,502	18,490	18,555	18,618
North Atlantic	Asia	91,078	33,039	100,510	95,822	98,716	88,570	81,193	74,536	63,886	56,567	52,254
North Atlantic	Europe	51,033	61,856	43,279	41,434	40,408	47,313	43,959	39,999	37,256	38,999	43,828
North Atlantic	Mideast	8,105	19,625	2,249	2,458	2,630	2,531	2,448	2,299	2,053	1,854	1,688
North Atlantic	North America	16,711	100	2,042	1,898	1,941	1,520	1,249	1,038	738	564	476
North Atlantic	South America	13,410	10,186	4,873	4,935	5,080	5,816	5,967	5,945	5,967	6,047	6,170
North Atlantic	Caribbean	6	55	0	0	0	0	0	0	0	0	0
South Atlantic	Africa	976	2,193	2,048	2,180	2,248	2,782	3,111	3,367	3,996	4,779	5,720
South Atlantic	Asia	2,234	1,345	1,564	1,603	1,633	1,828	1,930	2,000	2,176	2,413	2,723
South Atlantic	Europe	17,595	30,354	61,389	56,563	56,046	81,040	83,453	84,218	88,199	94,162	102,540
South Atlantic	Mideast	7,104	12,425	3,286	3,763	4,322	4,471	4,809	4,999	5,463	6,018	6,656
South Atlantic	North America	9,734	2,217	2,769	2,799	2,610	2,563	2,492	2,407	2,240	2,079	1,925
South Atlantic	South America	99,602	34,908	23,105	24,796	24,933	24,836	24,422	24,087	23,744	23,920	24,669
South Atlantic	Caribbean	6,172	3,022	2,892	3,120	3,168	2,950	2,719	2,519	2,137	1,787	1,473
Gulf Coast	Africa	4,073	8,135	6,644	7,391	8,352	9,543	9,634	9,391	9,012	8,712	8,468
Gulf Coast	Asia	19,394	10,609	32,900	34,605	36,393	39,728	40,272	40,035	40,191	40,839	42,063
Gulf Coast	Europe	9,493	38,419	19,539	18,069	17,319	20,042	16,656	14,189	12,434	12,505	13,337
Gulf Coast	Mideast	236	753	833	912	957	1,099	1,221	1,311	1,522	1,771	2,056
Gulf Coast	North America	16,724	8,002	29,735	33,372	35,073	38,577	39,536	39,629	40,232	41,107	42,096
Gulf Coast	South America	59,866	56,762	65,696	68,758	74,726	83,684	84,361	83,603	83,260	86,303	88,006
Gulf Coast	Caribbean	2,436	1,117	759	819	832	775	714	662	561	470	387
South Pacific	Africa	1,531	128	24	24	26	29	29	28	25	22	21
South Pacific	Asia	74,362	141,639	80,732	78,937	77,712	78,509	74,737	70,336	64,231	60,691	59,268
South Pacific	Europe	10,867	8,933	5,873	5,390	4,966	5,579	4,690	3,591	2,204	1,472	1,102
South Pacific	Mideast	291	6,113	1,307	1,471	1,633	1,755	1,913	2,013	2,255	2,546	2,875
South Pacific	North America	4,405	106,149	99,760	103,361	98,715	109,851	121,060	132,500	158,408	188,796	224,365
South Pacific	South America	7,352	8,659	15,025	16,001	16,084	18,737	20,342	21,833	25,568	30,471	36,759
South Pacific	Caribbean	299	2,739	3,014	3,336	3,474	3,668	3,833	4,027	4,388	4,713	4,987
North Pacific	Africa	7	701	4	4	4	5	4	4	3	3	3
North Pacific	Asia	11,151	23,270	17,674	17,606	17,046	17,850	17,579	16,979	16,262	15,995	16,113
North Pacific	Europe	306	2	81	77	75	81	77	72	62	53	43
North Pacific	Mideast	0	0	7	7	7	9	10	11	13	15	18
North Pacific	North America	40,047	83,134	59,243	61,527	59,255	63,869	68,615	73,625	85,410	99,776	117,043
North Pacific	South America	313	270	56	61	63	65	65	66	67	67	67
North Pacific	Caribbean	0	20	0	0	0	0	0	0	0	0	0
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	1	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	3,552	0	0	0	0	0	0	0	0	0	0
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**600,196**	**721,045**	**704,292**	**709,141**	**712,346**	**777,723**	**781,698**	**779,819**	**802,453**	**854,073**	**927,820**
Average Annual Growth Rate			**3.74%**	**-0.78%**	**0.69%**	**0.45%**	**1.77%**	**0.10%**	**-0.05%**	**0.29%**	**0.63%**	**0.83%**

Containerized US Commodity Forecast For FOOD
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	28,108	64,259	70,882	81,281	93,541	123,973	133,530	142,036	158,060	173,126	187,448
North Atlantic	Asia	856,353	1,191,386	1,684,891	1,626,358	1,751,608	2,209,903	2,364,648	2,524,778	2,856,690	3,205,289	3,562,196
North Atlantic	Europe	1,853,059	2,699,806	2,863,422	3,062,279	3,349,319	3,615,337	3,673,026	3,727,127	3,815,499	3,840,914	3,800,852
North Atlantic	Mideast	146,818	110,462	136,477	152,471	172,574	202,234	219,211	233,978	262,921	290,347	315,323
North Atlantic	North America	6,011	3,374	7,396	7,927	8,460	9,681	9,497	9,277	8,707	8,028	7,362
North Atlantic	South America	530,697	614,120	790,765	835,109	861,519	996,341	1,025,116	1,057,878	1,122,828	1,177,520	1,229,498
North Atlantic	Caribbean	11,041	14,770	14,024	14,540	14,841	14,338	13,566	13,014	11,962	10,760	9,816
South Atlantic	Africa	6,334	8,235	16,966	19,433	22,513	30,338	33,792	37,231	44,362	51,768	59,283
South Atlantic	Asia	163,818	227,213	332,323	322,231	340,846	417,275	444,978	473,402	532,660	598,697	673,256
South Atlantic	Europe	384,271	631,753	673,880	737,853	825,735	911,029	987,735	1,078,102	1,280,941	1,492,347	1,702,400
South Atlantic	Mideast	13,893	17,752	21,262	23,839	27,331	41,503	45,866	50,247	60,362	71,880	84,405
South Atlantic	North America	7,331	22,566	17,139	16,812	17,244	20,767	22,761	24,927	29,192	33,170	37,292
South Atlantic	South America	195,201	246,173	336,915	352,070	363,293	424,088	446,564	473,023	526,431	574,106	622,328
South Atlantic	Caribbean	50,229	65,701	77,194	77,642	82,299	82,534	78,219	75,361	69,166	60,954	53,537
Gulf Coast	Africa	594	8,338	7,824	9,163	10,730	14,538	16,566	18,647	22,993	27,515	32,092
Gulf Coast	Asia	56,278	64,671	142,629	137,962	146,681	193,421	203,761	213,302	231,529	249,748	268,095
Gulf Coast	Europe	210,857	312,105	517,528	565,160	630,503	682,359	732,131	790,463	915,012	1,035,336	1,141,624
Gulf Coast	Mideast	4,461	2,602	6,188	6,951	7,796	8,661	9,427	10,160	11,850	13,944	16,510
Gulf Coast	North America	27,657	8,744	112,033	107,512	107,939	133,800	149,966	166,171	198,229	229,419	259,170
Gulf Coast	South America	56,642	77,151	86,835	91,724	96,946	114,434	119,439	123,568	131,113	137,850	143,956
Gulf Coast	Caribbean	25,793	13,959	22,582	22,754	23,985	26,118	25,974	25,553	24,057	21,967	19,809
South Pacific	Africa	549	2,391	3,821	4,429	5,156	7,005	7,876	8,743	10,524	12,347	14,175
South Pacific	Asia	1,251,653	1,939,896	2,341,975	2,299,958	2,447,586	2,872,891	3,024,655	3,190,139	3,541,683	3,921,959	4,319,996
South Pacific	Europe	440,401	668,576	682,641	743,338	826,015	931,474	1,008,560	1,092,269	1,272,896	1,453,862	1,622,273
South Pacific	Mideast	3,473	6,614	11,507	13,006	14,860	17,365	20,495	23,756	31,390	40,741	52,009
South Pacific	North America	1,463	15,212	20,088	19,366	19,294	20,743	20,532	20,196	19,061	17,450	15,538
South Pacific	South America	86,984	116,320	175,404	181,618	186,690	214,502	232,409	252,462	297,009	346,829	401,306
South Pacific	Caribbean	6,444	8,893	14,673	15,422	16,720	18,021	18,580	19,305	20,886	22,565	24,508
North Pacific	Africa	100	104	319	377	445	603	699	801	1,016	1,242	1,472
North Pacific	Asia	190,812	208,982	243,364	234,975	252,740	306,073	328,980	352,690	402,202	454,473	508,685
North Pacific	Europe	16,360	27,783	36,702	39,783	44,467	53,972	59,680	65,661	78,332	92,102	106,537
North Pacific	Mideast	8	224	522	561	622	704	829	955	1,251	1,618	2,071
North Pacific	North America	333	947	4,509	4,747	5,254	6,468	6,523	6,630	6,675	6,502	6,141
North Pacific	South America	6,979	10,403	12,231	12,517	12,685	13,210	13,389	13,881	14,970	16,052	17,142
North Pacific	Caribbean	1,873	1,906	1,405	1,592	1,809	2,159	2,440	2,722	3,281	3,826	4,358
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	113	126	140	148	146	143	133	120	107
Great Lakes	Europe	82	130	1,122	1,189	1,288	1,657	1,842	2,022	2,523	3,209	4,086
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**6,642,959**	**9,413,524**	**11,489,550**	**11,844,075**	**12,791,474**	**14,739,666**	**15,503,407**	**16,320,620**	**18,018,399**	**19,699,582**	**21,326,656**
Average Annual Growth Rate			**7.22%**	**6.87%**	**3.09%**	**8.00%**	**2.88%**	**1.02%**	**1.03%**	**0.99%**	**0.90%**	**0.80%**

Containerized US Commodity Forecast For FUELS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	0	0	0	0	0	0	0	0	0	0	0
North Atlantic	Asia	34	214	5,916	6,943	7,524	9,930	12,394	14,989	21,226	29,103	38,810
North Atlantic	Europe	3,061	6,772	21,105	24,293	25,804	31,605	37,306	43,050	56,627	73,348	93,499
North Atlantic	Mideast	0	1	10,031	11,538	12,254	14,613	16,468	17,966	20,637	22,844	24,472
North Atlantic	North America	0	0	0	0	0	0	0	0	0	0	0
North Atlantic	South America	1	0	207,217	238,341	253,118	303,728	351,864	395,917	494,004	616,199	785,737
North Atlantic	Caribbean	0	0	0	0	0	0	0	0	0	0	0
South Atlantic	Africa	0	0	0	0	0	0	0	0	0	0	0
South Atlantic	Asia	1,787	1,699	1,978	2,254	2,372	2,704	2,920	3,059	3,265	3,392	3,442
South Atlantic	Europe	638	1,717	3,681	4,246	4,521	5,505	6,380	7,193	8,963	10,978	13,269
South Atlantic	Mideast	0	0	0	0	0	0	0	1	1	1	2
South Atlantic	North America	9	0	0	0	0	0	0	0	0	0	0
South Atlantic	South America	0	550	97,715	110,884	116,232	131,570	145,152	157,020	185,533	223,687	274,892
South Atlantic	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Gulf Coast	Africa	0	0	0	0	0	0	0	0	0	0	0
Gulf Coast	Asia	818	1,432	6,122	6,870	7,119	7,570	7,814	7,841	7,811	7,815	8,018
Gulf Coast	Europe	3,003	7,148	7,515	8,523	8,868	10,293	11,903	13,603	18,098	24,138	31,868
Gulf Coast	Mideast	0	260	151	178	194	262	335	415	613	873	1,203
Gulf Coast	North America	109	0	0	0	0	0	0	0	0	0	0
Gulf Coast	South America	0	131	157,440	178,982	187,964	214,827	239,233	261,339	314,833	386,231	481,224
Gulf Coast	Caribbean	0	0	0	0	0	0	0	0	0	0	0
South Pacific	Africa	0	0	0	0	0	0	0	0	0	0	0
South Pacific	Asia	1,915	1,634	19,742	22,722	24,148	29,130	34,113	38,831	49,777	64,075	84,564
South Pacific	Europe	4,487	2,627	3,198	3,726	4,007	5,126	6,248	7,404	10,154	13,589	17,791
South Pacific	Mideast	0	0	0	0	0	0	0	0	0	0	0
South Pacific	North America	0	0	0	0	0	0	0	0	0	0	0
South Pacific	South America	0	4,137	35,812	41,191	43,746	52,421	60,353	67,447	82,696	100,768	124,656
South Pacific	Caribbean	0	0	0	0	0	0	0	0	0	0	0
North Pacific	Africa	0	0	0	0	0	0	0	0	0	0	0
North Pacific	Asia	650	83	129	148	156	183	204	220	248	272	293
North Pacific	Europe	1	0	23	27	28	34	38	42	49	54	59
North Pacific	Mideast	0	0	0	0	0	0	0	0	0	0	0
North Pacific	North America	0	0	0	0	0	0	0	0	0	0	0
North Pacific	South America	0	199	2,763	3,178	3,375	4,048	4,686	5,268	6,557	8,153	10,354
North Pacific	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	0	0	2	2	2	3	3	3	4	4	4
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**16,514**	**28,605**	**580,539**	**664,046**	**701,431**	**823,553**	**937,414**	**1,041,606**	**1,281,094**	**1,585,523**	**1,994,157**
Average Annual Growth Rate			**11.61%**	**172.77%**	**14.38%**	**5.63%**	**3.26%**	**2.62%**	**2.13%**	**2.09%**	**2.15%**	**2.32%**

Containerized US Commodity Forecast For III-TECH PRODUCTS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	21	110	558	640	734	1,188	1,508	1,867	2,751	3,903	5,378
North Atlantic	Asia	67,691	121,557	148,555	155,111	172,091	279,893	392,412	528,061	920,109	1,542,211	2,489,208
North Atlantic	Europe	62,321	43,900	63,970	67,429	74,456	108,380	129,964	151,552	199,986	256,404	321,425
North Atlantic	Mideast	1,282	2,868	2,265	2,556	2,890	4,523	5,497	6,542	9,005	12,079	15,878
North Atlantic	North America	17	106	328	367	401	613	879	1,198	2,140	3,685	6,204
North Atlantic	South America	1,968	3,841	2,104	2,393	2,687	4,527	6,033	7,762	12,435	19,301	29,098
North Atlantic	Caribbean	1	0	0	0	0	0	0	0	0	0	0
South Atlantic	Africa	138	16	72	81	90	128	146	162	197	238	287
South Atlantic	Asia	74,224	120,173	148,801	154,939	167,675	258,676	345,412	446,880	733,051	1,172,157	1,820,865
South Atlantic	Europe	15,270	21,278	19,129	19,783	22,057	35,908	46,986	59,523	93,060	141,191	208,260
South Atlantic	Mideast	175	761	586	649	715	1,083	1,369	1,697	2,555	3,763	5,417
South Atlantic	North America	132	770	625	696	774	1,113	1,509	1,945	3,086	4,612	6,547
South Atlantic	South America	2,960	2,897	4,707	5,363	6,084	10,083	13,105	16,344	24,268	34,337	46,621
South Atlantic	Caribbean	21	12	32	36	41	58	66	73	86	97	105
Gulf Coast	Africa	7	68	0	0	0	0	0	0	0	1	1
Gulf Coast	Asia	1,067	3,347	5,027	5,227	5,870	9,839	14,011	18,833	31,967	51,278	78,765
Gulf Coast	Europe	5,044	9,110	7,758	8,079	8,883	13,758	17,368	21,441	32,025	46,619	66,208
Gulf Coast	Mideast	206	632	522	565	612	840	974	1,091	1,339	1,598	1,856
Gulf Coast	North America	2	721	57	62	70	102	129	158	231	333	469
Gulf Coast	South America	165	1,068	727	820	928	1,504	2,020	2,610	4,182	6,415	9,461
Gulf Coast	Caribbean	2	0	45	49	56	81	97	114	153	201	263
South Pacific	Africa	6	2	9	10	11	18	22	25	31	37	42
South Pacific	Asia	1,626,380	2,787,367	2,766,030	2,918,432	3,169,401	4,906,515	6,448,375	8,111,419	12,120,555	17,035,535	22,671,617
South Pacific	Europe	6,007	7,114	8,212	8,203	8,971	13,968	17,846	22,075	33,150	48,670	69,814
South Pacific	Mideast	56	58	141	152	165	230	271	309	391	483	583
South Pacific	North America	96	950	1,132	1,308	1,483	2,509	3,814	5,437	10,143	17,496	28,379
South Pacific	South America	32	177	1,174	1,369	1,595	2,698	4,137	5,974	11,358	19,920	32,786
South Pacific	Caribbean	2	0	0	0	0	0	0	0	0	0	0
North Pacific	Africa	0	0	0	0	0	0	0	0	0	0	0
North Pacific	Asia	262,081	367,083	281,227	296,066	321,742	489,334	645,136	810,191	1,203,593	1,680,669	2,225,006
North Pacific	Europe	176	326	104	113	120	178	228	279	417	611	878
North Pacific	Mideast	0	0	17	19	20	27	32	35	43	51	59
North Pacific	North America	6	22	9	10	12	19	26	34	56	89	138
North Pacific	South America	5	9	0	0	0	0	0	0	1	1	3
North Pacific	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	4	8	54	58	67	99	123	149	216	305	422
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**2,127,567**	**3,496,351**	**3,463,979**	**3,650,585**	**3,970,702**	**6,147,891**	**8,099,491**	**10,223,780**	**15,452,578**	**22,104,291**	**30,142,045**
Average Annual Growth Rate			**10.45%**	**-0.31%**	**5.39%**	**8.77%**	**9.14%**	**5.67%**	**4.77%**	**4.22%**	**3.64%**	**3.15%**

Containerized US Commodity Forecast For INTERMEDIATE MANUFACTURED PRODUCTS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	63,909	87,894	95,945	102,094	106,086	99,493	98,248	98,026	103,174	106,611	112,008
North Atlantic	Asia	608,793	1,197,136	1,404,462	1,463,405	1,586,981	2,110,509	2,581,398	3,031,675	4,154,093	5,608,714	7,445,697
North Atlantic	Europe	1,325,206	1,958,435	1,769,294	1,955,262	2,196,530	2,956,032	3,516,136	4,062,373	5,354,792	6,932,263	8,860,644
North Atlantic	Mideast	52,163	130,319	174,213	194,591	215,537	276,474	318,392	359,418	453,221	565,373	694,207
North Atlantic	North America	2,420	1,570	1,471	1,586	1,791	2,259	2,835	3,354	4,666	6,449	8,683
North Atlantic	South America	295,766	440,158	746,247	765,838	831,401	1,095,503	1,335,270	1,583,194	2,173,434	2,932,177	3,974,773
North Atlantic	Caribbean	253	1,548	1,222	1,394	1,580	2,003	2,177	2,317	2,625	2,986	3,406
South Atlantic	Africa	7,900	15,339	22,520	24,952	27,638	35,384	42,947	50,929	69,950	91,356	115,240
South Atlantic	Asia	368,554	647,811	904,841	964,982	1,065,678	1,571,578	2,140,767	2,815,087	4,857,544	8,302,071	13,919,297
South Atlantic	Europe	447,222	1,034,880	1,090,854	1,206,450	1,358,767	1,848,765	2,166,462	2,491,131	3,334,603	4,529,528	6,202,497
South Atlantic	Mideast	22,397	51,525	126,171	143,133	162,054	206,723	235,539	263,368	327,571	405,534	499,427
South Atlantic	North America	4,550	34,905	22,913	25,439	28,515	36,860	43,864	50,573	66,377	86,829	113,065
South Atlantic	South America	229,298	443,591	796,657	833,763	911,794	1,147,465	1,299,961	1,445,786	1,758,195	2,106,284	2,521,320
South Atlantic	Caribbean	15,749	17,004	18,027	20,745	23,877	34,576	45,916	58,216	90,921	138,235	204,878
Gulf Coast	Africa	29,621	54,941	47,670	54,223	57,571	49,867	44,981	41,325	40,551	42,747	45,156
Gulf Coast	Asia	99,120	188,618	150,376	164,865	185,092	276,150	372,199	477,157	769,800	1,219,760	1,901,763
Gulf Coast	Europe	769,146	1,022,693	757,471	836,208	937,295	1,302,268	1,595,314	1,893,322	2,684,560	3,832,064	5,462,387
Gulf Coast	Mideast	30,054	97,697	61,587	69,641	78,609	100,056	117,907	134,645	173,548	220,688	276,004
Gulf Coast	North America	29,051	13,141	13,749	15,460	17,469	23,673	31,942	40,383	62,429	93,631	136,487
Gulf Coast	South America	206,823	432,302	592,198	629,599	693,164	903,673	1,061,190	1,206,765	1,546,370	1,966,828	2,501,276
Gulf Coast	Caribbean	2,648	11,988	20,504	23,733	27,466	38,269	52,922	69,118	113,906	180,872	276,745
South Pacific	Africa	7,784	6,009	5,098	5,311	5,676	7,051	7,977	8,938	11,030	13,211	15,372
South Pacific	Asia	3,222,956	6,403,179	7,253,405	7,633,601	8,284,136	10,979,849	13,491,493	15,925,588	22,027,022	30,057,555	40,254,650
South Pacific	Europe	364,355	767,698	722,769	833,283	961,485	1,349,501	1,601,629	1,870,796	2,550,455	3,465,613	4,681,736
South Pacific	Mideast	5,218	47,656	115,541	134,555	156,619	224,260	279,371	340,959	502,774	733,326	1,055,293
South Pacific	North America	42,255	989	2,341	2,468	2,806	3,501	4,304	4,852	6,082	7,693	9,714
South Pacific	South America	31,989	72,530	169,132	180,901	200,101	265,836	323,775	382,073	528,556	729,423	1,002,506
South Pacific	Caribbean	2,077	497	666	748	839	1,140	1,334	1,501	1,886	2,386	3,058
North Pacific	Africa	73	528	619	674	724	807	876	948	1,128	1,308	1,457
North Pacific	Asia	1,078,777	1,333,049	1,498,111	1,586,089	1,727,091	2,321,555	2,908,512	3,474,059	4,862,575	6,653,654	8,901,213
North Pacific	Europe	20,531	33,550	35,262	38,947	43,930	63,162	78,608	94,330	132,765	182,957	252,906
North Pacific	Mideast	0	330	5,668	6,274	7,034	9,845	12,679	15,764	23,282	34,072	50,845
North Pacific	North America	125,059	234	56	60	67	95	124	154	230	334	465
North Pacific	South America	7,730	2,601	3,099	3,490	3,959	5,511	6,754	7,908	10,620	13,972	18,046
North Pacific	Caribbean	0	11	43	50	57	83	116	151	249	396	611
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	6,929	236	596	575	594	709	827	893	954	914	867
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**9,526,377**	**16,552,595**	**18,630,801**	**19,924,389**	**21,910,015**	**29,350,486**	**35,824,747**	**42,307,075**	**58,801,937**	**81,267,810**	**111,523,696**
Average Annual Growth Rate			**11.68%**	**4.02%**	**6.94%**	**9.97%**	**6.02%**	**4.07%**	**3.38%**	**3.35%**	**3.29%**	**3.22%**

Containerized US Commodity Forecast For MATERIALS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	5,136	6,116	10,970	10,422	10,403	12,219	13,449	14,234	15,767	17,350	18,949
North Atlantic	Asia	201,593	467,932	765,276	774,525	802,443	937,206	1,027,946	1,121,928	1,376,697	1,682,006	1,946,147
North Atlantic	Europe	643,999	1,144,776	1,346,720	1,297,730	1,285,587	1,273,419	1,212,026	1,186,619	1,242,151	1,370,845	1,531,732
North Atlantic	Mideast	18,513	61,269	77,369	83,880	90,428	109,423	118,273	128,976	156,600	193,960	242,630
North Atlantic	North America	32,910	23,791	24,067	27,252	29,430	35,644	38,977	41,012	45,276	49,766	54,253
North Atlantic	South America	200,984	465,885	704,783	708,078	735,427	915,331	1,006,732	1,102,222	1,329,425	1,619,008	1,987,624
North Atlantic	Caribbean	272	1,725	2,838	2,893	3,066	3,475	3,997	4,481	5,692	7,375	9,720
South Atlantic	Africa	6,187	12,683	22,271	21,156	20,857	18,737	18,458	19,340	22,636	27,959	35,407
South Atlantic	Asia	237,254	436,507	657,453	672,989	702,714	830,556	922,892	1,025,386	1,294,684	1,638,860	1,988,859
South Atlantic	Europe	307,828	517,054	801,102	795,526	815,014	857,179	862,754	877,396	952,621	1,075,860	1,248,118
South Atlantic	Mideast	19,026	59,782	74,807	80,453	87,250	105,331	114,059	124,608	153,214	193,062	245,462
South Atlantic	North America	1,126	18,880	16,046	18,070	19,457	23,408	25,616	26,974	29,835	32,912	36,070
South Atlantic	South America	214,880	299,976	485,400	486,554	507,167	675,032	739,398	787,314	872,643	953,780	1,037,542
South Atlantic	Caribbean	36,745	32,590	48,551	46,084	46,225	49,888	53,573	56,743	63,110	70,201	78,480
Gulf Coast	Africa	1,525	4,176	13,130	11,844	11,062	10,943	10,753	10,748	11,325	12,377	13,641
Gulf Coast	Asia	21,992	38,082	62,099	66,461	71,651	94,074	106,062	115,703	136,709	160,150	181,753
Gulf Coast	Europe	128,966	227,407	211,051	197,766	191,308	211,323	216,607	222,165	245,537	280,256	324,655
Gulf Coast	Mideast	2,589	5,299	6,730	7,145	7,855	9,900	11,029	12,232	15,312	19,464	24,843
Gulf Coast	North America	3,629	15,797	32,134	31,387	31,905	29,556	29,124	29,882	32,080	35,495	40,678
Gulf Coast	South America	107,222	223,606	383,693	381,025	388,659	471,583	488,026	497,770	519,736	548,871	583,504
Gulf Coast	Caribbean	5,121	4,334	9,975	9,570	9,620	9,592	9,795	10,184	10,968	11,848	12,958
South Pacific	Africa	24	896	1,272	1,233	1,260	1,719	2,141	2,544	3,536	4,885	6,729
South Pacific	Asia	1,512,160	3,000,930	3,620,453	3,596,179	3,681,556	4,077,371	4,326,077	4,548,477	5,274,742	6,265,855	7,457,086
South Pacific	Europe	144,820	223,171	184,397	176,746	174,827	182,677	181,941	183,481	200,729	231,399	274,749
South Pacific	Mideast	1,053	7,974	11,627	11,954	12,295	14,870	15,972	17,014	19,453	22,523	26,356
South Pacific	North America	18,195	100,325	88,816	100,803	108,907	132,383	145,072	152,807	168,830	185,601	202,332
South Pacific	South America	29,810	38,715	99,180	93,726	93,899	129,314	150,487	166,473	199,281	236,854	281,840
South Pacific	Caribbean	1,894	1,704	4,558	4,502	4,660	5,215	5,782	6,174	6,994	7,932	9,024
North Pacific	Africa	24	28	203	192	189	189	196	214	260	321	410
North Pacific	Asia	340,512	609,454	757,241	738,100	740,725	770,108	792,200	821,841	944,474	1,119,068	1,332,563
North Pacific	Europe	3,545	10,474	6,110	5,675	5,594	6,349	6,856	7,534	9,302	11,697	14,929
North Pacific	Mideast	0	415	880	823	819	1,169	1,421	1,637	2,116	2,695	3,403
North Pacific	North America	36,688	18,008	1,390	1,560	1,678	2,008	2,180	2,283	2,507	2,750	2,996
North Pacific	South America	5,931	12,492	17,668	16,286	16,009	22,751	27,364	31,058	38,866	47,950	58,835
North Pacific	Caribbean	0	121	122	120	124	140	155	166	188	213	242
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	98	4	77	77	79	104	113	119	128	137	145
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**4,292,248**	**8,092,376**	**10,550,261**	**10,478,786**	**10,710,150**	**12,030,187**	**12,687,499**	**13,357,736**	**15,403,422**	**18,141,286**	**21,314,665**
Average Annual Growth Rate			**13.52%**	**9.24%**	**-0.68%**	**2.21%**	**2.35%**	**1.07%**	**1.03%**	**1.44%**	**1.65%**	**1.63%**

Containerized US Commodity Forecast For ALL COMMODITIES
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(METRIC TONNES)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	143,285	276,149	329,362	353,172	381,118	458,640	504,997	548,736	657,590	787,554	945,623
North Atlantic	Asia	3,081,907	5,018,788	7,164,437	7,328,864	7,888,540	10,293,457	11,835,198	13,337,385	17,254,664	22,312,655	28,549,081
North Atlantic	Europe	6,276,153	8,945,162	9,218,066	9,684,897	10,439,853	12,515,349	13,591,315	14,575,485	17,281,329	20,731,239	24,839,644
North Atlantic	Mideast	383,754	587,441	678,147	746,208	821,997	993,739	1,114,331	1,233,692	1,511,043	1,834,988	2,200,044
North Atlantic	North America	67,359	68,812	59,644	64,924	67,169	80,904	89,757	98,682	123,132	157,179	201,901
North Atlantic	South America	1,770,658	2,659,346	4,112,297	4,308,605	4,491,022	5,474,624	6,182,330	6,863,643	8,534,506	10,566,204	13,101,782
North Atlantic	Caribbean	24,359	69,688	95,654	94,937	95,027	88,613	85,267	80,634	72,308	65,936	62,291
South Atlantic	Africa	45,152	66,421	108,051	116,425	128,107	169,203	196,852	225,306	292,652	372,303	463,822
South Atlantic	Asia	1,689,840	2,844,511	4,023,957	4,242,260	4,607,202	6,515,967	8,165,272	10,079,383	15,568,902	24,097,522	36,816,628
South Atlantic	Europe	1,977,002	3,559,871	4,107,672	4,315,734	4,663,397	5,847,028	6,560,176	7,250,188	9,133,839	11,765,249	15,248,731
South Atlantic	Mideast	116,021	213,985	309,220	340,958	379,531	481,940	545,558	609,896	768,492	972,221	1,225,101
South Atlantic	North America	45,906	163,224	104,839	110,313	117,301	138,870	154,112	166,689	195,880	232,138	277,337
South Atlantic	South America	1,363,254	1,882,160	2,805,120	2,902,979	3,070,109	3,791,727	4,190,319	4,552,992	5,360,804	6,279,284	7,362,521
South Atlantic	Caribbean	319,886	716,291	699,288	711,879	739,580	833,062	924,539	1,020,501	1,260,428	1,549,317	1,889,429
Gulf Coast	Africa	48,389	97,960	106,487	115,442	123,482	130,561	134,189	137,768	154,088	176,631	202,274
Gulf Coast	Asia	352,837	489,093	622,750	649,782	702,374	935,304	1,106,344	1,284,275	1,772,510	2,499,200	3,553,818
Gulf Coast	Europe	1,841,371	2,642,074	2,696,920	2,882,089	3,153,437	4,025,351	4,563,526	5,035,592	6,354,562	8,296,071	10,945,030
Gulf Coast	Mideast	64,187	133,040	106,306	116,816	129,333	161,762	188,004	213,627	274,521	350,176	441,489
Gulf Coast	North America	256,074	306,356	389,152	388,952	398,487	447,136	486,191	522,637	612,447	723,383	855,913
Gulf Coast	South America	783,122	1,515,404	2,311,903	2,389,742	2,512,857	2,956,428	3,207,970	3,422,452	3,946,394	4,612,484	5,457,685
Gulf Coast	Caribbean	154,641	313,402	345,961	352,427	367,150	415,206	468,525	525,153	675,185	870,476	1,114,953
South Pacific	Africa	10,741	13,669	17,338	18,793	20,737	27,595	32,413	36,810	48,227	61,802	77,493
South Pacific	Asia	15,315,374	27,093,798	31,215,619	32,515,110	34,977,173	46,836,695	55,324,253	63,847,834	84,925,159	111,307,606	142,645,251
South Pacific	Europe	1,243,720	2,025,636	1,981,764	2,161,224	2,397,330	3,026,492	3,434,484	3,858,326	4,938,855	6,362,411	8,181,989
South Pacific	Mideast	22,133	92,113	170,802	195,046	223,252	315,135	384,098	464,042	672,035	963,542	1,359,220
South Pacific	North America	104,482	239,240	234,284	251,404	255,216	301,117	333,476	361,935	429,201	512,413	613,557
South Pacific	South America	269,198	420,230	731,074	759,625	792,231	942,782	1,058,612	1,162,431	1,428,954	1,779,468	2,239,143
South Pacific	Caribbean	45,953	209,051	362,454	386,610	401,299	351,643	353,244	337,543	303,262	279,507	273,621
North Pacific	Africa	366	1,563	1,655	1,802	1,963	2,478	2,827	3,195	4,049	5,014	6,057
North Pacific	Asia	4,363,037	5,514,287	6,166,552	6,443,568	6,930,495	9,303,147	11,032,575	12,729,657	16,909,878	22,100,847	28,242,788
North Pacific	Europe	55,627	98,056	108,903	117,040	129,256	168,367	196,775	225,871	297,137	385,615	500,272
North Pacific	Mideast	84	1,237	11,239	12,253	13,441	18,922	23,966	29,374	42,737	61,483	88,950
North Pacific	North America	223,192	131,574	96,943	104,278	107,138	123,460	137,801	152,026	184,313	222,211	266,113
North Pacific	South America	109,816	64,103	84,926	85,133	86,477	99,487	109,852	119,600	143,997	174,832	212,971
North Pacific	Caribbean	6,371	14,005	17,830	17,635	17,622	15,935	15,257	14,255	12,358	10,990	10,238
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	1	0	113	126	140	148	146	143	133	120	107
Great Lakes	Europe	11,866	569	29,284	28,730	30,351	35,760	41,188	46,558	58,447	71,994	87,549
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**42,587,118**	**68,488,306**	**81,626,014**	**85,315,782**	**91,661,192**	**118,324,034**	**136,775,739**	**155,174,314**	**202,204,039**	**263,552,065**	**340,560,419**
Average Annual Growth Rate			**9.97%**	**6.02%**	**4.52%**	**7.44%**	**5.24%**	**2.94%**	**2.56%**	**2.68%**	**2.69%**	**2.60%**

Containerized U.S. Commodity By Origin (TEUs)

Containerized US Commodity Forecast For AGRICULTURE COMMODITIES
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(TEUs)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	222	246	138	134	129	126	117	117	110	103	98
North Atlantic	Asia	29,324	16,795	16,562	18,197	19,061	20,979	22,857	25,021	28,831	31,941	34,074
North Atlantic	Europe	48,187	53,335	25,243	26,481	26,714	26,714	27,837	29,266	31,768	34,886	38,903
North Atlantic	Mideast	1,599	1,198	1,813	2,021	2,183	3,378	3,792	4,220	5,156	6,207	7,357
North Atlantic	North America	47	29	27	26	25	21	17	21	21	21	20
North Atlantic	South America	5,896	4,915	4,625	4,886	5,089	6,556	7,190	8,184	9,738	11,350	13,031
North Atlantic	Caribbean	224	1,210	4,387	4,787	5,155	6,859	7,586	8,203	9,311	10,335	11,297
South Atlantic	Africa	85	128	53	54	52	52	51	50	49	49	49
South Atlantic	Asia	15,647	12,810	76,168	82,691	84,693	83,227	85,477	88,076	94,928	102,572	110,996
South Atlantic	Europe	30,375	21,549	30,338	32,030	30,505	22,929	19,276	17,134	14,598	13,799	14,165
South Atlantic	Mideast	636	1,435	8,213	8,436	8,435	10,585	11,925	13,171	16,058	19,433	23,117
South Atlantic	North America	149	93	60	60	62	82	89	96	111	127	144
South Atlantic	South America	5,727	3,798	3,613	3,714	3,851	4,523	4,892	5,340	6,162	7,022	7,936
South Atlantic	Caribbean	1,043	867	2,136	2,253	2,365	2,828	3,044	3,204	3,425	3,591	3,728
Gulf Coast	Africa	177	158	270	287	282	283	275	298	315	334	356
Gulf Coast	Asia	9,230	2,376	6,197	6,700	6,822	7,510	7,970	8,494	9,695	11,059	12,665
Gulf Coast	Europe	35,973	31,997	46,649	47,259	45,739	43,596	42,521	42,244	42,884	44,867	47,755
Gulf Coast	Mideast	4,085	12,628	15,589	16,032	16,084	20,620	23,474	26,109	32,146	39,152	46,789
Gulf Coast	North America	81	457	372	364	367	396	406	464	527	597	671
Gulf Coast	South America	8,512	11,288	10,528	10,293	10,548	11,499	11,956	12,566	13,423	14,238	15,100
Gulf Coast	Caribbean	7,004	9,570	9,262	9,634	9,985	10,961	11,596	11,977	12,463	12,751	12,901
South Pacific	Africa	16	56	72	68	67	116	129	145	174	202	231
South Pacific	Asia	207,892	152,256	206,726	220,751	224,055	259,422	283,586	308,715	371,878	463,584	581,431
South Pacific	Europe	18,536	23,308	21,041	20,644	18,991	22,612	24,306	25,632	28,353	31,303	34,411
South Pacific	Mideast	1,474	3,952	5,155	5,319	5,355	7,004	7,920	8,841	10,913	13,282	15,855
South Pacific	North America	16	56	79	87	94	168	197	221	269	320	373
South Pacific	South America	2,982	7,080	5,985	6,169	6,526	8,112	9,067	10,056	12,003	14,036	16,201
South Pacific	Caribbean	435	971	1,199	1,304	1,402	1,851	2,041	2,195	2,468	2,716	2,946
North Pacific	Africa	107	26	361	353	348	366	380	394	401	403	405
North Pacific	Asia	154,034	112,855	96,943	106,939	109,440	133,747	145,737	157,209	185,748	214,919	268,333
North Pacific	Europe	5,235	4,458	4,598	4,956	5,021	5,109	5,296	5,517	5,945	6,438	6,976
North Pacific	Mideast	10	60	201	205	218	282	325	368	454	545	642
North Pacific	North America	191	196	22	20	18	25	27	29	33	38	42
North Pacific	South America	2,388	3,042	3,983	4,126	4,288	5,086	5,545	5,990	6,789	7,569	8,354
North Pacific	Caribbean	6	446	257	280	301	400	441	476	539	596	651
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**597,544**	**495,641**	**608,863**	**647,559**	**654,272**	**727,824**	**777,348**	**830,045**	**957,685**	**1,120,386**	**1,338,003**
Average Annual Growth Rate			**-3.67%**	**7.10%**	**6.36%**	**1.04%**	**2.15%**	**1.33%**	**1.32%**	**1.44%**	**1.58%**	**1.79%**

Containerized US Commodity Forecast For CAPITAL EQUIPMENT
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(TEUs)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	7,015	6,217	10,175	9,934	10,216	12,146	13,414	14,174	15,496	16,542	17,482
North Atlantic	Asia	29,091	19,652	31,799	34,009	35,267	45,026	56,592	69,844	107,082	166,188	262,740
North Atlantic	Europe	85,940	102,064	127,615	133,025	137,296	176,547	203,904	229,730	290,340	368,285	465,303
North Atlantic	Mideast	6,501	7,982	11,221	12,098	13,189	14,092	14,881	15,666	17,016	18,034	18,933
North Atlantic	North America	90	568	226	247	251	319	331	339	358	380	405
North Atlantic	South America	38,998	34,127	29,490	31,693	32,183	37,282	40,203	42,176	46,761	51,856	57,402
North Atlantic	Caribbean	320	4,081	2,884	3,063	3,282	4,146	4,314	4,488	4,953	5,519	6,134
South Atlantic	Africa	1,586	1,273	1,935	1,957	2,046	2,305	2,450	2,555	2,768	2,980	3,217
South Atlantic	Asia	17,815	16,613	20,937	22,637	23,256	28,088	33,347	39,731	58,925	93,166	157,802
South Atlantic	Europe	39,317	64,757	84,959	87,909	90,016	113,746	131,811	147,421	182,649	225,583	274,642
South Atlantic	Mideast	3,718	3,062	2,160	2,227	2,330	2,801	3,193	3,524	4,176	4,811	5,471
South Atlantic	North America	621	1,556	1,368	1,516	1,600	1,943	2,168	2,312	2,587	2,825	3,031
South Atlantic	South America	63,796	67,597	55,108	59,315	60,309	69,490	76,419	81,547	93,436	107,422	123,308
South Atlantic	Caribbean	12,648	14,985	16,102	16,362	16,758	18,229	17,821	17,660	18,225	19,570	21,277
Gulf Coast	Africa	827	1,181	1,995	2,080	2,183	2,918	3,957	5,532	11,657	23,073	39,511
Gulf Coast	Asia	8,848	6,093	7,279	7,333	7,351	8,230	9,687	11,613	17,601	27,922	46,476
Gulf Coast	Europe	15,226	18,854	28,675	30,476	31,308	37,125	42,125	47,228	63,577	94,234	141,816
Gulf Coast	Mideast	786	706	1,460	1,530	1,633	1,916	2,150	2,354	2,790	3,240	3,685
Gulf Coast	North America	1,496	3,450	1,942	2,205	2,297	2,897	3,281	3,534	4,011	4,422	4,766
Gulf Coast	South America	25,342	28,795	28,534	30,470	30,415	34,340	37,391	39,893	46,037	53,433	61,629
Gulf Coast	Caribbean	4,545	4,191	5,916	6,095	6,320	6,984	6,971	6,978	7,335	8,107	9,082
South Pacific	Africa	52	103	158	154	161	195	222	239	273	306	339
South Pacific	Asia	160,013	149,229	167,382	177,743	184,636	225,838	269,546	324,850	495,226	811,047	1,452,619
South Pacific	Europe	9,355	10,054	14,428	14,876	15,508	19,220	21,985	24,470	30,226	37,572	46,327
South Pacific	Mideast	176	215	398	418	448	535	554	576	611	626	628
South Pacific	North America	44	4,471	918	1,028	1,095	1,481	1,860	2,107	2,508	2,806	3,040
South Pacific	South America	5,629	4,041	4,394	4,555	4,690	5,371	6,058	7,082	10,558	16,070	23,131
South Pacific	Caribbean	512	893	1,197	1,253	1,326	1,611	1,650	1,697	1,848	2,047	2,270
North Pacific	Africa	25	58	24	24	25	30	34	36	40	42	45
North Pacific	Asia	43,191	35,735	46,688	49,098	52,071	60,457	70,708	81,920	110,607	150,290	207,891
North Pacific	Europe	1,701	3,320	3,668	3,850	4,117	5,314	6,114	6,918	9,148	12,431	16,693
North Pacific	Mideast	19	35	7	7	7	9	10	12	14	17	19
North Pacific	North America	266	108	32	34	34	39	42	46	54	62	73
North Pacific	South America	840	478	413	442	430	462	496	523	586	651	709
North Pacific	Caribbean	34	26	11	13	14	20	22	23	27	31	35
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**586,382**	**616,548**	**711,496**	**749,674**	**774,067**	**941,153**	**1,085,712**	**1,238,797**	**1,659,503**	**2,331,590**	**3,477,934**
Average Annual Growth Rate			**1.01%**	**4.89%**	**5.37%**	**3.25%**	**3.99%**	**2.90%**	**2.67%**	**2.97%**	**3.46%**	**4.08%**

Containerized US Commodity Forecast For CHEMICALS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(TEUs)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	1,313	1,820	1,900	1,845	1,873	2,141	2,421	2,717	3,381	4,194	5,207
North Atlantic	Asia	36,315	37,607	64,077	64,546	66,365	76,334	88,332	106,115	166,299	292,951	566,336
North Atlantic	Europe	52,354	64,208	67,659	66,827	65,722	76,256	86,328	96,507	123,425	163,417	223,028
North Atlantic	Mideast	2,965	3,228	4,014	4,092	4,200	4,695	5,197	5,798	7,241	9,099	11,474
North Atlantic	North America	179	105	31	33	34	38	43	46	54	62	71
North Atlantic	South America	16,004	21,620	19,677	20,635	20,951	24,118	27,103	30,157	38,461	50,795	67,596
North Atlantic	Caribbean	1,060	441	590	609	628	734	860	1,016	1,444	1,993	2,597
South Atlantic	Africa	1,810	2,416	1,672	1,624	1,650	1,885	2,153	2,474	3,336	4,735	7,265
South Atlantic	Asia	41,902	36,688	67,302	67,727	70,472	83,492	97,216	116,657	174,868	279,903	479,937
South Atlantic	Europe	27,355	32,274	32,429	32,205	31,821	37,742	43,612	49,639	67,191	97,568	145,931
South Atlantic	Mideast	2,359	3,152	2,715	2,767	2,886	3,129	3,404	3,744	4,542	5,557	6,844
South Atlantic	North America	591	1,623	6,286	6,625	6,743	7,546	8,353	8,898	10,023	11,146	12,288
South Atlantic	South America	26,982	32,903	35,362	37,102	38,096	45,521	54,795	67,365	114,304	204,344	340,338
South Atlantic	Caribbean	3,124	3,426	5,092	5,227	5,364	6,146	7,082	8,211	11,246	15,011	19,014
Gulf Coast	Africa	2,809	4,869	4,458	4,383	4,387	4,890	5,448	6,182	8,336	12,231	20,173
Gulf Coast	Asia	37,835	28,860	45,820	47,442	48,695	55,166	64,321	79,112	131,963	245,958	476,715
Gulf Coast	Europe	86,240	110,292	112,989	111,484	108,934	123,734	137,410	150,213	182,398	226,037	291,849
Gulf Coast	Mideast	8,047	9,348	16,662	16,964	17,517	18,766	20,192	22,001	26,159	31,204	37,321
Gulf Coast	North America	1,966	6,224	5,542	5,890	6,040	6,973	7,912	8,726	10,550	12,672	15,100
Gulf Coast	South America	82,936	102,632	104,076	110,867	112,329	127,674	145,189	166,702	239,207	375,334	590,250
Gulf Coast	Caribbean	16,711	20,798	24,547	25,394	26,248	30,921	36,233	42,338	57,796	75,764	93,865
South Pacific	Africa	79	27	21	20	20	23	27	31	41	52	65
South Pacific	Asia	269,594	285,035	334,485	336,302	347,068	398,239	455,771	536,611	788,686	1,271,544	2,247,832
South Pacific	Europe	1,960	1,478	1,249	1,244	1,238	1,440	1,637	1,822	2,264	2,842	3,583
South Pacific	Mideast	88	59	40	41	42	49	56	64	83	108	140
South Pacific	North America	41	91	35	37	39	50	63	75	105	147	201
South Pacific	South America	1,539	2,472	1,753	1,865	1,895	2,170	2,517	3,006	4,846	8,376	13,688
South Pacific	Caribbean	112	205	482	505	526	622	705	774	908	1,051	1,214
North Pacific	Africa	40	33	4	4	4	4	4	5	5	6	7
North Pacific	Asia	68,697	62,571	71,536	72,285	73,254	83,943	94,279	107,584	146,406	215,850	349,639
North Pacific	Europe	126	350	452	458	467	529	589	643	768	929	1,132
North Pacific	Mideast	35	43	71	72	74	85	95	105	130	160	196
North Pacific	North America	33	479	52	51	51	69	83	97	124	154	186
North Pacific	South America	637	751	829	886	902	1,022	1,144	1,275	1,667	2,382	3,543
North Pacific	Caribbean	26	77	99	105	109	134	158	177	215	258	308
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**793,862**	**878,204**	**1,034,008**	**1,048,165**	**1,066,642**	**1,226,279**	**1,400,734**	**1,626,888**	**2,328,474**	**3,623,833**	**6,034,933**
Average Annual Growth Rate			**2.04%**	**5.59%**	**1.37%**	**1.76%**	**2.83%**	**2.70%**	**3.04%**	**3.65%**	**4.52%**	**5.23%**

Containerized US Commodity Forecast For CONSUMER GOODS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(TEUs)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	1,191	1,111	1,285	1,217	1,259	1,499	1,713	1,921	2,459	3,276	4,510
North Atlantic	Asia	9,670	9,273	15,739	16,755	17,723	22,749	29,498	39,249	75,823	145,513	291,434
North Atlantic	Europe	21,052	22,174	26,920	28,445	29,444	31,865	35,056	41,046	63,060	111,112	217,501
North Atlantic	Mideast	1,817	2,597	2,084	2,142	2,245	2,844	3,436	4,040	5,614	7,893	10,999
North Atlantic	North America	51	27	132	140	149	192	233	270	357	469	610
North Atlantic	South America	10,172	10,994	8,963	9,691	9,882	11,920	13,876	15,713	19,968	25,325	32,023
North Atlantic	Caribbean	457	599	936	982	1,030	1,231	1,325	1,442	1,757	2,186	2,694
South Atlantic	Africa	249	379	304	312	330	434	478	525	645	844	1,174
South Atlantic	Asia	6,723	5,738	9,891	10,710	11,338	14,822	20,182	28,718	60,691	131,903	290,405
South Atlantic	Europe	7,408	8,453	10,528	10,952	11,226	12,593	13,848	15,507	20,137	27,665	40,705
South Atlantic	Mideast	1,175	1,464	882	916	984	1,305	1,642	1,991	2,918	4,354	6,429
South Atlantic	North America	573	1,051	663	690	711	841	957	1,082	1,357	1,713	2,186
South Atlantic	South America	34,212	27,418	18,260	18,744	19,027	20,567	22,094	23,344	26,674	31,436	37,863
South Atlantic	Caribbean	20,684	51,643	24,104	24,912	25,641	27,918	29,534	31,291	35,217	39,997	45,310
Gulf Coast	Africa	47	467	374	380	405	533	578	633	795	1,092	1,610
Gulf Coast	Asia	833	1,799	1,410	1,548	1,620	2,281	3,068	4,127	7,676	14,690	28,757
Gulf Coast	Europe	5,230	7,957	9,164	9,490	9,705	10,744	11,838	13,669	19,908	32,692	60,296
Gulf Coast	Mideast	330	486	452	462	484	607	729	852	1,176	1,648	2,285
Gulf Coast	North America	964	8,251	19,199	18,534	17,921	17,604	16,133	16,244	14,118	11,265	9,778
Gulf Coast	South America	5,371	4,526	3,789	4,011	4,168	5,050	5,800	6,425	7,848	9,638	11,880
Gulf Coast	Caribbean	3,535	12,505	9,665	9,983	10,270	11,223	11,929	12,600	13,843	15,072	16,239
South Pacific	Africa	14	46	68	66	65	81	95	109	140	179	226
South Pacific	Asia	66,879	57,693	52,881	56,870	59,873	73,040	90,355	114,305	195,329	354,018	657,944
South Pacific	Europe	3,625	2,790	2,673	2,815	2,894	3,009	3,327	4,129	7,369	14,956	33,123
South Pacific	Mideast	145	151	97	100	105	133	161	191	266	372	516
South Pacific	North America	80	879	457	500	527	669	784	894	1,121	1,394	1,763
South Pacific	South America	5,139	2,907	3,593	3,766	3,775	4,104	4,447	4,800	5,721	7,073	9,071
South Pacific	Caribbean	415	968	3,282	3,330	3,374	3,548	3,733	3,961	4,553	5,323	6,199
North Pacific	Africa	3	3	1	1	1	1	1	1	1	1	1
North Pacific	Asia	14,609	9,191	9,529	10,353	11,049	13,334	16,746	21,625	38,500	73,022	143,101
North Pacific	Europe	413	268	280	301	317	364	458	662	1,499	3,532	8,591
North Pacific	Mideast	1	26	11	12	13	20	26	34	55	88	137
North Pacific	North America	99	27	7	8	8	10	11	12	15	19	23
North Pacific	South America	102	87	21	23	23	26	29	33	42	55	72
North Pacific	Caribbean	1	10	7	8	9	12	13	14	16	18	20
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**223,269**	**253,960**	**237,653**	**249,166**	**257,596**	**297,170**	**344,137**	**411,458**	**634,667**	**1,079,830**	**1,975,476**
Average Annual Growth Rate			**2.61%**	**-2.19%**	**4.84%**	**3.38%**	**2.90%**	**2.98%**	**3.64%**	**4.43%**	**5.46%**	**6.23%**

Containerized US Commodity Forecast For EXTRACTIVE COMMODITIES
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(TEUs)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	136	12	17	19	19	24	25	27	31	35	39
North Atlantic	Asia	8,302	6,591	20,495	22,517	22,947	24,655	25,049	26,083	28,530	30,585	32,574
North Atlantic	Europe	3,860	2,616	3,826	3,869	3,878	3,862	3,677	3,600	3,498	3,430	3,374
North Atlantic	Mideast	165	79	2,501	2,360	2,464	2,001	1,949	1,960	1,978	1,989	2,021
North Atlantic	North America	8	14	15	14	15	18	19	20	24	27	31
North Atlantic	South America	1,471	1,251	1,694	1,706	1,729	1,812	1,866	1,896	1,983	2,089	2,212
North Atlantic	Caribbean	144	243	127	130	132	136	138	140	143	147	152
South Atlantic	Africa	295	315	178	161	145	197	210	226	258	289	320
South Atlantic	Asia	51,346	76,594	81,338	83,350	84,835	89,878	93,857	98,640	112,374	132,144	161,499
South Atlantic	Europe	17,724	19,226	26,662	27,041	27,284	25,153	24,239	23,743	23,022	22,635	22,566
South Atlantic	Mideast	529	623	689	658	634	975	1,051	1,159	1,430	1,775	2,213
South Atlantic	North America	49	317	864	833	856	1,016	1,099	1,173	1,375	1,596	1,829
South Atlantic	South America	4,353	3,480	4,784	4,883	4,954	5,352	5,473	5,512	5,659	5,786	5,861
South Atlantic	Caribbean	722	191	1,892	1,942	1,971	2,018	2,056	2,082	2,127	2,185	2,262
Gulf Coast	Africa	44	30	244	242	240	262	269	280	308	341	378
Gulf Coast	Asia	4,760	2,716	2,555	2,747	2,868	3,187	3,408	3,770	4,700	6,080	8,284
Gulf Coast	Europe	2,587	7,535	13,301	13,091	13,142	12,774	12,304	11,855	11,084	10,394	9,769
Gulf Coast	Mideast	74	27	8	9	9	11	12	13	15	18	22
Gulf Coast	North America	77	47	546	574	589	671	720	764	870	995	1,136
Gulf Coast	South America	5,726	2,209	1,688	1,743	1,776	1,936	1,984	2,013	2,092	2,161	2,212
Gulf Coast	Caribbean	1,825	320	2,897	2,987	3,032	3,090	3,135	3,177	3,253	3,349	3,472
South Pacific	Africa	518	132	108	101	93	118	124	132	148	163	178
South Pacific	Asia	44,162	43,914	42,335	45,989	45,961	47,552	47,789	49,555	54,205	59,717	67,406
South Pacific	Europe	6,802	6,725	6,518	6,621	6,684	5,969	5,592	5,372	5,036	4,794	4,617
South Pacific	Mideast	156	7	389	389	390	429	452	480	551	641	750
South Pacific	North America	1	89	1	1	2	2	2	2	2	2	3
South Pacific	South America	844	673	584	603	601	621	629	632	634	634	632
South Pacific	Caribbean	53	4	15	17	17	16	15	16	17	18	19
North Pacific	Africa	0	0	1	0	0	1	1	1	1	1	1
North Pacific	Asia	18,520	21,090	22,512	24,031	24,454	25,051	25,222	25,804	27,663	30,086	33,624
North Pacific	Europe	1,293	660	397	410	414	376	358	346	327	310	294
North Pacific	Mideast	3	0	0	0	0	0	0	0	0	0	0
North Pacific	North America	40	33	29	29	32	40	41	43	46	50	54
North Pacific	South America	130	120	86	89	91	102	111	120	135	147	157
North Pacific	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**176,720**	**197,880**	**239,295**	**249,157**	**252,260**	**259,302**	**262,874**	**270,634**	**293,518**	**324,614**	**369,959**
Average Annual Growth Rate			**2.29%**	**6.54%**	**4.12%**	**1.25%**	**0.55%**	**0.27%**	**0.58%**	**0.82%**	**1.01%**	**1.32%**

Containerized US Commodity Forecast For FOOD
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(TEUs)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	2,203	1,302	4,822	5,161	5,104	5,000	4,687	4,541	4,383	4,374	4,470
North Atlantic	Asia	24,567	26,765	27,175	28,038	28,784	31,735	33,317	36,178	42,823	50,992	59,156
North Atlantic	Europe	63,796	49,254	52,210	52,086	51,628	51,861	49,663	49,697	52,807	58,189	64,873
North Atlantic	Mideast	4,753	8,137	6,888	7,052	7,249	8,486	9,256	10,261	12,733	15,576	18,549
North Atlantic	North America	265	378	560	538	554	593	607	673	806	942	1,075
North Atlantic	South America	13,821	14,721	14,450	14,993	15,410	18,361	19,723	21,184	24,560	28,346	32,426
North Atlantic	Caribbean	816	1,276	2,412	2,472	2,469	2,214	1,981	1,817	1,507	1,240	1,024
South Atlantic	Africa	1,035	1,532	597	616	617	730	745	816	970	1,138	1,312
South Atlantic	Asia	30,435	43,687	43,323	45,291	46,235	54,783	59,083	65,367	79,541	96,747	86,672
South Atlantic	Europe	26,023	22,685	28,418	28,980	28,227	26,941	25,398	24,939	25,254	26,370	27,841
South Atlantic	Mideast	1,457	6,308	8,665	8,324	8,394	12,880	14,125	16,039	20,538	25,672	31,096
South Atlantic	North America	1,081	1,749	1,929	2,039	2,199	3,106	3,588	4,062	5,066	6,129	7,215
South Atlantic	South America	18,401	18,758	11,224	11,824	12,315	15,387	16,744	18,276	21,734	25,631	29,829
South Atlantic	Caribbean	4,153	6,845	7,792	8,031	8,079	7,540	6,951	6,545	5,781	5,155	4,694
Gulf Coast	Africa	290	1,001	1,866	1,775	1,727	2,147	2,301	2,484	2,883	3,316	3,765
Gulf Coast	Asia	2,239	2,435	2,300	2,465	2,646	3,686	4,360	5,131	6,874	8,901	10,390
Gulf Coast	Europe	20,950	23,960	26,592	27,791	29,167	34,682	35,425	36,845	40,914	45,390	49,669
Gulf Coast	Mideast	1,272	1,549	4,957	4,913	5,164	9,062	10,412	12,127	15,912	20,064	24,387
Gulf Coast	North America	146	1,466	176,424	192,833	207,778	298,159	347,210	393,901	493,013	597,922	704,940
Gulf Coast	South America	15,774	9,528	8,981	9,386	9,802	13,232	14,979	16,708	20,427	24,400	28,519
Gulf Coast	Caribbean	7,915	12,640	12,691	13,177	13,385	13,166	12,531	12,229	11,705	11,377	11,276
South Pacific	Africa	50	78	165	151	139	171	189	205	236	268	302
South Pacific	Asia	347,871	371,093	355,216	369,833	381,388	441,336	466,883	500,236	563,219	633,741	702,620
South Pacific	Europe	16,523	21,491	19,757	19,871	19,566	21,193	21,421	21,913	23,273	24,929	26,791
South Pacific	Mideast	302	469	583	577	579	695	780	847	984	1,135	1,304
South Pacific	North America	400	565	1,261	1,360	1,448	1,929	2,210	2,467	3,001	3,564	4,144
South Pacific	South America	2,620	2,704	2,348	2,458	2,562	3,055	3,310	3,534	3,963	4,436	4,973
South Pacific	Caribbean	174	771	785	811	819	770	714	671	588	518	463
North Pacific	Africa	74	77	255	246	225	310	317	352	423	496	570
North Pacific	Asia	262,578	296,193	325,472	335,716	353,187	420,887	451,673	488,041	564,284	649,865	736,686
North Pacific	Europe	9,425	8,499	13,278	13,651	13,618	13,974	13,228	13,292	14,390	15,755	17,062
North Pacific	Mideast	69	249	332	320	317	337	362	397	468	547	634
North Pacific	North America	519	1,290	1,038	1,013	1,046	1,305	1,460	1,588	1,834	2,069	2,292
North Pacific	South America	1,466	1,362	939	983	988	1,046	1,095	1,163	1,299	1,446	1,617
North Pacific	Caribbean	0	94	20	21	22	22	22	22	21	20	20
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**883,465**	**960,913**	**1,165,721**	**1,214,797**	**1,262,836**	**1,520,782**	**1,636,749**	**1,774,547**	**2,068,216**	**2,396,662**	**2,702,656**
Average Annual Growth Rate			**1.69%**	**6.65%**	**4.21%**	**3.95%**	**3.79%**	**1.48%**	**1.63%**	**1.54%**	**1.48%**	**1.21%**

Containerized US Commodity Forecast For FUELS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(TEUs)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	54	90	49	49	50	45	42	42	42	41	40
North Atlantic	Asia	2,272	3,205	14,293	14,070	13,795	11,426	9,450	8,301	6,273	4,430	2,879
North Atlantic	Europe	1,853	2,678	3,371	3,556	3,491	2,794	2,350	2,035	1,520	1,100	766
North Atlantic	Mideast	236	199	46	44	45	39	36	36	36	36	35
North Atlantic	North America	15	11	4	4	4	4	3	3	3	3	3
North Atlantic	South America	1,366	1,260	2,309	2,302	2,265	2,088	1,973	1,990	2,016	2,014	1,971
North Atlantic	Caribbean	0	57	2	2	2	2	2	2	2	2	2
South Atlantic	Africa	1	3	1	1	1	1	1	1	1	1	1
South Atlantic	Asia	107	111	168	174	169	158	152	154	165	184	214
South Atlantic	Europe	127	350	435	439	422	347	292	254	196	154	126
South Atlantic	Mideast	0	24	11	10	11	10	10	10	10	10	10
South Atlantic	North America	0	0	0	0	0	0	0	0	0	0	0
South Atlantic	South America	77	297	209	210	209	210	213	219	227	231	230
South Atlantic	Caribbean	57	50	80	81	81	82	83	84	84	84	83
Gulf Coast	Africa	27	69	157	156	160	144	133	132	132	131	127
Gulf Coast	Asia	653	646	629	643	618	503	411	354	266	193	137
Gulf Coast	Europe	1,471	1,608	1,942	2,043	2,010	1,632	1,398	1,248	1,018	843	723
Gulf Coast	Mideast	116	402	523	505	515	487	469	474	484	486	476
Gulf Coast	North America	64	121	88	87	88	80	75	75	74	73	70
Gulf Coast	South America	5,054	7,722	12,269	12,290	12,235	12,057	12,074	12,457	12,977	13,285	13,388
Gulf Coast	Caribbean	4,067	6,035	16,673	16,774	16,804	17,122	17,338	17,451	17,490	17,408	17,228
South Pacific	Africa	0	2	1	1	1	1	1	1	1	1	1
South Pacific	Asia	10,853	15,592	16,990	16,637	16,519	15,331	14,425	13,640	13,789	16,685	23,116
South Pacific	Europe	180	98	823	872	861	682	569	489	364	263	184
South Pacific	Mideast	0	0	0	0	0	0	0	0	0	0	0
South Pacific	North America	0	10	2	2	2	2	2	2	2	2	2
South Pacific	South America	32	203	515	512	507	467	440	442	447	446	436
South Pacific	Caribbean	0	46	768	772	774	788	798	803	805	801	793
North Pacific	Africa	0	2	31	31	31	28	26	26	26	26	25
North Pacific	Asia	3,462	396	4,349	4,273	4,292	3,555	2,983	2,470	1,668	1,053	609
North Pacific	Europe	76	117	52	52	50	47	46	49	55	63	73
North Pacific	Mideast	0	0	0	0	0	0	0	0	0	0	0
North Pacific	North America	0	1	0	0	0	0	0	0	0	0	0
North Pacific	South America	60	6	67	70	71	78	85	92	103	114	127
North Pacific	Caribbean		1	1,155	1,162	1,164	1,186	1,201	1,209	1,212	1,206	1,194
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**32,281**	**41,411**	**78,011**	**77,824**	**77,248**	**71,397**	**67,081**	**64,547**	**61,487**	**61,369**	**65,065**
Average Annual Growth Rate			**5.11%**	**23.50%**	**-0.24%**	**-0.74%**	**-1.56%**	**-1.24%**	**-0.77%**	**-0.48%**	**-0.02%**	**0.59%**

Containerized US Commodity Forecast For HI-TECH PRODUCTS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(TEUs)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	344	418	410	423	432	564	713	915	1,599	3,047	6,420
North Atlantic	Asia	3,455	4,716	7,437	7,764	8,347	11,352	15,323	21,329	43,180	89,843	188,232
North Atlantic	Europe	13,522	17,465	18,727	18,862	19,219	21,884	23,893	26,691	34,804	47,593	68,017
North Atlantic	Mideast	461	1,247	1,301	1,342	1,420	1,886	2,313	2,749	3,795	5,126	6,802
North Atlantic	North America	22	49	5	5	6	9	12	15	25	38	54
North Atlantic	South America	3,896	6,531	7,030	7,702	7,965	10,224	12,455	14,246	18,149	22,069	25,827
North Atlantic	Caribbean	92	141	412	432	456	629	948	1,531	3,886	9,331	21,968
South Atlantic	Africa	249	260	292	306	320	407	495	586	850	1,311	2,237
South Atlantic	Asia	2,334	1,344	1,555	1,687	1,819	2,587	3,593	5,117	10,631	22,588	47,881
South Atlantic	Europe	3,888	5,530	5,940	6,005	6,275	7,445	8,359	9,344	11,755	14,840	18,921
South Atlantic	Mideast	180	337	291	307	333	463	596	732	1,087	1,576	2,229
South Atlantic	North America	54	272	249	284	308	474	628	776	1,117	1,483	1,855
South Atlantic	South America	17,810	16,990	11,872	12,862	13,635	19,290	26,656	37,043	74,273	154,971	341,126
South Atlantic	Caribbean	1,937	2,654	4,194	4,403	4,644	6,458	9,912	16,514	43,758	110,377	258,793
Gulf Coast	Africa	54	337	174	182	189	243	292	336	434	543	661
Gulf Coast	Asia	404	531	433	469	508	766	1,132	1,744	4,100	9,539	22,450
Gulf Coast	Europe	5,168	8,421	7,497	7,407	7,597	8,536	9,149	9,872	11,861	14,708	19,090
Gulf Coast	Mideast	105	141	234	247	269	368	472	579	874	1,293	1,872
Gulf Coast	North America	57	155	216	245	266	414	556	695	1,025	1,397	1,794
Gulf Coast	South America	3,958	2,586	1,409	1,519	1,601	2,086	2,620	3,145	4,482	6,507	10,234
Gulf Coast	Caribbean	240	237	313	326	341	451	654	1,018	2,489	6,005	13,729
South Pacific	Africa	11	31	140	147	154	202	256	297	364	398	403
South Pacific	Asia	36,516	37,620	41,835	45,098	48,127	65,290	87,044	118,422	230,576	466,883	959,208
South Pacific	Europe	3,818	2,186	2,271	2,262	2,356	2,671	2,868	3,094	3,731	4,671	6,159
South Pacific	Mideast	111	86	1,237	1,413	1,620	1,747	1,972	2,211	2,646	2,932	3,073
South Pacific	North America	8	97	361	411	442	578	679	747	894	1,061	1,268
South Pacific	South America	4,522	5,568	2,433	2,596	2,741	3,676	4,792	6,055	9,861	16,770	30,421
South Pacific	Caribbean	55	77	213	234	257	417	674	1,042	2,412	5,365	11,394
North Pacific	Africa	0	7	4	5	5	6	8	9	12	15	19
North Pacific	Asia	7,111	4,996	5,630	6,048	6,558	8,648	11,389	15,336	28,699	55,130	107,868
North Pacific	Europe	92	690	76	77	81	91	99	109	137	175	223
North Pacific	Mideast	5	8	3	3	3	4	5	6	7	10	12
North Pacific	North America	3	4	5	5	5	7	8	10	15	20	27
North Pacific	South America	105	1,005	18	19	20	29	41	60	129	272	559
North Pacific	Caribbean	16	4	3	4	4	8	17	33	104	279	673
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**110,600**	**122,741**	**124,222**	**131,100**	**138,322**	**179,910**	**230,624**	**302,407**	**553,761**	**1,078,367**	**2,181,502**
Average Annual Growth Rate			**2.10%**	**0.40%**	**5.54%**	**5.51%**	**5.40%**	**5.09%**	**5.57%**	**6.24%**	**6.89%**	**7.30%**

Containerized US Commodity Forecast For INTERMEDIATE MANUFACTURED PRODUCTS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(TEUs)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	1,519	1,652	2,734	2,645	2,568	3,011	3,408	3,721	4,349	4,985	5,627
North Atlantic	Asia	34,969	39,525	50,312	52,654	54,576	67,986	84,935	102,292	154,983	250,859	430,162
North Atlantic	Europe	32,650	40,143	63,280	65,186	68,367	82,429	97,885	113,966	156,185	223,111	344,059
North Atlantic	Mideast	5,026	4,505	5,158	5,285	5,219	6,377	7,328	8,089	9,736	11,559	13,617
North Atlantic	North America	99	43	117	128	134	164	195	218	259	292	314
North Atlantic	South America	23,580	14,742	12,995	13,870	14,108	16,187	18,486	20,371	24,314	28,530	33,115
North Atlantic	Caribbean	1,109	818	1,179	1,171	1,173	1,335	1,786	2,690	7,068	17,939	37,230
South Atlantic	Africa	730	657	656	612	571	694	797	896	1,103	1,312	1,510
South Atlantic	Asia	16,006	21,345	31,432	33,063	34,636	42,209	51,855	61,708	92,088	149,580	262,058
South Atlantic	Europe	15,308	20,883	23,085	23,631	24,112	28,306	32,482	36,719	47,802	65,365	97,151
South Atlantic	Mideast	1,773	2,047	1,637	1,660	1,667	1,985	2,302	2,591	3,258	4,080	5,112
South Atlantic	North America	462	869	1,633	1,813	2,004	3,035	4,346	5,643	8,788	12,977	18,432
South Atlantic	South America	46,978	29,513	25,344	26,847	27,492	31,750	36,099	39,658	46,959	54,603	62,815
South Atlantic	Caribbean	10,083	9,615	9,767	9,998	10,284	12,738	17,636	26,564	67,884	169,106	348,179
Gulf Coast	Africa	463	987	545	534	520	604	665	731	870	1,013	1,155
Gulf Coast	Asia	5,028	2,288	24,064	25,017	25,727	31,903	39,537	46,961	68,972	105,843	169,199
Gulf Coast	Europe	11,346	15,002	19,515	19,902	20,530	25,050	29,743	33,739	42,391	52,728	66,074
Gulf Coast	Mideast	1,200	955	797	795	774	973	1,173	1,414	2,077	3,084	4,575
Gulf Coast	North America	1,331	1,806	2,665	2,925	3,145	4,238	5,579	6,768	9,486	12,873	17,090
Gulf Coast	South America	19,458	19,246	12,524	13,252	13,513	15,136	16,728	18,097	20,916	23,839	26,946
Gulf Coast	Caribbean	5,154	6,029	4,872	5,012	5,133	6,016	7,758	10,950	26,136	63,883	130,968
South Pacific	Africa	9	85	137	132	130	157	181	201	235	262	278
South Pacific	Asia	142,664	128,611	140,872	147,481	154,565	192,211	240,569	290,155	438,581	706,598	1,195,344
South Pacific	Europe	3,407	3,274	21,065	22,062	24,503	32,988	42,731	51,545	69,807	90,510	114,298
South Pacific	Mideast	198	109	92	93	92	107	122	138	178	229	296
South Pacific	North America	68	955	4,218	4,432	4,577	4,952	5,395	5,587	5,774	5,864	5,956
South Pacific	South America	3,457	2,180	2,669	2,766	2,802	3,218	3,784	4,483	6,370	8,727	11,301
South Pacific	Caribbean	362	688	999	1,028	1,064	1,353	1,918	2,963	7,856	19,911	41,275
North Pacific	Africa	0	28	26	26	27	32	37	42	50	58	64
North Pacific	Asia	68,984	25,319	30,757	32,397	34,000	40,235	48,742	57,968	86,729	139,338	234,969
North Pacific	Europe	461	455	786	820	887	1,194	1,506	1,956	3,648	6,797	11,575
North Pacific	Mideast	7	2	1	1	1	2	2	2	3	4	4
North Pacific	North America	365	267	264	276	281	374	478	567	739	915	1,102
North Pacific	South America	371	157	123	122	117	107	107	109	118	133	151
North Pacific	Caribbean	15	10	3	4	4	6	10	17	47	123	257
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	6	0	0	0	0	0	0	0	0	0	0
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**454,646**	**394,810**	**496,325**	**517,641**	**539,304**	**659,061**	**806,305**	**959,521**	**1,415,759**	**2,237,029**	**3,692,261**
Average Annual Growth Rate			**-2.78%**	**7.93%**	**4.29%**	**4.19%**	**4.09%**	**4.12%**	**3.54%**	**3.97%**	**4.68%**	**5.14%**

Containerized US Commodity Forecast For MATERIALS
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(TEUs)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	3,716	2,333	3,160	3,103	2,982	3,003	3,007	3,055	3,258	3,558	4,102
North Atlantic	Asia	132,088	155,017	310,290	311,946	299,258	244,281	208,855	198,725	182,022	174,138	172,789
North Atlantic	Europe	70,605	51,671	50,203	52,830	52,815	42,673	39,231	40,266	47,984	69,694	122,741
North Atlantic	Mideast	8,712	11,225	5,918	6,010	6,122	5,561	5,312	5,412	5,709	6,147	6,750
North Atlantic	North America	1,421	748	585	594	606	629	683	751	892	1,042	1,200
North Atlantic	South America	24,727	24,537	23,422	23,509	22,891	21,533	21,177	21,588	23,056	24,762	26,442
North Atlantic	Caribbean	1,858	2,958	6,161	6,702	7,320	11,494	18,462	27,676	60,465	126,518	254,044
South Atlantic	Africa	887	1,440	767	741	706	696	685	677	721	723	730
South Atlantic	Asia	98,981	117,171	131,992	136,344	134,522	124,330	119,946	127,142	148,625	177,301	207,575
South Atlantic	Europe	62,479	79,521	86,930	92,490	95,073	81,514	77,755	81,053	90,039	103,105	120,888
South Atlantic	Mideast	10,612	13,959	14,209	14,104	13,824	13,565	13,230	13,497	14,338	15,472	16,908
South Atlantic	North America	1,513	2,898	1,574	1,594	1,627	1,626	1,695	1,695	1,664	1,712	1,826
South Atlantic	South America	52,432	57,240	48,949	49,596	49,051	48,389	48,700	50,102	55,007	60,579	66,583
South Atlantic	Caribbean	18,451	25,446	56,765	63,804	71,886	126,756	218,754	339,746	774,089	1,655,170	3,362,470
Gulf Coast	Africa	1,038	1,088	1,658	1,600	1,535	1,424	1,349	1,285	1,223	1,197	1,211
Gulf Coast	Asia	26,143	21,311	18,776	18,968	18,165	15,513	14,237	14,716	16,643	19,520	22,755
Gulf Coast	Europe	28,903	33,201	29,385	31,318	32,080	28,484	27,848	28,998	32,258	37,423	44,978
Gulf Coast	Mideast	3,624	5,712	3,367	3,347	3,270	3,452	3,570	3,782	4,300	4,947	5,742
Gulf Coast	North America	939	5,216	13,431	13,303	13,477	13,230	13,295	13,293	13,221	13,519	14,101
Gulf Coast	South America	17,093	13,343	10,830	10,782	10,577	10,098	10,012	10,236	10,968	11,834	12,713
Gulf Coast	Caribbean	19,462	27,055	48,224	51,235	54,635	77,156	113,609	161,142	328,103	659,693	1,294,578
South Pacific	Africa	114	195	286	272	264	245	225	205	192	167	145
South Pacific	Asia	350,301	345,535	633,175	630,377	602,069	499,603	425,670	396,400	344,844	314,220	303,726
South Pacific	Europe	6,710	2,990	1,704	1,840	1,845	1,513	1,372	1,310	1,214	1,152	1,125
South Pacific	Mideast	290	242	136	134	132	129	126	121	116	117	123
South Pacific	North America	52	193	140	138	143	156	168	174	187	207	234
South Pacific	South America	11,861	12,409	15,828	15,142	14,446	11,829	10,030	8,700	7,217	6,748	6,781
South Pacific	Caribbean	1,604	5,733	14,210	16,260	18,619	34,689	61,685	97,147	224,804	484,382	988,022
North Pacific	Africa	24	92	69	69	70	70	67	65	63	63	63
North Pacific	Asia	265,472	194,454	209,005	213,163	206,668	184,567	171,855	173,859	184,162	199,730	214,942
North Pacific	Europe	2,094	632	875	957	985	829	777	777	810	919	1,206
North Pacific	Mideast	1	2	26	26	25	24	23	20	15	11	9
North Pacific	North America	156	67	280	284	288	296	318	346	407	475	545
North Pacific	South America	867	1,166	606	605	598	580	582	600	647	698	744
North Pacific	Caribbean	0	119	222	234	246	330	463	636	1,236	2,415	4,659
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**1,225,228**	**1,216,922**	**1,743,159**	**1,773,421**	**1,738,822**	**1,610,270**	**1,634,773**	**1,825,194**	**2,580,498**	**4,179,359**	**7,283,450**
Average Annual Growth Rate			**-0.14%**	**12.73%**	**1.74%**	**-1.95%**	**-1.52%**	**0.30%**	**2.23%**	**3.52%**	**4.94%**	**5.71%**

Containerized US Commodity Forecast For ALL COMMODITIES
Sorted by ORIGIN, by Major Region, 1995-2050, Selected Years
(TEUs)

Origin	Destination	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	17,714	15,201	24,691	24,530	24,633	27,559	29,548	31,229	35,108	40,155	47,995
North Atlantic	Asia	310,054	319,145	558,179	570,496	566,122	556,525	574,208	633,137	833,846	1,237,439	2,040,377
North Atlantic	Europe	393,819	405,608	439,053	451,167	458,574	516,885	569,824	632,804	805,392	1,080,815	1,548,565
North Atlantic	Mideast	32,235	40,396	40,944	42,447	44,335	49,358	53,501	58,232	69,014	81,665	96,539
North Atlantic	North America	2,196	1,973	1,703	1,729	1,777	1,987	2,142	2,356	2,798	3,276	3,784
North Atlantic	South America	139,930	134,698	124,654	130,986	132,473	150,080	164,053	177,505	209,005	247,137	292,045
North Atlantic	Caribbean	6,080	11,823	19,089	20,350	21,646	28,779	37,402	49,004	90,536	175,411	337,142
South Atlantic	Africa	6,928	8,401	6,455	6,383	6,439	7,400	8,065	8,805	10,702	13,381	17,816
South Atlantic	Asia	281,296	332,102	464,106	483,674	491,975	523,576	564,710	631,311	832,835	1,186,089	1,805,039
South Atlantic	Europe	230,004	275,207	329,724	341,682	344,962	356,716	377,072	405,753	482,644	597,086	762,937
South Atlantic	Mideast	22,439	32,412	39,473	39,410	39,498	47,698	51,478	56,456	68,354	82,741	99,427
South Atlantic	North America	5,091	10,427	14,625	15,454	16,111	19,669	22,922	25,737	32,090	39,707	48,805
South Atlantic	South America	270,767	257,994	214,724	225,095	228,939	260,479	292,084	328,407	444,435	652,027	1,015,889
South Atlantic	Caribbean	72,902	115,722	127,923	137,013	147,072	210,712	312,874	451,900	961,834	2,020,247	4,065,810
Gulf Coast	Africa	5,776	10,187	11,741	11,620	11,628	13,448	15,266	17,894	26,953	43,270	68,949
Gulf Coast	Asia	95,974	69,056	109,465	113,331	115,021	128,545	148,131	176,022	268,491	449,707	797,829
Gulf Coast	Europe	213,093	258,827	295,708	300,263	300,211	326,356	349,762	375,911	448,293	559,316	732,018
Gulf Coast	Mideast	19,639	31,953	44,049	44,804	45,718	56,262	62,652	69,706	85,933	105,136	127,154
Gulf Coast	North America	7,123	27,192	220,425	236,959	251,967	344,664	395,166	444,464	546,896	655,735	769,447
Gulf Coast	South America	189,223	201,876	194,628	204,612	206,964	233,107	258,732	288,242	378,377	534,669	772,870
Gulf Coast	Caribbean	70,459	99,379	135,059	140,617	146,153	177,090	221,753	279,860	480,613	873,409	1,603,338
South Pacific	Africa	861	754	1,156	1,111	1,094	1,309	1,449	1,566	1,804	1,998	2,170
South Pacific	Asia	1,636,745	1,586,577	1,991,897	2,047,080	2,064,261	2,217,863	2,381,638	2,652,889	3,496,334	5,098,038	8,191,244
South Pacific	Europe	70,917	74,394	91,528	93,108	94,447	111,297	125,808	139,777	171,636	212,992	270,620
South Pacific	Mideast	2,940	5,291	8,127	8,482	8,764	10,827	12,144	13,470	16,349	19,443	22,686
South Pacific	North America	710	7,406	7,472	7,998	8,368	9,986	11,360	12,276	13,863	15,367	16,982
South Pacific	South America	38,624	40,237	40,102	40,432	40,546	42,622	45,077	48,790	61,620	83,315	116,636
South Pacific	Caribbean	3,720	10,357	23,149	25,515	28,177	45,666	73,934	111,269	246,259	522,132	1,054,595
North Pacific	Africa	272	327	776	759	736	848	875	930	1,021	1,111	1,201
North Pacific	Asia	906,658	762,800	822,420	854,304	874,974	974,426	1,039,333	1,131,816	1,374,465	1,729,282	2,297,663
North Pacific	Europe	20,917	19,449	24,462	25,532	25,957	27,827	28,471	30,270	36,726	47,347	63,824
North Pacific	Mideast	149	425	653	647	659	762	849	944	1,146	1,381	1,653
North Pacific	North America	1,673	2,471	1,730	1,720	1,764	2,164	2,470	2,738	3,267	3,802	4,345
North Pacific	South America	6,967	8,174	7,085	7,365	7,529	8,537	9,235	9,963	11,516	13,468	16,031
North Pacific	Caribbean	98	788	1,780	1,830	1,875	2,119	2,347	2,607	3,416	4,946	7,816
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	6	0	0	0	0	0	0	0	0	0	0
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**5,083,997**	**5,179,030**	**6,438,753**	**6,658,504**	**6,761,368**	**7,493,146**	**8,246,337**	**9,304,038**	**12,553,568**	**18,433,039**	**29,121,240**
Average Annual Growth Rate			**0.37%**	**7.53%**	**3.41%**	**1.54%**	**2.08%**	**1.93%**	**2.44%**	**3.04%**	**3.92%**	**4.68%**

Containerized U.S. Commodity By Destination (TEUs)

Containerized US Commodity Forecast For AGRICULTURE COMMODITIES
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(TEUs)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	532	4,969	5,495	5,266	5,311	5,277	5,110	4,592	4,266	3,965	3,756
North Atlantic	Asia	13,947	16,911	26,781	26,957	28,034	29,008	29,227	24,729	25,963	27,743	30,027
North Atlantic	Europe	18,754	42,156	55,782	54,067	53,364	61,950	61,553	55,444	54,609	56,506	59,848
North Atlantic	Mideast	2,112	3,154	4,951	5,545	6,231	7,467	8,346	5,340	6,198	7,167	8,253
North Atlantic	North America	1,241	2,158	903	903	887	761	722	701	783	933	1,130
North Atlantic	South America	19,341	37,133	67,880	67,970	69,950	77,014	84,487	90,792	110,780	135,072	163,371
North Atlantic	Caribbean	561	4,752	6,437	6,286	6,192	5,456	5,126	4,657	3,853	3,240	2,809
South Atlantic	Africa	370	227	106	109	117	113	111	74	73	72	70
South Atlantic	Asia	5,211	4,435	9,102	9,338	9,606	10,451	10,871	11,029	12,416	14,148	16,152
South Atlantic	Europe	3,821	19,271	19,350	18,661	18,525	23,485	24,626	23,418	23,716	25,108	27,293
South Atlantic	Mideast	202	623	432	471	524	607	663	684	776	877	989
South Atlantic	North America	221	1,971	802	801	806	809	813	827	888	975	1,082
South Atlantic	South America	26,586	39,119	60,872	61,363	64,253	73,457	77,073	79,379	83,728	86,843	88,774
South Atlantic	Caribbean	9,761	16,405	12,991	13,149	13,182	13,203	13,479	13,446	13,353	12,872	11,932
Gulf Coast	Africa	301	131	186	199	214	240	252	219	247	280	320
Gulf Coast	Asia	2,635	2,756	4,262	4,377	4,328	3,930	3,717	3,634	3,816	4,182	4,652
Gulf Coast	Europe	1,618	2,990	8,466	8,420	8,350	9,634	9,920	9,535	9,452	9,514	9,616
Gulf Coast	Mideast	155	55	216	236	269	331	372	399	468	545	630
Gulf Coast	North America	8,712	8,806	2,043	1,880	1,661	918	546	330	125	49	22
Gulf Coast	South America	18,634	43,130	66,732	66,958	68,911	73,219	73,729	73,605	73,717	73,069	71,439
Gulf Coast	Caribbean	12,716	10,181	4,842	4,600	4,467	3,638	3,117	2,557	1,834	1,374	1,087
South Pacific	Africa	23	73	60	67	75	88	98	75	92	111	132
South Pacific	Asia	21,727	47,071	77,434	77,739	80,635	86,900	91,417	87,638	100,151	115,486	132,971
South Pacific	Europe	2,820	3,231	5,318	5,308	5,347	6,243	6,455	6,349	7,111	8,067	9,125
South Pacific	Mideast	163	149	172	188	203	216	223	156	168	186	207
South Pacific	North America	1,455	1,164	616	655	698	769	858	783	991	1,243	1,536
South Pacific	South America	6,970	11,329	12,370	12,961	13,331	13,707	13,938	12,985	13,030	13,316	13,868
South Pacific	Caribbean	1,986	11,560	21,388	22,900	23,617	19,245	18,549	16,583	12,259	8,379	5,450
North Pacific	Africa	2	2	1	1	1	0	0	0	0	0	0
North Pacific	Asia	4,901	10,656	19,453	18,750	19,095	19,455	19,956	18,599	20,967	24,149	27,879
North Pacific	Europe	22	422	439	439	440	457	466	465	489	522	563
North Pacific	Mideast	5	3	4	5	5	5	5	6	6	6	7
North Pacific	North America	5,422	1,569	2,288	2,655	3,011	3,804	4,542	5,251	6,831	8,653	10,724
North Pacific	South America	5,022	1,935	2,742	2,712	2,758	2,850	3,018	3,172	3,638	4,243	4,978
North Pacific	Caribbean	438	1,090	1,410	1,373	1,349	1,162	1,068	948	721	537	400
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	0	1	0	0	0	0	0	0	0	0	0
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**198,388**	**351,586**	**502,330**	**503,308**	**515,745**	**555,871**	**574,453**	**558,402**	**597,517**	**649,432**	**711,090**
Average Annual Growth Rate			**12.13%**	**12.63%**	**0.19%**	**2.47%**	**1.51%**	**0.66%**	**-0.57%**	**0.68%**	**0.84%**	**0.91%**

Containerized US Commodity Forecast For CAPITAL EQUIPMENT
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(TEUs)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	927	2,953	3,565	3,994	4,560	7,480	9,399	11,368	16,204	22,380	29,972
North Atlantic	Asia	32,237	51,129	85,169	92,079	99,408	135,621	159,490	182,881	240,693	314,041	400,341
North Atlantic	Europe	105,139	152,481	154,596	166,370	182,206	251,157	293,848	336,689	434,131	542,574	653,441
North Atlantic	Mideast	2,349	2,986	7,058	6,974	7,144	9,702	10,986	11,992	14,463	17,512	21,027
North Atlantic	North America	118	150	169	187	202	272	324	375	502	668	876
North Atlantic	South America	26,108	33,767	53,740	60,239	62,206	82,881	100,079	116,564	155,086	199,537	248,770
North Atlantic	Caribbean	1	17	3	3	4	7	10	13	22	36	55
South Atlantic	Africa	2,107	1,307	5,119	5,679	6,467	10,354	12,377	14,250	18,459	23,256	28,517
South Atlantic	Asia	36,023	55,605	86,344	94,423	103,800	154,748	197,360	244,773	377,853	581,256	877,026
South Atlantic	Europe	46,457	87,427	110,164	113,615	122,141	187,816	233,101	281,413	400,042	550,035	730,324
South Atlantic	Mideast	2,523	2,956	5,683	6,156	6,925	11,023	13,692	16,374	23,075	31,723	42,334
South Atlantic	North America	1,027	2,030	4,267	4,814	5,432	8,541	10,706	12,897	18,174	24,715	32,446
South Atlantic	South America	15,769	23,089	27,048	30,379	33,165	48,465	59,545	70,855	99,253	136,272	182,562
South Atlantic	Caribbean	385	1,199	748	852	955	1,530	1,850	2,139	2,793	3,542	4,358
Gulf Coast	Africa	359	620	451	499	556	763	876	974	1,193	1,441	1,710
Gulf Coast	Asia	3,578	5,164	6,624	7,365	8,223	12,425	15,811	19,421	29,349	43,992	64,635
Gulf Coast	Europe	22,788	36,944	44,173	48,825	54,611	72,010	85,265	100,480	139,702	191,319	254,699
Gulf Coast	Mideast	560	545	2,976	3,211	3,587	5,431	6,776	8,180	11,855	16,822	23,183
Gulf Coast	North America	569	816	839	974	1,125	1,252	1,456	1,692	2,307	3,132	4,179
Gulf Coast	South America	7,266	10,887	90,173	101,895	114,835	178,312	220,900	262,744	362,341	483,949	625,834
Gulf Coast	Caribbean	952	4,294	16,333	19,014	21,855	30,453	35,541	39,970	50,706	63,954	79,530
South Pacific	Africa	16	206	354	404	460	616	736	854	1,141	1,500	1,929
South Pacific	Asia	426,067	595,394	732,303	793,347	861,682	1,214,076	1,450,700	1,685,942	2,255,148	2,958,491	3,768,431
South Pacific	Europe	11,035	17,884	15,988	17,039	18,700	27,770	33,854	40,233	55,794	75,271	98,439
South Pacific	Mideast	189	626	850	932	1,076	1,920	2,595	3,325	5,281	8,071	11,879
South Pacific	North America	181	1,051	1,684	1,906	2,153	3,384	4,187	4,980	6,857	9,141	11,797
South Pacific	South America	301	303	436	485	531	824	1,012	1,190	1,617	2,155	2,813
South Pacific	Caribbean	17	24	28	32	35	56	68	79	104	131	161
North Pacific	Africa	1	6	25	27	30	48	58	67	88	114	144
North Pacific	Asia	169,614	193,793	219,007	242,411	267,859	394,736	478,502	560,734	756,317	993,921	1,265,530
North Pacific	Europe	837	1,620	1,931	2,169	2,474	3,551	4,467	5,484	8,143	11,797	16,593
North Pacific	Mideast	0	10	15	14	16	26	33	40	59	84	118
North Pacific	North America	712	90	265	300	339	514	619	717	946	1,219	1,531
North Pacific	South America	27	10	58	64	69	114	147	180	263	375	519
North Pacific	Caribbean	0	1	0	0	0	0	0	1	1	1	2
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	169	30	64	70	79	110	129	142	167	189	205
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**916,410**	**1,287,409**	**1,678,250**	**1,826,748**	**1,994,911**	**2,857,989**	**3,446,498**	**4,040,010**	**5,490,128**	**7,314,619**	**9,485,907**
Average Annual Growth Rate			**7.03%**	**9.24%**	**8.85%**	**9.21%**	**7.46%**	**3.82%**	**3.23%**	**3.11%**	**2.91%**	**2.63%**

Containerized US Commodity Forecast For CHEMICALS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(TEUs)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	296	855	1,453	1,518	1,640	2,074	2,526	2,963	4,187	6,083	8,990
North Atlantic	Asia	24,852	35,872	51,590	53,567	57,449	69,705	77,396	83,394	99,760	124,218	158,514
North Atlantic	Europe	76,405	100,970	120,917	121,878	128,160	161,116	168,978	170,745	189,193	220,149	255,919
North Atlantic	Mideast	5,999	10,744	14,340	14,356	14,841	16,240	17,261	18,449	22,044	27,136	33,602
North Atlantic	North America	530	137	129	140	155	186	199	207	222	236	249
North Atlantic	South America	9,959	16,089	24,597	25,535	27,143	30,454	33,384	34,601	37,655	41,722	47,098
North Atlantic	Caribbean	26	84	28	32	37	52	60	66	77	88	99
South Atlantic	Africa	329	849	478	518	563	666	802	913	1,193	1,562	2,040
South Atlantic	Asia	17,985	30,944	42,280	42,502	43,749	46,773	50,391	53,004	62,271	78,566	103,754
South Atlantic	Europe	28,830	41,033	48,990	49,133	51,265	65,914	71,133	73,595	88,203	114,961	151,493
South Atlantic	Mideast	2,492	2,749	7,218	6,909	6,993	6,771	6,479	6,097	5,837	6,263	7,069
South Atlantic	North America	2,606	2,281	2,118	2,102	2,158	2,407	2,588	2,634	2,765	2,961	3,204
South Atlantic	South America	7,578	9,779	12,049	12,016	12,504	14,802	16,709	17,885	20,668	24,292	29,094
South Atlantic	Caribbean	128	1,181	338	389	453	652	797	955	1,363	1,934	2,710
Gulf Coast	Africa	143	983	1,430	1,389	1,435	1,724	1,920	2,026	2,239	2,467	2,725
Gulf Coast	Asia	6,000	11,613	9,895	10,083	10,664	12,200	13,084	13,301	13,874	14,817	16,127
Gulf Coast	Europe	35,627	47,764	57,414	59,963	64,927	85,985	94,480	99,126	117,977	151,070	195,812
Gulf Coast	Mideast	1,007	1,517	2,417	2,355	2,391	2,402	2,371	2,367	2,502	2,828	3,271
Gulf Coast	North America	5,242	2,402	7,920	7,803	8,110	9,175	9,795	9,960	10,516	11,523	13,124
Gulf Coast	South America	5,668	11,583	11,638	11,919	12,577	14,232	15,799	16,553	18,477	21,177	25,003
Gulf Coast	Caribbean	71	785	662	741	830	1,099	1,345	1,579	2,173	2,983	4,068
South Pacific	Africa	3	7	4	4	4	5	7	8	10	13	16
South Pacific	Asia	74,267	147,998	179,416	186,481	198,759	248,172	288,579	324,852	419,498	552,950	726,839
South Pacific	Europe	9,819	6,871	10,853	10,832	11,285	13,910	14,604	14,695	15,626	17,223	18,964
South Pacific	Mideast	559	578	825	850	898	1,166	1,397	1,656	2,385	3,466	4,995
South Pacific	North America	641	882	2,023	2,109	2,192	2,307	2,466	2,457	2,450	2,459	2,501
South Pacific	South America	399	491	1,432	1,433	1,480	1,671	1,849	1,917	2,068	2,245	2,465
South Pacific	Caribbean	5	51	158	181	210	299	362	432	613	869	1,218
North Pacific	Africa	0	2	0	0	0	0	0	1	1	1	1
North Pacific	Asia	25,020	30,670	44,119	44,519	46,555	56,209	63,003	68,539	83,704	105,914	135,171
North Pacific	Europe	173	222	853	846	932	1,219	1,324	1,393	1,477	1,425	1,304
North Pacific	Mideast	2	9	143	159	174	267	345	426	638	939	1,361
North Pacific	North America	396	134	81	75	74	75	71	65	53	43	33
North Pacific	South America	17	45	37	38	39	43	47	49	51	54	57
North Pacific	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	14	4	21	24	28	40	51	62	94	140	203
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**343,089**	**518,179**	**657,869**	**672,401**	**710,674**	**870,013**	**961,604**	**1,026,970**	**1,231,863**	**1,544,776**	**1,959,094**
Average Annual Growth Rate			**8.60%**	**8.28%**	**2.21%**	**5.69%**	**4.13%**	**2.02%**	**1.32%**	**1.84%**	**2.29%**	**2.40%**

Containerized US Commodity Forecast For CONSUMER GOODS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(TEUs)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	2,562	5,168	18,944	21,091	23,439	29,981	33,578	35,238	41,658	44,610	48,768
North Atlantic	Asia	113,503	216,845	387,030	406,925	442,126	630,475	740,474	859,751	1,149,556	1,510,453	1,940,144
North Atlantic	Europe	75,683	162,209	170,283	186,065	201,042	262,557	313,566	364,789	497,705	679,975	912,305
North Atlantic	Mideast	10,753	17,854	24,876	28,406	32,320	33,794	38,274	43,484	55,927	70,059	84,642
North Atlantic	North America	44	366	867	933	995	1,268	1,442	1,638	2,128	2,744	3,485
North Atlantic	South America	7,985	14,175	29,488	32,077	32,014	45,750	51,505	61,424	87,701	123,294	168,918
North Atlantic	Caribbean	121	3,324	4,370	4,390	4,493	4,738	4,850	4,911	5,063	5,132	5,125
South Atlantic	Africa	1,065	3,065	3,091	3,289	3,521	4,703	5,484	6,225	7,860	9,680	11,643
South Atlantic	Asia	64,866	178,257	317,544	344,968	387,159	624,221	802,546	1,015,118	1,597,744	2,450,914	3,647,756
South Atlantic	Europe	21,286	50,178	58,893	63,477	67,305	83,115	94,411	102,452	120,753	145,381	176,849
South Atlantic	Mideast	2,230	6,493	10,171	11,743	13,426	17,586	22,071	27,664	43,254	66,549	100,177
South Atlantic	North America	659	2,414	1,748	1,921	2,102	2,865	3,470	4,115	5,677	7,644	10,042
South Atlantic	South America	16,620	26,301	32,981	34,730	36,123	45,590	51,427	58,542	76,104	97,726	123,317
South Atlantic	Caribbean	34,858	87,040	89,201	91,906	96,329	115,011	132,913	151,711	197,759	251,544	312,094
Gulf Coast	Africa	337	316	489	536	579	795	929	1,061	1,357	1,693	2,063
Gulf Coast	Asia	1,049	1,481	11,688	12,398	13,930	22,025	27,597	34,209	52,083	77,801	113,388
Gulf Coast	Europe	7,687	22,457	24,638	27,043	29,004	37,955	44,419	50,274	64,098	82,375	105,664
Gulf Coast	Mideast	253	477	1,220	1,398	1,574	2,030	2,537	3,125	4,686	6,886	9,882
Gulf Coast	North America	1,004	16,000	22,007	23,166	24,838	32,664	38,573	44,260	57,125	71,937	88,462
Gulf Coast	South America	1,756	2,347	4,502	4,900	4,895	6,752	7,305	8,206	10,306	12,745	15,459
Gulf Coast	Caribbean	5,946	30,947	47,583	48,895	51,231	60,875	70,326	80,130	104,062	131,830	162,867
South Pacific	Africa	282	283	627	671	728	1,025	1,282	1,556	2,230	3,081	4,102
South Pacific	Asia	713,850	1,436,756	1,947,727	2,025,738	2,194,055	3,057,743	3,519,272	4,026,637	5,231,691	6,665,806	8,285,348
South Pacific	Europe	15,120	28,367	33,675	36,414	39,551	51,102	60,076	67,983	88,927	120,630	164,199
South Pacific	Mideast	190	1,346	695	787	847	1,216	1,456	1,769	2,550	3,566	4,765
South Pacific	North America	559	1,411	5,003	5,698	5,858	8,847	10,876	13,120	18,741	26,135	35,540
South Pacific	South America	1,062	1,243	2,606	2,837	2,986	3,962	4,496	5,159	6,763	8,740	11,092
South Pacific	Caribbean	1,460	3,576	15,816	16,238	17,012	20,185	23,315	26,553	34,458	43,624	53,860
North Pacific	Africa	3	14	42	47	50	72	87	103	140	185	236
North Pacific	Asia	183,707	275,691	326,084	339,644	368,169	514,268	592,232	678,701	885,198	1,131,597	1,409,925
North Pacific	Europe	466	712	771	849	889	1,164	1,342	1,504	1,852	2,225	2,605
North Pacific	Mideast	3	6	171	195	206	300	381	470	697	999	1,381
North Pacific	North America	217	104	240	262	291	392	472	562	786	1,077	1,439
North Pacific	South America	72	219	313	352	382	545	643	746	990	1,294	1,663
North Pacific	Caribbean	10	6	7	8	9	11	12	15	21	29	38
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	3	5	3	3	3	3	2	2	2	2	3
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**1,287,273**	**2,597,457**	**3,595,392**	**3,779,995**	**4,099,478**	**5,725,385**	**6,703,643**	**7,783,208**	**10,457,654**	**13,859,959**	**18,019,248**
Average Annual Growth Rate			**15.07%**	**11.45%**	**5.13%**	**8.45%**	**6.91%**	**3.21%**	**3.03%**	**3.00%**	**2.86%**	**2.66%**

Containerized US Commodity Forecast For EXTRACTIVE COMMODITIES
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(TEUs)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	350	720	1,448	1,464	1,537	1,759	1,774	1,731	1,678	1,651	1,641
North Atlantic	Asia	1,549	1,384	1,576	1,583	1,560	1,711	1,724	1,706	1,731	1,816	1,953
North Atlantic	Europe	11,390	10,407	10,894	9,937	9,228	11,180	8,245	5,649	2,944	1,857	1,442
North Atlantic	Mideast	312	2,030	248	271	291	279	270	252	223	198	178
North Atlantic	North America	15	26	28	29	28	31	34	37	45	54	64
North Atlantic	South America	760	1,832	960	986	966	1,068	1,076	1,049	1,004	963	924
North Atlantic	Caribbean	1	3	0	0	0	0	0	0	0	0	0
South Atlantic	Africa	83	98	76	79	83	104	116	124	146	173	205
South Atlantic	Asia	86	162	75	79	77	92	98	102	111	122	136
South Atlantic	Europe	2,225	4,311	35,418	32,299	32,261	50,229	52,935	54,224	57,744	62,138	68,084
South Atlantic	Mideast	652	1,387	477	545	624	648	698	727	796	879	975
South Atlantic	North America	157	179	260	263	245	240	233	225	209	193	178
South Atlantic	South America	2,400	2,540	2,635	2,835	2,859	2,866	2,832	2,806	2,789	2,831	2,937
South Atlantic	Caribbean	231	85	86	92	93	87	81	75	64	55	46
Gulf Coast	Africa	258	209	202	217	245	288	296	295	296	300	307
Gulf Coast	Asia	285	582	640	643	635	691	678	647	591	535	481
Gulf Coast	Europe	1,455	6,631	4,039	3,619	3,343	3,703	2,446	1,543	735	457	353
Gulf Coast	Mideast	21	158	184	200	205	242	270	292	344	405	474
Gulf Coast	North America	635	463	411	417	391	382	369	355	327	300	275
Gulf Coast	South America	2,558	4,685	1,944	1,897	2,096	2,537	2,681	2,748	2,932	3,166	3,447
Gulf Coast	Caribbean	89	32	22	24	24	23	21	20	17	14	12
South Pacific	Africa	217	7	1	1	1	1	1	1	1	1	1
South Pacific	Asia	2,523	19,364	12,040	11,156	10,815	9,866	8,561	7,382	5,527	4,155	3,187
South Pacific	Europe	1,448	1,126	3,884	3,452	3,081	3,468	2,191	1,273	468	220	133
South Pacific	Mideast	27	753	202	226	246	270	296	314	355	405	462
South Pacific	North America	4	96	101	107	107	115	123	131	148	168	189
South Pacific	South America	294	443	1,150	1,237	1,238	1,466	1,642	1,803	2,202	2,721	3,382
South Pacific	Caribbean	1	48	58	65	67	71	74	78	85	91	97
North Pacific	Africa	1	11	0	0	0	0	0	0	0	0	0
North Pacific	Asia	1,271	2,478	2,049	1,937	1,872	1,764	1,581	1,403	1,121	904	744
North Pacific	Europe	75	6	15	14	13	15	14	13	12	10	8
North Pacific	Mideast	0	0	1	2	2	2	2	2	3	3	4
North Pacific	North America	3	54	43	44	43	47	51	55	65	76	90
North Pacific	South America	6	16	3	4	4	4	4	4	4	4	4
North Pacific	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	494	0	0	0	0	0	0	0	0	0	0
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**31,876**	**62,326**	**81,171**	**75,724**	**74,282**	**95,248**	**91,419**	**87,066**	**84,716**	**86,866**	**92,412**
Average Annual Growth Rate			**14.35%**	**9.21%**	**-6.71%**	**-1.90%**	**5.10%**	**-0.82%**	**-0.97%**	**-0.27%**	**0.25%**	**0.62%**

Containerized US Commodity Forecast For FOOD
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(TEUs)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	3,218	4,016	5,347	6,138	7,076	9,793	10,644	11,443	13,064	14,713	16,374
North Atlantic	Asia	57,093	83,479	132,917	129,375	139,763	177,333	189,634	202,880	230,822	260,776	292,378
North Atlantic	Europe	144,953	254,378	289,208	310,295	341,572	377,835	386,766	395,014	409,490	417,243	418,687
North Atlantic	Mideast	12,111	8,988	12,193	13,634	15,478	19,660	21,380	22,926	26,067	29,191	32,195
North Atlantic	North America	1,876	540	1,377	1,426	1,545	1,767	1,727	1,689	1,590	1,472	1,359
North Atlantic	South America	47,016	51,481	75,386	79,492	82,104	96,901	100,241	103,972	111,636	118,596	125,644
North Atlantic	Caribbean	292	1,401	1,032	1,033	1,086	1,076	1,034	1,028	1,003	858	748
South Atlantic	Africa	603	1,046	2,572	2,710	2,897	3,417	3,585	3,746	4,077	4,418	4,763
South Atlantic	Asia	10,633	16,088	27,709	26,864	28,604	35,914	38,414	41,152	46,854	52,820	59,721
South Atlantic	Europe	30,411	62,000	67,643	73,871	82,789	94,014	102,004	111,200	132,323	154,922	178,727
South Atlantic	Mideast	1,252	1,871	2,018	2,269	2,606	3,960	4,370	4,781	5,725	6,795	7,950
South Atlantic	North America	576	3,459	3,770	3,833	3,908	4,190	4,258	4,380	4,665	4,971	5,335
South Atlantic	South America	20,134	30,228	40,537	42,363	43,328	50,133	52,490	55,851	62,859	69,154	75,482
South Atlantic	Caribbean	7,840	7,056	8,544	8,549	9,134	9,122	8,585	8,220	7,470	6,547	5,754
Gulf Coast	Africa	97	361	325	377	436	602	660	714	818	917	1,012
Gulf Coast	Asia	4,888	4,729	7,733	7,179	7,886	11,443	12,272	13,025	14,495	15,975	17,463
Gulf Coast	Europe	17,094	28,170	47,912	52,302	58,461	64,430	68,852	73,918	84,873	95,771	105,869
Gulf Coast	Mideast	433	244	479	542	612	673	743	811	969	1,161	1,392
Gulf Coast	North America	2,790	779	10,835	10,445	10,467	12,762	14,194	15,644	18,524	21,334	24,024
Gulf Coast	South America	5,791	7,814	9,391	9,955	10,524	12,150	12,530	12,847	13,374	13,758	14,069
Gulf Coast	Caribbean	2,887	1,335	2,045	2,076	2,223	2,368	2,348	2,307	2,160	1,960	1,769
South Pacific	Africa	112	215	433	505	593	802	917	1,037	1,290	1,555	1,822
South Pacific	Asia	103,095	167,611	211,963	209,550	226,124	274,268	289,480	305,488	338,646	373,634	409,982
South Pacific	Europe	38,926	68,233	79,025	87,253	98,048	109,985	119,393	129,568	151,162	172,215	191,157
South Pacific	Mideast	242	418	734	830	949	1,152	1,357	1,569	2,066	2,674	3,404
South Pacific	North America	2,016	9,319	46,775	45,330	49,800	50,799	46,947	43,790	38,331	34,033	30,782
South Pacific	South America	10,113	13,602	21,095	21,500	21,672	22,984	23,256	24,209	26,339	28,616	31,138
South Pacific	Caribbean	545	1,663	1,883	1,955	2,103	2,323	2,445	2,580	2,858	3,135	3,466
North Pacific	Africa	18	18	63	74	88	119	138	158	201	245	291
North Pacific	Asia	14,257	16,756	20,698	20,123	21,706	26,147	27,963	29,921	34,059	38,471	43,137
North Pacific	Europe	1,164	2,518	3,495	3,852	4,319	5,267	5,861	6,464	7,726	9,063	10,433
North Pacific	Mideast	1	15	30	32	35	41	48	55	71	90	114
North Pacific	North America	467	638	3,901	4,096	4,549	5,642	5,689	5,786	5,831	5,690	5,386
North Pacific	South America	1,856	2,339	2,319	2,359	2,439	2,502	2,514	2,601	2,769	2,907	3,028
North Pacific	Caribbean	32	187	122	135	151	183	209	234	284	332	380
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	9	13	65	73	83	126	151	174	234	312	410
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**544,842**	**853,008**	**1,141,574**	**1,182,393**	**1,285,159**	**1,491,883**	**1,563,097**	**1,641,184**	**1,804,728**	**1,966,323**	**2,125,644**
Average Annual Growth Rate			**9.38%**	**10.20%**	**3.58%**	**8.69%**	**3.03%**	**0.94%**	**0.98%**	**0.95%**	**0.86%**	**0.78%**

Containerized US Commodity Forecast For FUELS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(TEUs)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	0	0	0	0	0	0	0	0	0	0	0
North Atlantic	Asia	13	15	2	2	2	3	3	3	3	4	4
North Atlantic	Europe	415	491	550	597	598	605	632	665	799	1,011	1,296
North Atlantic	Mideast	0	0	0	0	0	0	0	0	0	0	0
North Atlantic	North America	0	0	0	0	0	0	0	0	0	0	0
North Atlantic	South America	9	0	0	0	0	0	0	0	0	0	0
North Atlantic	Caribbean	0	0	0	0	0	0	0	0	0	0	0
South Atlantic	Africa	0	0	0	0	0	0	0	0	0	0	0
South Atlantic	Asia	160	156	181	206	217	248	267	280	299	311	315
South Atlantic	Europe	55	160	182	205	214	248	279	305	368	444	537
South Atlantic	Mideast	0	0	0	0	0	0	0	0	0	0	0
South Atlantic	North America	1	0	0	0	0	0	0	0	0	0	0
South Atlantic	South America	0	33	44	52	56	71	87	102	137	180	230
South Atlantic	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Gulf Coast	Africa	0	0	0	0	0	0	0	0	0	0	0
Gulf Coast	Asia	73	138	34	39	41	46	50	52	55	57	58
Gulf Coast	Europe	312	684	823	902	913	954	1,005	1,041	1,174	1,381	1,664
Gulf Coast	Mideast	0	8	7	8	9	12	15	18	27	39	53
Gulf Coast	North America	13	0	0	0	0	0	0	0	0	0	0
Gulf Coast	South America	0	7	103	116	122	135	146	154	170	189	215
Gulf Coast	Caribbean	0	0	0	0	0	0	0	0	0	0	0
South Pacific	Africa	0	0	0	0	0	0	0	0	0	0	0
South Pacific	Asia	594	999	3,017	3,478	3,704	4,508	5,308	6,076	7,859	10,161	13,362
South Pacific	Europe	7,031	109	21	23	23	22	22	21	22	24	27
South Pacific	Mideast	0	0	0	0	0	0	0	0	0	0	0
South Pacific	North America	0	0	0	0	0	0	0	0	0	0	0
South Pacific	South America	0	5	0	0	0	0	0	0	0	0	0
South Pacific	Caribbean	0	0	0	0	0	0	0	0	0	0	0
North Pacific	Africa	0	0	0	0	0	0	0	0	0	0	0
North Pacific	Asia	102	58	246	282	299	351	390	421	476	524	565
North Pacific	Europe	0	0	0	0	0	0	0	0	0	0	0
North Pacific	Mideast	0	0	0	0	0	0	0	0	0	0	0
North Pacific	North America	0	0	0	0	0	0	0	0	0	0	0
North Pacific	South America	0	0	0	0	0	0	0	0	0	0	0
North Pacific	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**8,780**	**2,863**	**5,209**	**5,910**	**6,197**	**7,202**	**8,204**	**9,139**	**11,391**	**14,324**	**18,326**
Average Annual Growth Rate			**-20.08%**	**22.09%**	**13.45%**	**4.85%**	**3.05%**	**2.64%**	**2.18%**	**2.23%**	**2.32%**	**2.49%**

Containerized US Commodity Forecast For HI-TECH PRODUCTS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(TEUs)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	8	121	18	21	25	40	60	85	154	259	411
North Atlantic	Asia	10,425	19,490	23,828	25,234	27,736	43,917	58,337	75,058	120,887	189,208	287,703
North Atlantic	Europe	10,274	10,631	20,665	21,725	23,773	34,207	42,045	50,062	68,665	91,115	117,704
North Atlantic	Mideast	233	295	265	293	326	496	618	754	1,096	1,560	2,175
North Atlantic	North America	8	11	64	73	78	121	178	246	445	764	1,276
North Atlantic	South America	615	1,432	896	1,023	1,168	1,951	2,551	3,245	5,121	7,874	11,784
North Atlantic	Caribbean	0	0	0	0	0	0	0	0	0	0	0
South Atlantic	Africa	8	6	4	4	5	9	11	13	19	28	39
South Atlantic	Asia	14,038	16,545	25,867	26,942	28,710	42,466	54,173	67,924	107,688	170,639	266,336
South Atlantic	Europe	2,622	5,076	5,417	5,718	6,369	10,042	13,220	16,870	26,614	40,564	59,910
South Atlantic	Mideast	25	213	183	201	224	340	428	525	772	1,109	1,554
South Atlantic	North America	54	279	845	946	1,059	1,522	1,758	1,991	2,484	3,046	3,713
South Atlantic	South America	1,496	1,660	5,787	6,480	7,088	11,405	15,799	20,833	34,127	52,606	76,995
South Atlantic	Caribbean	139	137	166	185	208	298	345	389	480	575	679
Gulf Coast	Africa	0	5	0	0	0	0	0	0	0	0	0
Gulf Coast	Asia	367	736	834	881	989	1,647	2,271	3,013	5,099	8,288	12,997
Gulf Coast	Europe	1,333	2,495	2,346	2,481	2,750	4,233	5,389	6,747	10,365	15,501	22,551
Gulf Coast	Mideast	31	151	116	126	136	186	216	242	298	356	415
Gulf Coast	North America	6	83	144	160	180	255	291	325	394	466	547
Gulf Coast	South America	200	3,847	2,757	3,156	3,533	5,878	8,940	12,713	23,489	39,954	63,740
Gulf Coast	Caribbean	30	2	1,003	1,093	1,246	1,816	2,249	2,699	3,827	5,327	7,298
South Pacific	Africa	0	0	0	0	0	0	0	0	0	0	0
South Pacific	Asia	320,741	545,890	593,119	631,854	684,456	1,054,304	1,374,417	1,718,624	2,546,881	3,561,291	4,725,311
South Pacific	Europe	1,351	1,952	2,682	2,772	2,993	4,544	5,953	7,515	11,658	17,496	25,460
South Pacific	Mideast	8	2	0	0	1	1	1	2	3	5	7
South Pacific	North America	73	640	1,138	1,323	1,520	2,595	4,049	5,884	11,271	19,796	32,538
South Pacific	South America	4	147	10,949	12,850	15,080	25,715	41,038	60,602	118,628	211,320	350,779
South Pacific	Caribbean	0	0	0	0	0	0	0	0	0	0	0
North Pacific	Africa	0	0	0	0	0	0	0	0	0	0	0
North Pacific	Asia	55,270	69,231	60,239	64,282	70,143	106,270	141,063	178,158	267,156	376,171	501,820
North Pacific	Europe	20	118	37	42	41	59	77	95	143	211	306
North Pacific	Mideast	0	0	0	0	0	0	0	0	0	0	0
North Pacific	North America	11	8	5	5	6	8	11	13	18	26	37
North Pacific	South America	1	4	0	0	0	0	0	0	0	0	0
North Pacific	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	1	1	5	5	6	10	13	16	25	38	56
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**419,394**	**681,207**	**759,376**	**809,875**	**879,848**	**1,354,334**	**1,775,501**	**2,234,643**	**3,367,806**	**4,815,596**	**6,574,139**
Average Annual Growth Rate			**10.19%**	**3.69%**	**6.65%**	**8.64%**	**9.01%**	**5.56%**	**4.71%**	**4.19%**	**3.64%**	**3.16%**

Containerized US Commodity Forecast For INTERMEDIATE MANUFACTURED PRODUCTS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(TEUs)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	3,180	4,023	4,210	4,495	4,757	4,980	5,341	5,730	6,839	8,138	9,852
North Atlantic	Asia	63,043	105,793	157,433	164,477	178,842	239,773	293,539	344,929	472,580	637,462	844,006
North Atlantic	Europe	117,273	174,070	162,969	174,612	193,010	242,718	285,766	326,978	423,757	538,523	672,602
North Atlantic	Mideast	7,340	18,409	24,785	27,552	30,349	40,248	49,206	58,264	79,696	106,009	136,424
North Atlantic	North America	135	1,351	2,745	2,902	3,334	3,836	4,442	4,600	4,720	4,778	4,859
North Atlantic	South America	22,227	39,230	66,128	69,619	76,495	102,161	127,316	153,455	220,559	314,298	446,602
North Atlantic	Caribbean	0	92	55	63	71	90	100	107	123	140	156
South Atlantic	Africa	498	1,258	2,125	2,371	2,673	3,717	4,680	5,683	8,111	11,126	14,855
South Atlantic	Asia	39,366	71,024	112,212	119,253	131,682	193,930	262,456	343,239	586,816	996,519	1,663,560
South Atlantic	Europe	38,376	80,946	89,573	96,834	108,301	146,572	181,072	217,397	312,299	446,779	634,987
South Atlantic	Mideast	3,860	7,300	12,779	14,285	16,040	21,662	26,597	31,920	45,348	63,457	86,564
South Atlantic	North America	1,268	2,114	3,815	4,072	4,578	6,038	7,453	8,572	11,149	14,626	19,280
South Atlantic	South America	23,832	40,098	50,614	54,001	59,722	77,659	92,201	106,722	140,983	183,599	236,317
South Atlantic	Caribbean	2,768	3,023	3,452	3,966	4,559	6,621	8,875	11,335	17,930	27,564	41,253
Gulf Coast	Africa	836	2,748	2,015	2,276	2,454	2,449	2,506	2,601	3,030	3,556	4,074
Gulf Coast	Asia	5,171	10,511	14,190	15,272	16,906	24,422	32,444	41,265	66,090	104,859	164,672
Gulf Coast	Europe	46,434	59,333	51,974	55,718	61,933	84,315	105,418	127,159	184,489	266,974	383,901
Gulf Coast	Mideast	2,398	7,718	3,755	4,129	4,579	5,965	7,127	8,305	11,133	14,759	19,252
Gulf Coast	North America	1,166	983	1,803	2,021	2,284	3,171	4,205	5,271	8,042	11,979	17,444
Gulf Coast	South America	17,105	24,977	34,852	36,529	39,815	50,874	60,470	69,088	90,100	117,441	153,109
Gulf Coast	Caribbean	545	2,096	2,268	2,629	3,048	4,211	5,633	7,202	11,438	17,623	26,331
South Pacific	Africa	331	131	92	103	113	135	154	176	223	273	319
South Pacific	Asia	326,109	725,063	893,949	936,065	1,017,020	1,364,532	1,676,419	1,976,062	2,724,779	3,704,358	4,941,010
South Pacific	Europe	22,799	48,848	46,640	52,201	59,312	75,662	87,629	101,076	137,147	187,760	257,009
South Pacific	Mideast	1,742	3,664	7,810	8,984	10,367	15,129	19,457	24,416	37,898	57,989	87,283
South Pacific	North America	414	399	1,406	1,483	1,697	2,025	2,394	2,546	2,847	3,280	3,922
South Pacific	South America	2,279	7,104	105,130	119,156	134,366	173,075	181,086	186,575	199,596	217,162	240,725
South Pacific	Caribbean	146	61	62	69	78	106	127	145	189	247	324
North Pacific	Africa	3	14	14	16	17	18	19	20	24	28	32
North Pacific	Asia	99,708	138,546	177,525	186,532	202,803	272,885	338,518	401,227	555,244	753,903	1,002,320
North Pacific	Europe	787	1,542	2,600	2,745	3,011	4,113	5,083	6,055	8,355	11,142	14,842
North Pacific	Mideast	0	36	836	896	971	1,338	1,808	2,300	3,359	4,843	7,439
North Pacific	North America	349	307	139	146	160	202	241	275	360	482	656
North Pacific	South America	326	232	110,992	126,652	143,073	183,233	187,651	188,863	190,621	192,108	193,050
North Pacific	Caribbean	0	1	7	8	10	14	20	26	42	67	104
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	347	15	7	8	8	11	13	15	20	26	33
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**852,164**	**1,583,059**	**2,150,962**	**2,292,140**	**2,518,438**	**3,357,889**	**4,067,467**	**4,769,598**	**6,565,938**	**9,023,878**	**12,329,164**
Average Annual Growth Rate			**13.19%**	**10.76%**	**6.56%**	**9.87%**	**5.92%**	**3.91%**	**3.24%**	**3.25%**	**3.23%**	**3.17%**

Containerized US Commodity Forecast For MATERIALS
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(TEUs)

Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	434	578	1,461	1,472	1,541	1,723	1,903	2,013	2,224	2,432	2,631
North Atlantic	Asia	35,768	63,030	112,611	113,710	118,515	139,470	153,716	166,030	201,305	247,614	294,908
North Atlantic	Europe	64,691	107,933	194,152	183,999	181,270	191,330	192,294	195,060	208,598	228,892	253,222
North Atlantic	Mideast	3,847	11,861	16,626	18,354	19,412	22,500	23,569	25,120	29,351	35,274	43,131
North Atlantic	North America	757	793	655	740	800	966	1,055	1,109	1,223	1,345	1,466
North Atlantic	South America	30,272	45,315	81,240	85,876	92,536	111,899	122,499	133,403	158,457	190,169	230,775
North Atlantic	Caribbean	19	275	599	602	621	616	649	693	814	994	1,248
South Atlantic	Africa	734	1,387	1,642	1,627	1,685	1,870	2,113	2,351	2,932	3,698	4,684
South Atlantic	Asia	31,763	56,839	89,563	91,400	95,501	112,770	125,770	138,582	174,763	224,983	282,385
South Atlantic	Europe	30,960	57,430	88,717	89,040	92,185	102,144	106,564	111,143	126,071	148,272	178,486
South Atlantic	Mideast	2,689	9,178	11,550	12,543	13,386	15,565	16,507	17,757	21,358	26,549	33,467
South Atlantic	North America	696	1,819	957	982	1,002	1,039	1,061	1,073	1,122	1,208	1,320
South Atlantic	South America	17,918	27,238	337,238	311,952	301,153	257,147	219,607	213,221	195,441	170,888	146,527
South Atlantic	Caribbean	3,823	5,801	8,161	8,059	8,278	8,401	8,766	9,165	10,023	11,043	12,311
Gulf Coast	Africa	115	438	1,353	1,231	1,190	1,523	1,707	1,825	2,048	2,279	2,518
Gulf Coast	Asia	1,288	2,255	6,291	6,719	7,318	10,042	11,525	12,699	15,331	18,463	21,700
Gulf Coast	Europe	11,259	22,264	23,804	22,620	22,238	25,709	27,182	28,439	32,078	37,007	43,193
Gulf Coast	Mideast	408	825	976	1,042	1,131	1,390	1,524	1,671	2,056	2,583	3,270
Gulf Coast	North America	2,552	2,427	28,177	25,648	24,378	18,422	14,484	13,258	11,060	9,275	8,323
Gulf Coast	South America	6,132	16,815	58,087	56,038	56,312	60,669	59,570	60,454	60,887	60,188	59,479
Gulf Coast	Caribbean	485	840	2,059	2,008	2,040	1,924	1,897	1,942	2,038	2,154	2,320
South Pacific	Africa	0	110	164	163	167	221	273	322	441	603	823
South Pacific	Asia	266,333	506,170	669,239	660,891	673,938	726,175	762,508	791,724	906,175	1,074,013	1,283,261
South Pacific	Europe	14,516	21,671	17,258	16,571	16,411	17,018	16,827	16,705	18,088	21,014	25,317
South Pacific	Mideast	194	918	1,944	1,980	2,015	2,494	2,735	2,959	3,476	4,122	4,927
South Pacific	North America	3,433	4,066	2,448	2,767	2,994	3,605	3,940	4,145	4,580	5,045	5,520
South Pacific	South America	3,053	4,623	10,964	10,266	10,185	12,403	13,947	14,958	17,070	19,552	22,662
South Pacific	Caribbean	175	237	558	555	577	626	681	719	802	901	1,019
North Pacific	Africa	0	3	10	10	10	13	16	18	25	33	45
North Pacific	Asia	59,323	107,061	135,776	131,273	130,947	131,074	132,041	134,090	150,870	178,090	212,933
North Pacific	Europe	347	978	568	529	523	593	640	699	860	1,084	1,388
North Pacific	Mideast	0	56	179	167	165	237	290	335	436	557	706
North Pacific	North America	4,459	1,069	98	96	96	89	82	76	71	73	78
North Pacific	South America	536	1,076	1,563	1,440	1,414	1,991	2,390	2,709	3,384	4,170	5,114
North Pacific	Caribbean	0	16	14	13	14	16	17	19	21	24	27
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	2	0	3	4	4	5	6	6	7	7	7
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**598,980**	**1,083,396**	**1,906,704**	**1,862,388**	**1,881,953**	**1,983,682**	**2,030,356**	**2,106,491**	**2,365,487**	**2,734,600**	**3,191,191**
Average Annual Growth Rate			**12.58%**	**20.73%**	**-2.32%**	**1.05%**	**1.06%**	**0.47%**	**0.74%**	**1.17%**	**1.46%**	**1.56%**

Containerized US Commodity Forecast For ALL COMMODITIES
Sorted by DESTINATION, by Major Region, 1995-2050, Selected Years
(TEUs)

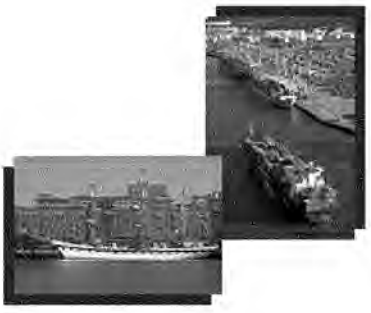
Destination	Origin	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
North Atlantic	Africa	11,506	23,405	41,942	45,459	49,887	63,108	70,335	75,165	90,274	104,231	122,395
North Atlantic	Asia	352,430	593,947	978,938	1,013,910	1,093,435	1,467,014	1,703,541	1,941,361	2,543,300	3,313,334	4,249,978
North Atlantic	Europe	624,978	1,015,725	1,180,015	1,229,544	1,314,223	1,594,454	1,753,693	1,901,094	2,289,891	2,777,845	3,346,466
North Atlantic	Mideast	45,055	76,321	105,340	115,384	126,393	150,387	169,911	186,581	235,065	294,107	361,627
North Atlantic	North America	4,723	5,534	6,937	7,333	8,023	9,208	10,123	10,602	11,659	12,994	14,763
North Atlantic	South America	164,292	240,453	400,315	422,818	444,580	550,078	623,138	698,506	888,000	1,131,526	1,443,885
North Atlantic	Caribbean	1,021	9,949	12,525	12,410	12,504	12,035	11,828	11,475	10,956	10,488	10,240
South Atlantic	Africa	5,797	9,243	15,213	16,386	18,012	24,951	29,277	33,381	42,871	54,012	66,818
South Atlantic	Asia	220,133	430,055	710,878	755,975	829,105	1,221,612	1,542,346	1,915,202	2,966,816	4,570,277	6,917,139
South Atlantic	Europe	205,044	407,832	524,347	542,852	581,355	763,578	879,344	992,016	1,288,131	1,688,606	2,206,690
South Atlantic	Mideast	15,925	32,770	50,510	55,122	60,747	78,162	91,504	106,527	146,940	204,201	281,078
South Atlantic	North America	7,265	16,545	18,583	19,732	21,291	27,651	32,341	36,714	47,134	60,339	76,600
South Atlantic	South America	132,332	200,084	569,805	556,169	560,250	581,596	587,770	626,195	716,089	824,392	962,235
South Atlantic	Caribbean	59,934	121,929	123,687	127,146	133,191	154,926	175,691	197,435	251,235	315,676	391,137
Gulf Coast	Africa	2,447	5,811	6,450	6,723	7,110	8,383	9,146	9,714	11,228	12,934	14,730
Gulf Coast	Asia	25,334	39,966	62,190	64,956	70,919	98,873	119,449	141,266	200,782	288,968	416,172
Gulf Coast	Europe	145,607	229,732	265,590	281,892	306,531	388,929	444,375	498,260	644,944	851,369	1,123,321
Gulf Coast	Mideast	5,268	11,698	12,347	13,247	14,493	18,661	21,950	25,410	34,338	46,383	61,823
Gulf Coast	North America	22,689	32,759	74,179	72,515	73,434	79,001	83,913	91,095	108,420	129,995	156,400
Gulf Coast	South America	65,112	126,092	280,180	293,364	313,620	404,758	462,070	519,113	655,793	825,635	1,031,793
Gulf Coast	Caribbean	23,721	50,512	76,817	81,079	86,964	106,406	122,476	138,405	178,256	227,218	285,282
South Pacific	Africa	985	1,031	1,735	1,919	2,140	2,894	3,468	4,029	5,429	7,138	9,144
South Pacific	Asia	2,255,308	4,192,316	5,320,205	5,536,300	5,951,187	8,040,545	9,466,661	10,930,426	14,536,355	19,020,344	24,289,703
South Pacific	Europe	124,866	198,292	215,344	231,866	254,751	309,726	347,005	385,419	486,003	619,920	789,830
South Pacific	Mideast	3,315	8,455	13,234	14,778	16,601	23,563	29,518	36,165	54,183	80,484	117,929
South Pacific	North America	8,776	19,028	61,193	61,377	67,018	74,446	75,840	77,834	86,216	101,300	124,325
South Pacific	South America	24,477	39,291	166,133	182,725	200,870	255,808	282,265	309,398	387,313	505,827	678,924
South Pacific	Caribbean	4,334	17,218	39,952	41,995	43,700	42,912	45,621	47,170	51,368	57,379	65,595
North Pacific	Africa	29	69	155	175	196	270	319	368	479	606	747
North Pacific	Asia	613,173	844,940	1,005,197	1,049,753	1,129,448	1,523,159	1,795,250	2,071,793	2,755,112	3,603,644	4,600,024
North Pacific	Europe	3,892	8,138	10,709	11,483	12,642	16,439	19,276	22,172	29,057	37,479	48,043
North Pacific	Mideast	11	134	1,379	1,469	1,574	2,216	2,912	3,634	5,268	7,522	11,131
North Pacific	North America	12,036	3,973	7,060	7,680	8,568	10,774	11,778	12,798	14,962	17,340	19,973
North Pacific	South America	7,863	5,876	118,027	133,621	150,178	191,281	196,415	198,323	201,721	205,155	208,413
North Pacific	Caribbean	480	1,300	1,560	1,538	1,533	1,386	1,326	1,242	1,090	989	951
Great Lakes	Africa	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Asia	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Europe	1,040	70	167	186	212	304	365	419	549	714	916
Great Lakes	Mideast	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	North America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	South America	0	0	0	0	0	0	0	0	0	0	0
Great Lakes	Caribbean	0	0	0	0	0	0	0	0	0	0	0
Total		**5,201,196**	**9,020,491**	**12,478,837**	**13,010,881**	**13,966,686**	**18,299,496**	**21,222,241**	**24,256,710**	**31,977,228**	**42,010,373**	**54,506,215**
Average Annual Growth Rate			**11.64%**	**11.42%**	**4.26%**	**7.35%**	**5.55%**	**3.01%**	**2.71%**	**2.80%**	**2.77%**	**2.64%**

Final Report

SAVANNAH HARBOR EXPANSION PROJECT
DEEP-DRAFT CHANNEL IMPROVEMENTS
ECONOMIC ANALYSIS: COMMODITY PROJECTIONS

Part 3: South Atlantic Region Waterborne Trade Forecast
Part 4: Savannah Harbor Waterborne Trade Forecast

US Army Corps of Engineers
Savannah District
Savannah, Georgia



Final

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Prepared by

GEC
9357 Interline Avenue
Baton Rouge, Louisiana 70809
Phone – 225/612-3000

357 E. Alameda
Santa Fe, New Mexico 87501

U.S. ARMY CORPS OF ENGINEERS
SAVANNAH DISTRICT
SAVANNAH, GEORGIA

November 2004

EXECUTIVE SUMMARY

The objective of this report is to present a long-term forecast of waterborne commerce for the U.S. South Atlantic Coast ports (including Norfolk) and Savannah Harbor for the period 2004 to 2050. The analysis proceeds out of the long-term forecast of World and U.S. waterborne commerce developed in parts 1 and 2 of this study.

To develop a long-term waterborne trade forecast for South Atlantic Coast ports, it is necessary to identify historic trends in the shares of U.S. waterborne trade handled by these ports since 1995. The trends in U.S. coastal shares are extrapolated in conjunction with variables (such as port physical characteristics) regarded as impacting coastal shares.

To develop port-specific shares, port coefficients and efficiency factors are aggregated through an econometric model in which port shares grow based on the average trend from 2000 to 2003. Specific port coefficients are estimated that relate share changes to changes in volumes through the port. Final port shares are based on a normalization procedure where port shares are aggregated and then forced to equal 100 percent, which insures that the maximum reported trade is not exceeded and that each port's relative attractiveness is appropriately measured.

The U.S. coast share and port shares are developed for total metric tonnes and for containers measured in Twenty-Foot Equivalent Units (TEUs). Containerized trade is derived using factors based on detailed commodity patterns (for example, that much of the U.S. containerized exports are low-value waste and scrap). Containerized tonnes are derived from TEU estimates, which insures consistency between reported metric tonnes and TEUs.

The U.S. South Atlantic Coast port forecasts reflect previous forecasts for the nation with respect to slowing of the rates of growth of annual imports and exports after 2005. U.S. and South Atlantic import markets are maturing, with slower growth from places like Europe and moderations in the burgeoning growth of trade with Asia. Exports are projected to decline faster than imports in the early years of the forecast, but then increase after 2030.

Forecast outputs are reported in metric tonnes, containerized tonnes, and TEUs for 1995 - 2003 then projected for 2004 - 2050. Outputs are summarized for 10 commodity groups, 13 world regions, and years 1995, 2000, 2003, 2004, 2005, 2010, 2015, 2020, 2030, 2040, and 2050 for the South Atlantic ports and Savannah. Because of the importance of containerized cargo to Savannah Harbor deepening, the forecasts emphasize TEUs derived from metric tonnes of all cargo.

For export TEUs, Savannah is projected to lose market share to Charleston because of slower comparative growth in its traditional export base. The export gap in annual TEUs is projected to close by 2020, with Charleston TEUs thereafter growing faster than Savannah's. However, by the end of the forecast the growth rate gap between Savannah and Charleston will be closed. For TEU imports, Savannah is expected to reduce the market share gap with Charleston in the early forecast years. After 2010, TEU import growth rates are projected to be the same, but the gap in total TEU imports will persist because Charleston has a larger inflow.

TABLE OF CONTENTS

Section **Page**

Part 3: SOUTH ATLANTIC REGION WATERBORNE TRADE FORECAST
and
Part 4: SAVANNAH HARBOR WATERBORNE TRADE FORECAST

I INTRODUCTION 1
II OBJECTIVES 1
III OVERVIEW 1
IV METHODOLOGY 2

Variables Impacting Port Shares 4

Static Factors 4
Geographic Distance 7
Dynamic Factors 7

Port Range Specific Effects 8
General Approach 8
Preliminary Analysis 10
TEUs 15
TEU Conversion 16

Metric Tonnes 18
Savannah and Charleston Projections 20

V DETAILED OUTPUTS FOR SOUTH ATLANTIC PORTS 22

Metric Tonnes 24
Containerized Tonnes 24
TEUs 37

VI DETAILED OUTPUTS FOR SAVANNAH HARBOR 37

Metric Tonnes 44
Containerized Tonnes 53
TEUs 62

VII CONCLUSIONS 71

Appendix A: Imports and Exports To/From U.S. South Atlantic Coast Ports, By World Trade Routes
Appendix B: Trade and Port Model Region Concordances
Appendix C: Trade and Port Model Product (Commodity) Concordances
Appendix D: Addendum to Final Report

LIST OF TABLES

Number **Page**

Part 3: SOUTH ATLANTIC REGION WATERBORNE TRADE FORECAST
and
Part 4: SAVANNAH HARBOR WATERBORNE TRADE FORECAST

1 PIERS and DOC Data Comparison of Imports from North Europe to Savannah, 2000-2003 (Metric Tonnes) 3

2 Port Characteristics 5

3 Port Effectiveness Measures 6

4 Coefficients Developed by the Port Choice Model for TEUs, for Import and Exports To/From North East Asia 11

5 Trade in Primary Materials to Central American (Export Shares for TEUs) 15

6 U.S. Trade in Containerized Products by Port and Port Range (TEUs) 15

7 Official Port Traffic Statistics as Reported by Ports to CI-Online 17

8 Share of TEUs Traded with World by U.S. Ports and Port Ranges 18

9 U.S. Trade in Bulk, Tanker and Liner Products (Metric Tonnes) 19

10 Shares of Total U.S. Exports and Imports 20

11 Savannah and Charleston Compared Trade To and From World in TEUs 21

12 Share of Savannah and Charleston Exports and Imports of Containerized Trade, by Commodity Group 23

13 Metric Tonnes of Imports to U.S. South Atlantic Coast Ports by World Trade Route, All Commodities: 1995-2050 (selected years) 25

14 Metric Tonnes of Exports to U.S. South Atlantic Coast Ports by World Trade Route, All Commodities: 1995-2050 (selected years) 28

15 Containerized Tonnes of Imports to U.S. South Atlantic Coast Ports by World Trade Route, All Commodities: 1995-2050 (selected years) 31

16 Containerized Tonnes of Exports to U.S. South Atlantic Coast Ports by World Trade Route, All Commodities: 1995-2050 (selected years) 34

LIST OF TABLES (cont'd)

Number **Page**

Part 3: SOUTH ATLANTIC REGION WATERBORNE TRADE FORECAST
and
Part 4: SAVANNAH HARBOR WATERBORNE TRADE FORECAST

17 TEUs of Imports to U.S. South Atlantic Coast Ports by World Trade Route, All Commodities: 1995-2050 (selected years) 38

18 TEUs of Exports to U.S. South Atlantic Coast Ports by World Trade Route, All Commodities: 1995-2050 (selected years) 41

19 Metric Tonnes of Imports to Savannah Harbor by World Trade Route and Commodity Groups: 1995-2050 (selected years) 45

20 Metric Tonnes of Exports to Savannah Harbor by World Trade Route and Commodity Groups: 1995-2050 (selected years) 49

21 Containerized Tonnes of Imports to Savannah Harbor by World Trade Route and Commodity Groups: 1995-2050 (selected years) 54

22 Containerized Tonnes of Exports to Savannah Harbor by World Trade Route and Commodity Groups: 1995-2050 (selected years) 58

23 TEUs of Imports to Savannah Harbor by World Trade Route and Commodity Groups: 1995-2050 (selected years) 63

24 TEUs of Exports to Savannah Harbor by World Trade Route and Commodity Groups: 1995-2050 (selected years) 67

LIST OF FIGURES

Number **Page**

Part 3: SOUTH ATLANTIC REGION WATERBORNE TRADE FORECAST
and
Part 4: SAVANNAH HARBOR WATERBORNE TRADE FORECAST

1 Import Shares of South Atlantic Ports, Consumer Products from North Europe 12

2 Import Shares of South Atlantic Ports, Consumer Products from North East Asia (includes China) 12

3 Year-to-Year Change in TEU Shares for Southern Ports for Primary Materials to Central America (2004-2050) 14

4 Exports – Savannah Compared to Charleston 72

5 Imports – Savannah Compared to Charleston 72

Part 3: SOUTH ATLANTIC REGION WATERBORNE TRADE FORECAST

and

Part 4: SAVANNAH HARBOR WATERBORNE TRADE FORECAST

I. INTRODUCTION

Commodity projections constitute one of the major inputs to harbor improvement studies, typically having a direct effect on National Economic Development (NED) benefits based on the growth and timing of future benefiting cargo volumes. The nature of commodity forecasts is long term, spanning upwards of 50 years concurrent with the estimated physical life of the project. Although most NED benefits will accrue within the first two decades of the inception of a project, from the standpoint of discount rates and net present value this is still a substantial period of time for forecasting. Traditionally, most forecasts range in duration from three to five years upwards to a decade. The very long-term forecasts necessitated by the large span of useful life of a deep-draft harbor improvement and the uncertainty of world trade require that commodity projections be carefully documented with respect to assumptions, data inputs, and interpretation of outputs.

II. OBJECTIVES

Savannah Harbor was last deepened subsequent to the Corps of Engineers 1992 Feasibility Study. In 1998, the Georgia Ports Authority (GPA) published a Feasibility Study, and deepening to no more than 48 feet was authorized by Congress, subject to the requirements in the October 1999 Chief's Report. The 1998 Feasibility Study had a commodity forecast for the period 2000 to 2050 with a base year of 1996.[1] The 1996 commodity projections are outdated and no longer appropriate for use. For example, the 1996 forecast shows Savannah Harbor container trade exceeding one million loaded TEUs by 2010.[2] In fact, this volume had already been achieved by 2003.

III. OVERVIEW

The international trade model used in the present analysis is based on a 92 x 92 matrix of real trade values for 80 commodities. The model, which is based on nominal U.S. dollars and 1995 U.S. dollar trade flows, covers 92 countries and regions. Within this group, the U.S. is divided into seven regions (U.S. East Coast, U.S. South, U.S. North, U.S. West, U.S. Alaska, U.S.

[1] Savannah Harbor Expansion, March 30, 1998, *Economic Appendix*, Historical and Projected Commodities, page 7.
[2] *Ibid*, page 15, Exhibit 3-11.

Hawaii, and Puerto Rico).[3] These major regional trade gateways are subdivided into a more detailed and disaggregated framework for measuring port success in attracting and holding liner and bulk trade flows. Key factors that drive port success (some of which are within the control of port administrators and others that are largely dependent on the changing pattern of industrial development and trade of the country as a whole) are used to project future port market shares. Port market shares are used to measure future growth in trade through these gateways.

The major U.S. gateways included in the model are the following:

- U.S. North Atlantic excluding Norfolk (USNAO)
- U.S. North Atlantic Norfolk (USNANF)[4]
- U.S. South Atlantic Wilmington (USSAW)
- U.S. South Atlantic Savannah (USSAS)
- U.S. South Atlantic Charleston (USSAC)
- U.S. South Atlantic Jacksonville (USSAJ)
- U.S. South Atlantic Miami (USSAM)
- U.S. Gulf Coast (USGC)
- U.S. Great Lakes (USGL)
- U.S. South Pacific (USSP)
- U.S. North Pacific (USNP)
- U.S. Alaska (USAK)
- U.S. Hawaii (USHI)

These 13 port ranges and ports constitute the elements of the port choice model developed for the present study. The model functions on the basis of U.S. Customs District data subdivided into these ports and port ranges.

IV. METHODOLOGY

The port choice model is based on an aggregated arrangement of countries and commodities that correspond to the PIERS aggregates for regions and commodity classifications comparable to that used in the first phase of the commodity projections study. This was done initially to enable comparison to PIERS data, which is available from public sources. However, examination of the PIERS data indicated that there were numerous problems with the time period covered and the completeness of the series.[5] Given the nature of the present study, it was determined that

[3] The U.S. South Region covers the South Atlantic Port Range and the Gulf Port Range, and the U.S. West covers the North Pacific Port Range and the South Pacific Port Range.

[4] In order to include Norfolk (Hampton Roads) in the South Atlantic port range, it was necessary to disaggregate it from the North Atlantic port range. The residual for the North Atlantic ports, excluding Norfolk, is shown for tracking purposes.

[5] The U.S. Department of Commerce (DOC) is the official U.S. source for both maritime and value-based trade data. These data are collected at a customs district level, and all known trade between the United States and the world must be cleared through customs. The Port Import Export Reporting Service (PIERS) operated by *The Journal of Commerce* as a for-profit entity collects data under the U.S. First Amendment right to public information. Information from ship manifests is collected by reporters of *The Journal of Commerce* and published daily. The government allowed PIERS to collect this information by hand, and for many years it was only available through this labor-intensive process. Not surprisingly, the collected information was often in error. Moreover, PIERS commodity categories are based on the sometimes very general descriptions in ship manifests. In addition, manifest information is only in metric tonnes and is not value-based. In recent years, the data collected exclusively by PIERS has become readily available to others because electronic manifests are now filed for much of the U.S. trade. Although these data are available to everyone, they are not customs data, and what appears on manifests is often less detailed than in

official U.S. government data produced by customs districts should be used and aggregated into the appropriate country, region, and port ranges.

As Table 1 illustrates, even for one of the largest routes inbound to Savannah from North Europe, there are numerous areas where PIERS data appear to be incomplete. Total metric tonnes (MTs) reported by PIERS is less than that officially reported by the Department of Commerce (DOC). The categories are slightly different as well (although the DOC data can be roughly correlated with the PIERS data if need be). It was decided to use the more detailed categories to allow for greater clarity and to be comparable to the earlier categories used in the study. Moreover, the DOC data enable matching with the main categories used in the core model and in the summary tables supplied for the world trade baseline.

Table 1. PIERS and DOC Data Comparison of Imports from North Europe to Savannah, 2000-2003 (Metric Tonnes)

PIERS Data				
Commodity	**2000**	**2001**	**2002**	**2003**
Automobiles	422	179	788	128
Chemical	396,842	413,246	557,873	700,262
Clay	10	14	18	30
Food	7,040	5,983	5,074	7,232
Forest and Paper Products	14,802	6,220	24,428	49,905
Hardware, Appliances, Machinery & Auto Parts	49,146	42,813	52,609	26,764
Iron and Steel	184,941	107,715	69,693	37,760
Metal and Ore	45	23,732	305	85
Mineral	23,149	909	982	1,178
Retail Consumer Goods	4,789	7,040	12,815	8,468
Textile	1,832	654	1,144	950
Total	**683,018**	**608,505**	**725,729**	**832,762**
DOC Data				
Commodity	**2000**	**2001**	**2002**	**2003**
Agriculture	75,735	74,777	125,077	45,252
Automobiles	1,822	1,725	1,239	178
Capital Equipment	86,740	81,503	68,185	57,662
Chemical	39,798	34,597	48,386	33,906
Consumer Goods	16,389	18,032	21,402	16,899
Extractive	298,379	310,845	512,358	547,962
Food	5,425	6,443	6,730	7,534
High Technology	343,673	240,210	213,065	174,471
Intermediate Products	90,338	70,684	81,710	72,155
Materials	125,388	108,777	140,835	153,748
Total	**1,083,687**	**947,593**	**1,218,987**	**1,109,767**

Source: QuERI-International.

customs declarations. Although PIERS and customs district metric tonnes should generally be the same, the PIERS data obtained for the purposes of this study showed numerous inconsistencies. Comparing total PIERS tonnes to DOC data shows that there is little compatibility between the two sources. The DOC data are the basis for the forecasting model used in the present study because they are more inclusive.

VARIABLES IMPACTING PORT SHARES

Model development demands that we first isolate the influences that "could" impact port selection by carriers. In a perfect world only these "objective measures" would determine port selection within a regional area. Some of these factors influencing port shares are static, changing only slowly over time. Others may be related to the dynamics of the region or the country (which regions are growing in terms of total trade and which products are of greatest importance). Geography will also play a major role in determining port throughput. These factors may include static factors -- ones that will vary only after a significant capital investment or where there is no time series available -- and more dynamic factors that are exogenous and change over time.[6]

Static Factors

The model is based on factors that should influence port choice. Actual port choice, however, is a function of decisions by companies, not port authorities or governments.[7] A port that has attractive features (deep water, good facilities, low-cost labor, and low port costs) may be located in a part of the country that has only a limited local market, that has poor transportation links to other regions, or that is geographically distant from the faster growing markets for U.S. trade. East Coast ports, for example, suffer because the U.S. trade with Europe is mature and the U.S. trade with fast-growing countries in Asia is more dynamic.

Additional factors that may influence port choice reflect economies of scale and cost of doing business for liner shippers and other transportation providers. If a port has adequate space for storage, rates are likely to be lower than at a port where storage is limited and costs reflect scarcity. Efficiency of equipment may be another factor of importance. Fewer berths mean that time delays will occur during a period of rapid growth. Port capacity per berth may also reflect the average size of vessels.

To measure the effect of equipment and other factors on port choice, QuERI has developed a database that categorizes most major U.S. and world ports using a number of criteria. Table 2 summarizes the characteristics of U.S. ports and port ranges.

To develop a port choice model, it is necessary to determine which factors govern the choices made by shipping companies. The factors identified in Table 3 cannot measure efficiency in themselves. They must be understood in relation to total traffic to obtain a measure of the relative effectiveness of ports. To do this, three separate measures of port effectiveness were developed:

- Twenty-Foot Equivalent Units (TEUs) per day per berth
- TEUs per day per ship-to-shore crane

[6] Static variables are primarily factors that represent current port capacity such as ship to shore cranes, storage space, berths, etc. Dynamic factors are those that can be measured on an annual basis and change over time, such as economic conditions within the region or the country. Static factors may become dynamic if a time series, covering more than one year, can be developed showing changes in port facilities.

[7] This is not to detract from marketing and investments and other measures taken by ports to attempt to influence decision makers to bring cargo and vessels to the port.

- TEU storage per daily TEU throughput

Table 2. Port Characteristics

City	Container Berths	Maximum Length Longest Berth (Meters)	Maximum Depth (Meters)	Total Port Area (Square Meters)	TEU Storage Capacity	Reefer Points	Ship to Shore Cranes	Post Panamax Cranes
Balitimore	3	952	12.8	1,120,000		128	7	
Baltimore	9	877	12.8	2,931,000	7,674	160	18	
Boston	2	330	12.2	677,000	7,500	396	6	
Chester	2	350	10.6	320,000	10,000	35	5	
Port of NY/NJ	26	1,370	14.0	3,242,000	14,786	1,516	38	2
Philadelphia	8	932	12.2	730,000	13,200	480	6	0
US North Atlantic Other	**50**	**0**	**0.0**	**9,020,000**	**53,160**	**2,715**	**80**	**2**
Norfolk	**12**	**1,290**	**13.7**	**3,954,800**	**37,040**	**314**	**24**	**4**
Charleston	**13**	**1,181**	**13.7**	**2,138,000**		**628**	**20**	
Jacksonville	**5**	**1,476**	**11.7**	**628,000**	**5,500**	**403**	**15**	
Miami	**5**	**1,525**	**12.8**	**2,530,700**	**6,038**	**918**	**10**	**7**
Port Everglades	**9**	**610**	**13.5**	**1,129,000**	**7,872**	**400**	**5**	**0**
Wilmington	**9**	**1,000**	**11.6**	**N/A**	**N/A**	**129**	**5**	**0**
Savanah	**7**	**2,322**	**12.8**	**4,532,000**	**33,598**	**284**	**13**	**6**
South Atlantic	**26**	**1,814**	**12.8**	**8,819,700**	**53,008**	**2,005**	**43**	**13**
Galveston	2	415	12.3	182,000	9,500	56	4	
Gulfport	1	1,525	12.3	40,000	9,500	60	2	
Houston	5	305	12.2	779,000	21,500	532	20	
Gulf Coast	**24**	**497**	**11.9**	**1,834,688**	**52,540**	**750**	**38**	**0**
Long Beach	3	823	15.2	420,780	18,600	300	5	
Long Beach	16	1,231	15.5	3,107,000	127,147	4,217	44	21
Los Angeles	19	1,768	14.0	2,925,000	52,574	3,340	44	17
South Pacific	**38**	**1,448**	**14.8**	**6,452,780**	**198,321**	**7,857**	**93**	**38**
Portland	6	869	12.2	498,000	19,146	474	11	2
San Francisco	3	762	10.7	279,352	4,414	414	4	0
Seattle	16	1,600	15.0	1,741,814	52,150	3,194	25	8
Oakland	26	1,327	15.2	3,355,001	56,100	4,260	41	
Tacoma	7	610	17.4	1,285,000	17,300	1,897	18	11
North Pacific	**58**	**0**	**0.0**	**7,159,167**	**149,110**	**10,239**	**99**	**21**
Alaska	**3**	**672**	**10.0**	**200,000**	**4,000**	**100**	**6**	**0**
Hawaii	**4**	**772**	**12.0**	**736,000**	**6,468**	**684**	**8**	**0**

Source: Containerization International, 2003, QuERI-International Aggregation.

Table 3. Port Effectiveness Measures

Port	TEUs per Day per Berth	TEUs per Crane per Day	TEU Storage per Daily TEUs	Regional GSP (Year 2000 Dollars)
Gulf Coast	98.23	62.04	22.29	$590,802
Norfolk	101.14	50.57	30.52	$2,306,694
Other North Atlantic	77.88	48.68	13.65	$2,306,694
North Pacific	182.46	114.04	16.60	$2,107,540
Charleston	101.99	66.29	49.78	$1,931,685
Jacksonville	101.86	33.95	10.80	$1,931,685
Miami	287.07	143.54	4.21	$1,931,685
Savannah	203.24	109.44	23.62	$1,931,685
South Pacific	433.00	176.93	12.05	$1,046,708

NOTE: GSP = Gross State Product

Source: Containerizational International, 2003, QuERI International Aggregation.

Each of these factors indicates different things. To measure ports with different absolute TEU throughputs, total TEUs were divided by 365 days per year. This assumes a stable pattern of flow for modeling purposes.[8] Each of the primary port facility factors was compared to the average TEUs per day measure. Where ports were aggregated, total TEUs were measured on a daily basis in relation to total ship-to-shore cranes or total number of active berths.

1. TEUs per available berth provide an approximate measure of average TEUs unloaded or loaded per ship arrival.[9] Ships remain only one day on average at a quay. If this is the case, the daily average divided by the number of berths provides an approximate measure of the volume per ship loaded or unloaded. Callings by larger ships and more boxes discharged or loaded should be a good measure of port attractiveness. This factor should be positive in relation to port share.

2. TEUs per day per ship-to-shore crane measures the relative ability of a port to handle larger vessels. If there are fewer cranes per ship, the volume per crane will be higher. If there are more cranes, TEUs per day per crane will be lower. If TEUs per day per ship-to-shore crane is a true measure of equipment relative to volume, ship owners can be expected to use a port with greater equipment ahead of a port with less equipment and therefore requiring more time in port to unload larger vessels. This factor should be negative in relation to port share. However, a case can be made for a positive relation where the throughput on the cranes is greater or the efficiency of the operators is better than average.

[8] There are distinct seasonal patterns of trade flows in a given year for particular trades that are beyond the scope of a long-term trade forecast.

[9] Given that container vessels at Savannah Harbor are often docked for less than an entire day (24 hour period), this equation gives an approximate measure of volume by berth.

3. Storage available per daily TEU flow indicates the relative size of TEU storage areas compared to the daily throughput of a port. Ports with greater available storage may pick up a larger share of the trade because they are less congested and offer better services to shippers.

With respect to other potential factors, the maximum depth or maximum length of quays is not robust in defining port shares for regional trade. This may be the result of a limited number of ships of sufficient size to influence trade flows by region and the availability of deep water at some very small ports with limited size and catchment areas. In today's environment, channel and port depth is not a reasonable measure for determining port share or potential port traffic. The availability of post-Panamax ship-to-shore cranes appears (at least at the present time) not to have a significant impact on port share. TEU throughput, as measured by total TEUs loaded and unloaded per ship-to-shore crane, captures at least some of the efficiency associated with these super cranes.

Geographic Distance

Distance from market is also critical in defining port shares. Ports on the West Coast are commonly cited as having a time and cost advantage over ports on the East Coast for some commodities. Geographic distance is represented in five increments. A port that is closest to the origin or destination is ranked as 1, the next closest as 2, and so on. Where two port ranges are nearly equal in distance, they are ranked the same. Geographic distance is inversely related to port share in all cases. The degree to which geography influences port share in the U.S. depends on the importance of the trade flow.

Together, these variables combined with coefficients estimated econometrically were used to approximate the base port share. They thus serve the same function as an intercept term in a standard time series econometric specification. The advantage is that a change in efficiency or storage can alter the observed average port share.

Dynamic Factors

Dynamic variables change over time. Economic activity variables were used in this study. Some analysts assume that when a region is growing strongly, more trade will naturally flow through a port. QuERI's models allow for regional differences by employing a measure of gross state product by commodity group. The rate of change varies between products and regions. When combined with the coefficients, this yields variations in port shares. Two different factors were developed for each commodity and port range (or port):

- Gross State Product (1995 dollars) Share by Commodity Group (major regions only).
- Total Gross State Product of Region.

It is expected that some products will be more sensitive than others with respect to changes in the Gross State Product share of regional economic activity. Intermediate products may be positively related to changes in share; but for other products, the presence of a strong and

growing industrial base may reduce the growth in market share of the port relative to growth through other ports outside of the region.

The total Gross State Product measures the overall size and growth rate of the region. It is not product-specific, but is applied to each of the products in the model. Nevertheless, as will be seen in the examination of one of the models, when the regional activity variable grows strongly, the share of a port often declines.

PORT RANGE SPECIFIC EFFECTS

Unlike other models, no port-specific constant term is used in QuERI's estimation. To develop specific port shares, the coefficients and the port-specific efficiency factors mentioned above are aggregated. Specific port coefficients are estimated that relate share changes to changes in TEU volumes through the port. The final port shares are based on a normalization procedure where port shares are aggregated and then forced to equal 100 percent.

This procedure insures that the maximum trade reported will not be exceeded and that each port's relative attractiveness is measured appropriately.

GENERAL APPROACH

The port share model is developed for total metric tonnes and TEUs. Containerized trade is derived using factors based on more detailed commodity patterns. Containerized tonnes will vary per TEU for similar products.[10] Many export bulk commodities are increasingly being shipped as backhaul cargo filling otherwise empty containers. For example, scrap metal, which is included in extractive, is sometimes shipped in containers. Waste paper is sometimes containerized and at other times moves in bulk carriers.

Containerized tonnes are derived from TEU estimates. To insure consistency and reduce anomalies, factors are checked after commodities are aggregated to insure that they fall within reasonable limits. Outliers are forced to upper or lower limits based on an algorithm that checks each year against a range that varies about one standard deviation of the average for the period 1995-2003. A second-order check limits differences between one year and the next to less than plus or minus 50 percent.

This insures consistency, but leads to small differences in containerized tonnes and TEUs as reported in prior databases. For purposes of division by port ranges and ports, this is essential to creating a reasonable forecast, especially one that extends to 50 years.[11]

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[10] In the U.S. core model, each of the 80 commodities has a unique containerized tons per TEU relationship. In this model, based on more aggregated data, the mix of products can produce results, when translated, that are different.

[11] The core database for containerized tonnes and TEUs is based on factors drawn from numerous sources. These are averages based on managers' estimates of tonnages carried on liner trade routes by many different companies and collected from various sources, including PIERS, Maersk, and P&O. Factors are also adjusted based on available information on top-line trade in containers. Standardized 20-foot TEUs are used as a universally recognized measure, but these are also impacted by route differences on numbers of TEUs and the more common and larger, Forty-Foot Equivalent units. Small variations in the ratio of 20- to 40-foot units can impact the applied stuffing factors, because the weight limits on 40-foot units are not simply double those of 20-foot units.

The econometric model was developed only for the major port ranges in the Continental United States. Other port ranges (U.S. Hawaii, U.S. Alaska, and U.S. Great Lakes) were geographically separate and/or the data streams were too sparse. For each port range, shares were allowed to grow based on the average growth trend from 2000 to 2003. The final estimated shares were renormalized yearly, insuring that the total volume of trade exported or imported is shared out completely.

The port share model formula is:

$$\ln(SH[X,M][to,fr][i,r,k] = f\begin{bmatrix} d[i,r], fberth[i], fssc[i], fstor[i], \ln(srgsp[k,i], \\ \ln(rgsptot[i]), \alpha \ln(Trade[t,i,r,k]) \end{bmatrix}$$

Where:
SH[X,M[to,fr][i,r,k] = Share of Port (i) of Total Exports (X) *to* or Imports (M) *fr*om with region [r] for product [k]
d[i,r] = order ranking of port from end-market (1 closest and 5 farthest)
fberth[i] = TEUs per day per berth for port i
fssc[i] = TEUs per ship-to-shore crane per day for port i
fstor[i] = Storage per daily TEU flow for port i
srgsp[k,i] = Share of Total U.S. Value-added of Region closest to port for product group k associated with port range i
rgsptot = Total value of gross state product (all commodities) associated with port range i
Trade[t,i,r,k] = Trade in MTs or TEUs (t) for port i, to/from region r, in product k

The model uses a multi-factor intercept term. Geography and port facilities define the intercept for each port. Using this approach, it is possible to measure the effect on port share (and throughput) of changes in equipage for the port. This enables measurement of the impact of an improvement in efficiency. Port-specific trends are derived from port shares and TEU volumes (or metric tonnes volumes) and are port-specific.

Typically, geographic distance has a negative sign, because the farther a port is from the origin or destination, the smaller the port share. This is true for higher-value products or for products that are differentiated. Products such as agricultural or wood products may show different patterns. Where a specific industry or natural resource is available, geographic location will play less of a role in determining port share.

When products are aggregated and when regions are aggregated into collections of similar (but oftentimes quite different) products, the growth rates of aggregates can vary. Containerized tonnes factors (applied to metric tonnes) and TEU stuffing factors (applied to containerized tonnes to develop estimates of TEUs) vary over time. The containerized shares sometime increase as routes become more concentrated with line trade or as commodities within even sometimes narrowly defined trade categories shift.

To insure consistency, QuERI has developed a method of checking historic factors based on individual product flows (that vary over time and have been adjusted to converge to well-known top-line estimates of total TEUs) and checks these against upper and lower bounds. When there is a significant divergence within these limits, the outliers are forced back to either the upper or lower bounds. This leads to some differences in containerized trade and TEUs from the prior study when trade is aggregated based on the original database. But these differences are mainly in estimation and do not noticeably impact the forecast of U.S. inbound and outbound trade.

Port efficiency factors carry mixed signs. Ports with a greater number of available berths may be less costly for ship owners, and ports with more berths are less likely to be congested. Thus, when TEUs per berth per day fall, port shares often increase.

There is more consistency in the signs of coefficients for port shares relative to TEUs loaded or offloaded per ship-to-shore crane. Generally, coefficients are positive and significant. Ports with faster and more efficient equipment have a greater share of this trade than ports with older and less effective equipment.

Storage per TEU is generally negative, reflecting the typically higher volume of the larger ports. In more active ports where cargo is moved through quickly, the needed storage area may be less relative to the TEU flow. These ports may also be older and in larger metropolitan areas where there are fewer places to store boxes. Lease costs on storage in a port like Los Angeles/Long Beach reflects the scarcity of land. Trade moves faster through this port, and if shippers need to store boxes until delivery, they find less-costly storage locations.

Economic factors for specific commodity groups generally show a negative sign. One possible explanation is that when a strong, dynamic local industry is growing rapidly, the incentive to import through the port is reduced. Import penetration may be less here than elsewhere. When a region is growing strongly, this generally reduces port share, which may also be the result of increased competition from closer suppliers at home.

Table 4 provides an example of the coefficients developed by the port choice model for TEUs for imports and exports related to North East Asia. The statistical coefficient and the t statistic are shown for the "effectiveness" parameters for geography, TEUs/Berth, TEUs/Crane, Storage/TEU, Gross State Product (GSP) Share, and Region Strength. The outputs for the port coasts and South Atlantic ports are shown for the Gulf, Norfolk, Other North Atlantic (excluding Norfolk), North Pacific, Charleston, Jacksonville, Miami, Savannah, and South Pacific.

PRELIMINARY ANALYSIS

Port shares have varied widely over the years in terms of both metric tonnes and TEU shares. Obviously, competitive pressures within port regions are also in play. Thus, Charleston and Savannah harbors each have been able to grow their share of the trade in containerized products in certain regions. As figures 1 and 2 illustrate, these vary by product and by region. For the North Europe trade (Figure 1) Charleston has been able to grow its share while Savannah has not. Conversely, the opposite has occurred for Savannah in the import share of consumer products from North East Asia (Figure 2), where Savannah has been able to grow its share while Charleston has not.

Competition between ports for business is intense. Predictions of future growth paths must rely solely on past relationships. There may be other factors that could influence or change the direction, but an objective analysis must rely on historic trends. For the present study, these trend data extend over the past eight years (1995-2003).[12]

[12] The summarized historic data reflects only 1995, 2000, and 2003, but the actual data set includes annual port statistics for the period 1995 through 2003.

Table 4. Coefficients Developed by the Port Choice Model for TEUs, for Import and Exports To/From North East Asia

Direction	Product Group	Coef/ T-Stat	Geo-graphy	TEU/Berth	TEU/Crane	Storage per TEU	GSP Share	Region Strength	Gulf	Norfolk	North Atlantic Other	North Pacific	Charleston	Jackson-ville	Miami	Savannah	South Pacific	Coef/ T-Stat.
Import	Agriculture	COEF	-1.722	-2.741	10.426	5.468	2.802	-3.503	0.385	1.25	2.159	0.379	0.111	1.526	1.313	0.2	0.469	0.935
Import	Agriculture	TSTAT	-0.911	-0.393	1.281	4.314	2.426	-4.724	2.578	4.577	8.887	1.466	0.697	2.022	4.034	1.419	2.41	1.174
Export	Agriculture	COEF	3.329	-9.881	9.031	-0.675	2.027	0.052	0.261	0.313	-0.051	0.71	0.179	-0.243	-0.064	0.425	1.263	0.966
Export	Agriculture	TSTAT	1.542	-0.821	0.629	-0.437	2.599	0.116	2.134	0.793	-0.175	2.933	1.365	-0.28	-0.188	3.119	3.691	1.134
Import	Extractive	COEF	1.156	12.045	-7.29	10.006	-1.661	-4.99	-0.556	-0.739	1.455	1.33	-1.352	0.507	2.451	-0.657	0.521	0.937
Import	Extractive	TSTAT	0.337	1.776	-0.956	5.939	-1.617	-3.883	-1.461	-2.877	3.826	2.478	-2.517	0.496	3.988	-2.074	1.542	1.698
Export	Extractive	COEF	2.932	32.738	-35.875	-0.528	-0.566	-1.368	0.761	-0.486	0.529	1.542	1.059	-1.672	0.054	0.751	0.222	0.938
Export	Extractive	TSTAT	1.43	3.453	-3.437	-0.202	-1.183	-2.725	2.977	-2.692	2.463	4.466	2.942	-2.899	0.116	-4.225	0.526	0.643
Import	Food	COEF	0.474	-10.902	17.953	2.537	1.211	-3.09	0.794	1.226	1.526	0.917	0.699	1.974	1.037	0.823	1.048	0.993
Import	Food	TSTAT	0.302	-1.447	1.907	2.169	4.017	-6.382	7.752	4.728	9.379	3.817	5.817	2.631	3.469	7.772	5.015	1.018
Export	Food	COEF	1.578	23.785	-21.553	-8.289	0.902	-0.789	1.288	0.761	0.59	0.959	1.741	-1.197	-1.158	0.609	-0.113	0.973
Export	Food	TSTAT	0.325	1.414	-1.124	-3.194	1.466	-2.101	3.685	1.195	0.907	2.11	5.674	-1.124	-2.694	2.638	-0.186	0.428
Import	Materials	COEF	3.193	-9.2	17.897	2.02	1.407	-3.902	0.734	1.049	1.233	1.073	0.682	1.682	0.67	0.618	1.008	0.996
Import	Materials	TSTAT	2.4	-1.814	2.808	3.116	6.458	-8.357	17.253	6.08	12.871	6.338	7.378	3.704	4.793	7.366	6.704	0.879
Export	Materials	COEF	1.644	17.725	-21.826	1.125	-1.099	-0.701	0.494	0.013	0.503	1.063	0.707	-0.615	0.582	0.689	0.506	0.997
Export	Materials	TSTAT	1.268	1.893	-2.169	0.426	-4.994	-3.427	1.62	0.098	5.173	3.822	1.815	-1.202	1.5	5.139	2.415	0.325
Import	Consumer	COEF	2.498	-21.658	32.603	-0.008	2.069	-3.671	0.922	1.358	1.128	0.834	0.939	2.32	0.635	0.869	1.131	0.993
Import	Consumer	TSTAT	1.508	-4.147	5.132	-0.011	5.571	-8.588	14.958	9.014	11.079	4.737	12.326	6.374	5.877	13.136	6.804	0.46
Export	Consumer	COEF	-5.958	13.896	-20.137	4.07	0.929	0.574	1.344	0.909	1.731	0.977	0.753	-0.766	1.769	1.101	0.935	0.977
Export	Consumer	TSTAT	-4.094	1.391	-1.818	2.101	1.486	1.475	8.633	3.025	6.521	5.616	3.086	-0.977	3.872	6.823	2.126	0.557
Import	Chemicals	COEF	5.407	-27.659	36.061	-4.224	0.816	-1.873	0.475	0.828	0.137	0.637	0.719	2.078	-0.48	0.558	1.156	0.993
Import	Chemicals	TSTAT	3.308	-3.39	3.608	-4.763	3.026	-3.112	2.166	2.584	0.671	1.957	3.24	2.916	-2.002	2.826	3.794	0.449
Export	Chemicals	COEF	0.077	-4.481	7.171	1.93	0.006	-1.688	0.404	0.628	0.751	0.56	0.369	0.619	0.333	0.439	0.623	0.963
Export	Chemicals	TSTAT	0.032	-0.326	0.45	1.923	0.011	-2.958	1.83	1.824	3.103	1.351	1.354	0.675	0.866	2.121	1.387	1.017
Import	High Tech.	COEF	-0.377	0.027	-0.71	-0.277	0.007	-0.009	-0.009	0.029	0.003	-0.009	0.024	-0.074	0.006	0.038	0.008	1
Import	High Tech.	TSTAT	-15.75	0.199	-4.327	-10.121	1.292	-1.625	-2.327	5.823	0.855	-2.196	6.42	-7.023	1.142	16.726	2.004	0.005
Export	High Tech.	COEF	-0.303	-0.844	0.276	-0.301	-0.007	-0.015	-0.034	0.043	-0.013	-0.02	0.016	-0.022	0.005	0.047	0.033	-1
Export	High Tech.	TSTAT	-10.822	-7.971	2.455	-13.449	-0.877	-1.781	-5.773	8.691	-2.475	-4.578	3.263	-2.6	0.952	12.444	5.433	0.009
Import	Interm. Mfg.	COEF	0.044	-10.417	14.355	0.064	-0.415	-1.545	0.345	0.776	0.771	0.469	0.48	1.062	0.399	0.548	0.647	0.998
Import	Interm. Mfg.	TSTAT	0.044	-3.416	3.993	0.062	-0.761	-6.829	3.045	6.817	5.547	3.874	4.542	6.274	2.161	7.445	7.331	0.256
Export	Interm. Mfg.	COEF	-3.42	23.533	-35.199	5.452	-0.602	1.259	0.647	-0.155	0.866	1.06	0.241	-1.967	1.545	0.759	0.848	0.917
Export	Interm. Mfg.	TSTAT	-1.464	1.7	-2.131	2.112	-0.307	1.863	2.409	-0.332	2.074	5.618	0.839	-1.911	3.074	3.358	1.934	0.675
Import	Capital Equip	COEF	1.479	-11.813	17.628	-4.191	-0.024	-1.367	0.559	1.017	0.616	0.547	0.914	1.116	-0.253	0.636	0.605	0.995
Import	Capital Equip	TSTAT	1.567	-3.159	3.857	-4.379	-0.095	-3.978	4.711	8.293	6.351	3.113	6.497	3.958	-1.373	6.482	4.622	0.168
Export	Capital Equip	COEF	-3.333	13.228	-18.493	1.586	0.299	0.58	0.907	0.529	1.057	0.828	0.672	-0.906	0.833	0.809	0.642	0.975
Export	Capital Equip	TSTAT	-3.213	2.399	-2.87	0.832	1.441	2.945	6.032	2.611	6.535	6.16	2.496	-2.144	2.104	6.236	3.037	0.35
Import	Auto	COEF	-3.846	-12.405	15.512	-1.508	0.41	-0.315	0.578	1.473	1.224	0.322	0.685	1.366	0.338	0.685	0.647	0.989
Import	Auto	TSTAT	-2.453	-2.307	2.39	-1.099	1.148	-1.026	4.362	6.698	6.203	1.692	4.459	3.312	1.167	6.073	3.333	0.239
Export	Auto	COEF	1.314	-47.494	51.431	-4.807	-0.932	0.248	1.205	2.483	0.696	0.828	1.307	-4.604	0.681	1.834	2.362	0.958
Export	Auto	TSTAT	0.491	-4.282	4.038	-1.959	-1.555	0.45	3.016	5.007	1.861	1.889	2.673	5.028	1.092	5.406	5.446	0.619

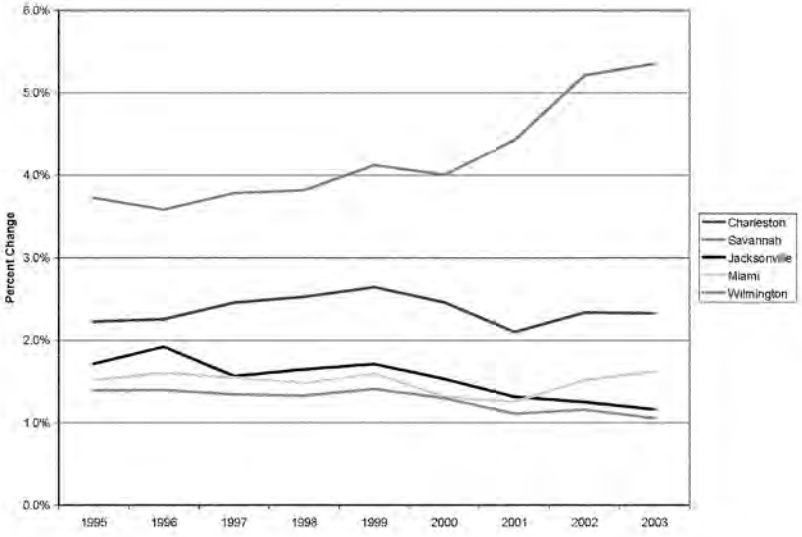

Figure 1. Import Shares of South Atlantic Ports, Consumer Products from North Europe

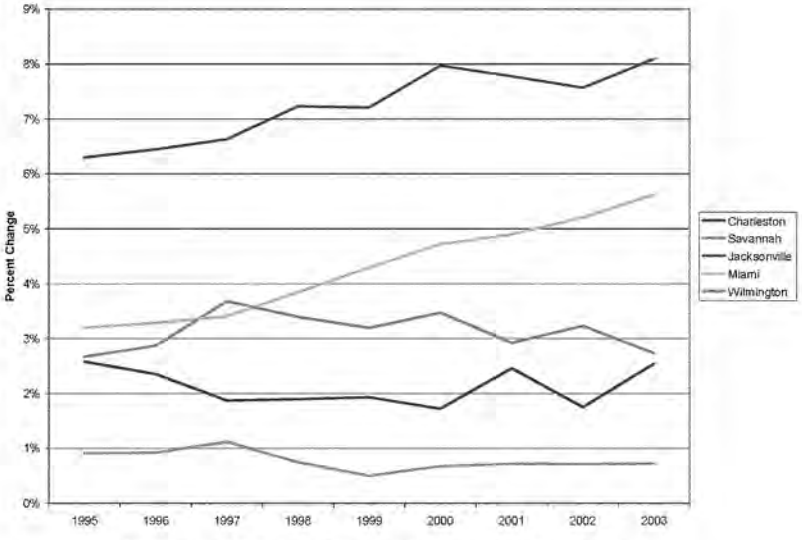

Figure 2. Import Shares of South Atlantic Ports, Consumer Products from North East Asia (includes China)

In examining the total volume through a port, we are left with the following external factors that influence port shares:

- Geographic proximity to growing or declining markets
- Past success at attracting and holding liner shipping companies
- Mix of products available for shipment from region
- Relative wealth of region and growth prospects

The port choice model uses geographic proxy measures of port accessibility and efficiency to accommodate the first two factors that impact port success. Geographic proximity to markets is measured through a rank relating the port or port region to overseas regions. Past success in attracting and holding liner shipping companies is measured using the volume of trade passing through the port. Where there is a positive relationship between port characteristics and volume, it can be assumed that these are the result of non-specific factors that define port attractiveness. These are included in the port-specific coefficient for port share to relative trade growth.

Port shares are influenced as well by the mix of products produced in the region (the South Atlantic has textile and paper and wood products in abundance) and the markets for the national output that are growing the fastest (for exports) or supplying the most imports.

The coefficient relating the U.S. regional exports to the port share also reflects the relative attractiveness of the port (refer to Table 4). Unlike the more static port characteristics used to define the port intercept (in the equation), regional economic outlook variables move over time. A separate forecasting model was developed to project GSP growth by state and product.

When a port-specific coefficient is greater than zero (refer to Table 4), the port picks up share relative to trade flow. The greater the coefficient the greater the impact on port shares for the same growth in total volume. Comparing coefficients across ports can give a fair measure of the success of that port relative to a sister port in the same region (these are measured on a regional port share rather than the national port share). For example, the port coefficients for Charleston and Savannah are quite similar across most of the commodity groups and trade flows in Table 4, with some exceptions such as larger coefficients for Charleston for food exports and larger coefficients for Savannah for exports of intermediate manufacturing.

The coefficient relating U.S. regional exports to the port share also reflects the relative attractiveness of the port. Unlike the more static port characteristics, it moves over time, reflecting the growth rate of overall U.S. trade and how this impacts the share of the various ports. A port that increases share will have a coefficient that is typically greater than 0, and one that significantly increases share will have a coefficient greater than 1.0. Comparing coefficients across ports provides a perspective on the success of a particular port relative to a port in the same region. These coefficients reflect the regional port share rather than the national port share.

The model takes each of these external factors into account. Port characteristics show fixed relationships, but these relationships can change over time, reflected in new information on

capitalization.[13] Figure 3 shows for a minor trade that the model with its varying growth trends and factors allows variation in the port shares. These variations are small, but over time they can have a significant impact on the flow of goods through a port. The example presented in Figure 3 is for three U.S. ports for a minor trade in Primary Materials (Textiles, Wood Products, Pulp and Paper Products) to Central America. The major ports for this trade are Southern U.S. ports on the East and West coasts that account for 99.2 percent of the total.

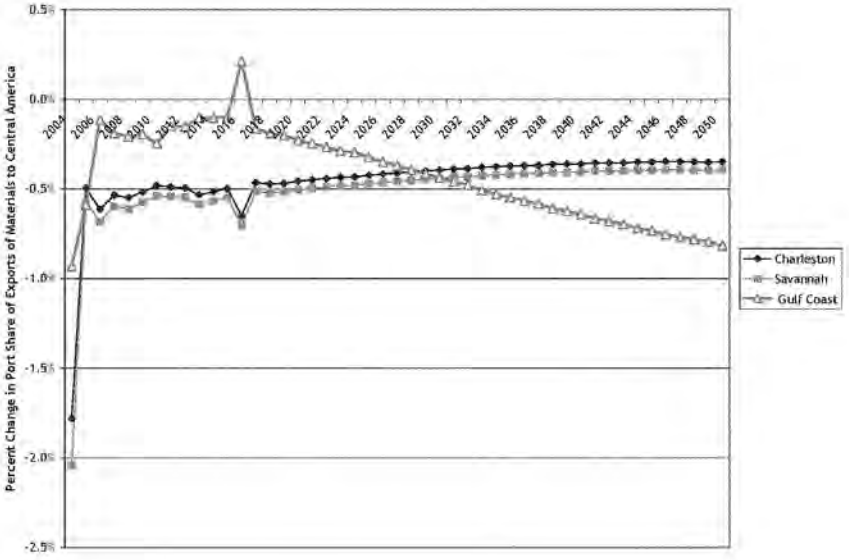

Figure 3. Year-to-Year Change in TEU Shares for Southern Ports for Primary Materials to Central America (2004-2050)

Table 5 shows the model-projected change in shares. These are quite small relative to the historic larger shifts sometimes observed in this trade.

[13] Although it is reasonable to use a comparative static approach and change one of the factors to measure the impact on port share, actual port characteristics and their impact on port shares are statistically modeled jointly. If Charleston improves its throughput per crane, it is reasonable to use this as a measure of the improvement in share relative to Savannah. Because port shares are renormalized, all changes in port characteristics need to be input and the resulting port shares calculated based on the normalized shares.

Table 5. Trade in Primary Materials to Central America (Export Shares for TEUs)

Port	1995	2000	2004	2005	2006	2007	2008	2009	2010
Gulf	33.59%	37.67%	36.01%	35.81%	35.78%	35.73%	35.67%	35.61%	35.54%
Norfolk	0.86%	0.70%	1.62%	1.60%	1.58%	1.56%	1.53%	1.51%	1.49%
Other North Atlantic	13.04%	10.04%	7.08%	7.10%	7.09%	7.08%	7.08%	7.07%	7.07%
Charleston	0.54%	4.50%	3.18%	3.17%	3.15%	3.13%	3.11%	3.09%	3.08%
Jacksonville	14.13%	8.63%	1.75%	1.69%	1.63%	1.58%	1.53%	1.47%	1.43%
Miami	23.74%	30.02%	33.66%	34.05%	34.32%	34.58%	34.85%	35.10%	35.35%
Savannah	5.44%	1.16%	4.80%	4.77%	4.74%	4.71%	4.68%	4.65%	4.63%
South Pacific	8.16%	6.88%	11.39%	11.30%	11.21%	11.13%	11.06%	10.98%	10.92%
Main Ports Total	99.49%	99.59%	99.50%	99.49%	99.50%	99.50%	99.50%	99.50%	99.50%

Source: QuERI-International.

TEUs

Table 6 shows the U.S. waterborne trade by import and export TEUs for major port ranges and for the South Atlantic ports of Charleston, Savannah, Jacksonville, Miami, Norfolk, and Wilmington. In assessing port shares across all commodity groups and trade regions, the mix of products also plays a key role. Trade in TEUs to and from the world shows different trends. As with aggregate port shares, it is dependent on the mix of commodities imported and exported and the sources for these commodities.

Table 6. U.S. Trade in Containerized Products by Port and Port Range (TEUs)

Exports								
Port/Port Range	**1995**	**2000**	**2005**	**2010**	**2020**	**2030**	**2040**	**2050**
Alaska	75,591	87,116	106,233	117,333	136,293	179,920	298,492	570,378
Gulf Coast	485,632	668,007	1,009,186	1,203,541	1,531,331	2,051,545	3,013,773	4,709,706
Great Lakes	26,523	48,490	53,878	61,418	79,099	122,079	242,777	525,132
Hawaii	16,760	25,304	229,475	257,045	327,528	469,320	773,187	1,422,637
Norfolk	368,035	353,597	391,428	419,754	488,878	640,788	993,433	1,720,759
North Atlantic Other	740,845	663,327	983,430	1,042,163	1,224,451	1,634,357	2,586,973	4,574,573
North Pacific	1,291,329	881,997	1,042,121	1,162,168	1,362,456	1,716,070	2,365,450	3,559,320
Charleston	364,677	414,276	449,501	505,916	648,299	895,918	1,364,276	2,196,283
Jacksonville	124,569	85,307	99,299	112,183	135,491	181,511	285,999	503,993
Miami	300,850	258,875	301,741	343,887	431,894	584,904	877,896	1,392,760
Savannah	229,687	266,237	440,833	454,179	524,294	678,899	992,854	1,599,101
Wilmington	54,094	22,298	21,143	24,479	36,222	71,517	178,500	435,375
South Pacific	1,640,588	1,483,657	1,794,697	1,921,938	2,296,057	3,099,866	4,964,520	8,966,347
Total Exports of U.S.	**5,719,179**	**5,228,489**	**6,922,766**	**7,626,003**	**9,222,292**	**12,326,785**	**18,938,131**	**32,173,364**
Imports								
Port/Port Range	**1995**	**2000**	**2005**	**2010**	**2020**	**2030**	**2040**	**2050**
Alaska	32,317	52,487	67,998	104,895	173,752	263,023	378,115	519,582
Gulf Coast	308,888	463,315	722,461	929,264	1,201,285	1,536,379	1,974,756	2,534,587
Great Lakes	16,585	53,162	68,873	106,328	177,132	271,270	398,812	571,768
Hawaii	64,599	84,512	126,038	182,573	302,765	506,237	873,849	1,565,782
Norfolk	252,672	464,963	747,670	986,995	1,297,150	1,719,736	2,294,811	3,028,714
North Atlantic Other	1,159,283	1,654,252	2,623,821	3,414,396	4,433,351	5,797,003	7,617,592	9,900,757
North Pacific	1,041,877	855,429	1,167,503	1,544,645	2,057,800	2,693,347	3,474,461	4,369,382
Charleston	273,581	508,175	766,476	1,053,532	1,522,373	2,125,422	2,917,229	3,905,324
Jacksonville	22,148	128,026	207,389	285,008	452,996	722,891	1,093,184	1,540,227
Miami	191,197	385,878	567,097	717,307	928,160	1,190,658	1,517,631	1,909,779
Savannah	196,136	388,714	664,876	916,546	1,310,895	1,848,206	2,585,808	3,527,589
Wilmington	26,268	71,050	92,810	139,503	230,356	357,183	533,105	770,210
South Pacific	2,563,634	4,032,476	6,042,027	7,937,940	10,303,360	13,204,243	16,767,558	20,978,966
Total Imports of U.S.	**6,149,984**	**9,142,438**	**13,864,939**	**18,318,933**	**24,392,355**	**32,233,589**	**42,426,911**	**55,122,665**

Source: QuERI-International.

Using the standardized conversion method, Gulf ports and Great Lakes ports with large volumes of metric tonnes for some commodities with small containerization shares sometimes show TEU estimates that are too large. To correct for this problem, containerization shares were adjusted for key products shipped into and out of these ports. TEU totals were then redistributed to other ports.

The QuERI estimates were compared to data on trade into and out of the largest U.S. ports available from the US Maritime Administration. A 2002 full year base was used to line up the in and out totals by port and port range. Adjustment factors varied between 0.9 and 1.1, with most factors close to unity (1.0).

TEU CONVERSION

A standardized TEU-to-metric tonnes conversion factor is used throughout the model. Actual port throughput may vary depending upon the mix of commodities and relative weight-to-container fill factors.

A comparison to estimated TEUs based on consistent TEU stuffing factors and methodology to actual, reported TEUs through the port shows that there may be a wide difference between what the port reports and what the model shows. One reason may be the definition of how a port measures a TEU. Because TEUs reflect the movement of ship cranes (sometimes boxes have to be removed from a ship to get at another box underneath and then are returned to the ship), the TEUs reported by the port may be, and usually are, greater than those measured using the "standardized" conversion approach. A TEU that is unloaded at the port and then reloaded on the ship may show up twice. Transshipments through the port are shown as TEUs, but are not included in the definition used in the present study. Table 7 indicates that for Charleston the ratio between port-reported TEUs and estimated loaded TEUs varies from 1.49 to 1.15. The ratio between port-reported TEUs and estimated loaded TEUs for Savannah is very consistent, ranging between 1.27 and 1.32.

The limited information available and the problems of comparing across all port ranges consistently forced the present study to use stable constants for filling TEUs and measuring TEU throughput for laden containers with trade reported for one port range and one origin or destination. Table 7 indicates the relationship between port-reported TEUs and tonnage and estimated TEUs based on metric tonnes for Savannah and Charleston.

Table 8 indicates port shares of TEUs for exports and imports by coast and for the South Atlantic ports of Charleston, Savannah, Jacksonville, and Miami for select years beginning in 1995 and ending in 2050. The projections show the North Atlantic (North Atlantic Other), excluding Norfolk, losing market share with respect to imports. Conversely, the South Atlantic ports, particularly Charleston and Savannah, are shown as gaining market share with respect to imports. The West Coast port ranges (North Pacific and South Pacific) show a declining share for imports and exports for the North Pacific and nearly a constant share for imports but a declining share for exports for the South Pacific.

Table 7. Official Port Traffic Statistics as Reported by Ports to CI-Online

Savannah				
	2000	**2001**	**2002**	**2003**
CI-Online Port Data (may reflect container lifts of laden boxes)				
Total TEUs	**954,382**	**1,077,486**	**1,327,939**	**1,521,206**
Imports	464,890	497,628		
Exports	489,492	579,858		
Empty	190,222	217,327		
Empty%	19.9%	20.2%		
Tonnage	7,321,490	8,055,583	8,893,236	10,045,117
U.S. Maritime Commission, 2002 Top 30 Container Port Statistics				
Inbound			561,000	
Outbound			453,000	
Total TEUs			**1,014,000**	
QuERI Estimates Based on DOC Metric Tonne Data				
Total TEUs	**754,383**	**816,097**	**1,016,353**	**1,166,453**
Inbound	410,031	429,621	557,843	641,552
Outbound	344,352	386,476	458,510	524,901
Tonnage (MTs)	14,077,855	16,364,668	18,638,072	21,140,851
Ratio Total Port Statistics to QuERI Estimates	1.27	1.32	1.31	1.30

Charleston				
	2000	**2001**	**2002**	**2003**
CI-Online Port Data (may reflect container lifts of laden boxes)				
Total TEUs	**1,632,747**	**1,528,034**	**1,592,835**	**1,690,846**
Imports				
Exports				
Empty				
Empty%				
Tonnage				
U.S. Maritime Commission, 2002 Top 30 Container Port Statistics				
Inbound			676,000	
Outbound			521,000	
Total			**1,197,000**	
QuERI Estimates Based on DOC Metric Tonne Data				
TEUs	**1,094,484**	**1,084,574**	**1,205,287**	**1,325,275**
Inbound	556,897	570,312	669,267	778,365
Outbound	537,587	514,262	536,020	546,910
MT	14,920,083	16,700,667	17,816,260	17,331,068
Ratio Total Port Statistics to QuERI Estimates	1.49	1.41	1.32	1.28

Source: QuERI-International.

Table 8. Share of TEUs Traded with World by U.S. Ports and Port Ranges

Exports								
Port/Port Range	1995	2000	2005	2010	2020	2030	2040	2050
Alaska	1.3%	1.1%	1.5%	1.5%	1.5%	1.5%	1.6%	1.8%
Gulf Coast	8.5%	12.8%	14.6%	15.8%	16.6%	16.6%	15.9%	14.6%
Great Lakes	0.5%	0.9%	0.8%	0.8%	0.9%	1.0%	1.3%	1.6%
Hawaii	0.3%	0.5%	3.3%	3.4%	3.6%	3.8%	4.1%	4.4%
Norfolk	6.4%	6.8%	5.7%	5.5%	5.3%	5.2%	5.2%	5.3%
North Atlantic Other	13.0%	12.7%	14.2%	13.7%	13.3%	13.3%	13.7%	14.2%
North Pacific	22.6%	16.9%	15.1%	15.2%	14.8%	13.9%	12.5%	11.1%
Charleston	**6.4%**	**7.9%**	**6.5%**	**6.6%**	**7.0%**	**7.3%**	**7.2%**	**6.8%**
Jacksonville	2.2%	1.6%	1.4%	1.5%	1.5%	1.5%	1.5%	1.6%
Miami	5.3%	5.0%	4.4%	4.5%	4.7%	4.7%	4.6%	4.3%
Savannah	**4.0%**	**5.1%**	**6.4%**	**6.0%**	**5.7%**	**5.5%**	**5.2%**	**5.0%**
Wilmington	0.9%	0.4%	0.3%	0.3%	0.4%	0.6%	0.9%	1.4%
South Pacific	28.7%	28.4%	25.9%	25.2%	24.9%	25.1%	26.2%	27.9%
Imports								
Port/Port Range	1995	2000	2005	2010	2020	2030	2040	2050
Alaska	0.5%	0.6%	0.5%	0.6%	0.7%	0.8%	0.9%	0.9%
Gulf Coast	5.0%	5.1%	5.2%	5.1%	4.9%	4.8%	4.7%	4.6%
Great Lakes	0.3%	0.6%	0.5%	0.6%	0.7%	0.8%	0.9%	1.0%
Hawaii	1.0%	0.9%	0.9%	1.0%	1.2%	1.6%	2.1%	2.8%
Norfolk	4.1%	5.1%	5.4%	5.4%	5.3%	5.3%	5.4%	5.5%
North Atlantic Other	18.9%	18.1%	18.9%	18.6%	18.2%	18.0%	18.0%	18.0%
North Pacific	16.9%	9.4%	8.4%	8.4%	8.4%	8.3%	8.2%	7.9%
Charleston	**4.4%**	**5.6%**	**5.5%**	**5.8%**	**6.2%**	**6.6%**	**6.9%**	**7.1%**
Jacksonville	0.4%	1.4%	1.5%	1.6%	1.9%	2.2%	2.6%	2.8%
Miami	3.1%	4.2%	4.1%	3.9%	3.8%	3.7%	3.6%	3.5%
Savannah	**3.2%**	**4.3%**	**4.8%**	**5.0%**	**5.4%**	**5.7%**	**6.1%**	**6.4%**
Wilmington	0.4%	0.8%	0.7%	0.8%	0.9%	1.1%	1.3%	1.4%
South Pacific	41.7%	44.1%	43.6%	43.3%	42.2%	41.0%	39.5%	38.1%

Source: QuERI-International.

Metric Tonnes

Tables 9 and 10 examine the volume of trade in metric tonnes by ports and port ranges as well as port shares. The U.S. Gulf port range has the largest volume of total metric tonnes. Exports, measured in metric tonnes, are dominated by grains and coal; imports are dominated by crude and finished petroleum products. The importance of the Gulf as a major refiner insures that it will continue to have the largest share of imports while at the same time continuing in importance as the major point of export for U.S. grains.

Table 9 provides the same detail as Table 6 (TEUs) for metric tonnes. Ports like Norfolk that ship coal or the Gulf Coast ports that ship most of the nation's grain dominate the metric tonne trade. The compound annual growth rates (percent) in Table 9 for Savannah and Charleston indicate growth rates for total metric tonnes consistent with the U.S.

Table 10 shows the port share of metric tonnes of exports and imports for the port ranges and South Atlantic ports of Norfolk, Charleston, Savannah, Jacksonville, and Miami for select years between 1995 and 2050. Other than Norfolk's declining share for exports, the South Atlantic ports' share is generally steady or increasing.

Table 9. U.S. Trade in Bulk, Tanker and Liner Products (Metric Tonnes)

Exports								
Port/Port Range	**1995**	**2000**	**2005**	**2010**	**2020**	**2030**	**2040**	**2050**
All Port Ranges	**251,370,211**	**212,856,887**	**217,671,381**	**232,098,313**	**258,521,722**	**303,739,049**	**379,462,039**	**531,306,089**
Percent Change	**N/A**	**-3.3%**	**0.4%**	**1.3%**	**1.1%**	**1.6%**	**2.3%**	**3.4%**
Alaska	4,637,202	5,827,467	4,763,719	5,093,229	5,679,937	6,813,025	8,821,873	12,841,114
Gulf Coast	86,020,093	78,724,188	79,934,223	85,696,672	95,881,482	111,653,896	137,546,076	185,563,105
Great Lakes	24,761,892	28,897,332	32,223,985	34,957,925	38,454,878	42,467,988	46,849,641	54,913,805
Hawaii	911,137	716,264	550,018	609,247	776,097	1,162,245	2,134,529	4,393,352
Norfolk	37,366,365	20,704,378	13,834,626	13,328,551	13,246,731	14,255,089	17,425,599	24,880,576
North Atlantic, Other	20,978,097	11,951,303	15,501,700	15,759,479	16,976,977	20,046,958	26,428,802	39,299,488
North Pacific	29,276,605	21,164,204	25,991,101	29,187,856	33,116,500	38,996,288	44,795,450	61,231,824
Charleston	**4,471,085**	**4,943,363**	**4,525,876**	**4,796,518**	**5,808,573**	**7,936,065**	**12,518,670**	**21,669,619**
Percent Change	**N/A**	**2.0%**	**-1.7%**	**1.2%**	**1.9%**	**3.2%**	**4.7%**	**5.6%**
Jacksonville	2,910,767	2,482,693	2,384,639	2,613,260	3,073,434	3,872,342	5,222,280	7,457,401
Miami	2,417,887	2,775,307	2,859,001	3,127,980	3,632,336	4,549,295	6,448,638	9,948,136
Savannah	**5,838,559**	**5,527,534**	**7,633,734**	**7,670,422**	**8,344,201**	**10,062,735**	**13,254,459**	**19,254,265**
Percent Change	**N/A**	**-1.1%**	**6.7%**	**0.1%**	**0.8%**	**1.9%**	**2.8%**	**3.8%**
Wilmington	1,118,155	1,142,204	683,424	640,118	706,696	987,658	1,790,944	3,739,136
South Pacific	30,662,388	28,000,650	26,785,336	28,618,058	32,823,878	40,963,466	56,225,087	86,114,270
Imports								
Port/Port Range	**1995**	**2000**	**2005**	**2010**	**2020**	**2030**	**2040**	**2050**
All Port Ranges	**349,618,044**	**480,643,870**	**609,407,813**	**732,752,219**	**870,072,437**	**1,028,642,640**	**1,237,230,419**	**1,503,326,524**
Percent Change	**N/A**	**6.6%**	**4.9%**	**3.8%**	**1.7%**	**1.7%**	**1.9%**	**2.0%**
Alaska	803,667	1,258,731	1,218,720	1,809,025	3,623,504	7,830,756	17,626,301	38,574,272
Gulf Coast	169,360,761	219,075,383	268,687,425	315,463,494	351,341,992	382,280,584	417,884,012	457,682,219
Great Lakes	25,588,225	30,166,611	33,291,795	37,495,126	42,628,587	49,419,867	60,078,568	78,572,643
Hawaii	5,370,606	6,389,349	6,913,556	8,734,781	12,367,443	18,625,637	29,067,376	44,313,899
Norfolk	6,994,318	8,322,228	10,780,474	13,627,474	17,292,126	21,422,507	26,272,184	31,878,838
North Atlantic, Other	70,489,654	97,532,863	136,058,556	162,839,330	192,105,162	223,766,727	263,367,006	313,960,208
North Pacific	13,841,574	18,430,292	20,695,134	27,302,737	38,466,398	52,944,216	71,063,242	91,314,456
Charleston	**4,097,103**	**7,434,344**	**11,600,373**	**15,145,150**	**20,549,886**	**27,184,092**	**35,637,899**	**45,562,525**
Percent Change	**N/A**	**12.7%**	**9.3%**	**5.5%**	**3.1%**	**2.8%**	**2.7%**	**2.5%**
Jacksonville	9,061,850	14,263,647	20,494,894	24,079,236	30,630,275	40,439,603	54,232,906	70,450,496
Miami	5,270,227	7,275,991	10,439,970	13,257,224	17,811,726	24,200,574	33,310,833	44,912,039
Savannah	**5,584,624**	**8,605,861**	**12,662,126**	**15,399,479**	**19,362,813**	**24,908,258**	**32,474,072**	**41,380,610**
Percent Change	**N/A**	**9.0%**	**8.0%**	**4.0%**	**2.3%**	**2.6%**	**2.7%**	**2.5%**
Wilmington	2,448,975	2,437,581	3,347,959	4,596,198	7,516,245	12,963,526	22,585,840	37,475,137
South Pacific	30,906,458	59,455,989	73,216,821	93,092,965	116,376,480	142,655,692	173,630,179	207,249,181

Source: QuERI-International.

Table 10. Shares of Total U.S. Exports and Imports

Exports								
Port/Port Range	**1995**	**2000**	**2005**	**2010**	**2020**	**2030**	**2040**	**2050**
Alaska	1.8%	2.7%	2.2%	2.2%	2.2%	2.2%	2.3%	2.4%
Gulf Coast	34.2%	37.0%	36.7%	36.9%	37.1%	36.8%	36.2%	34.9%
Great Lakes	9.9%	13.6%	14.8%	15.1%	14.9%	14.0%	12.3%	10.3%
Hawaii	0.4%	0.3%	0.3%	0.3%	0.3%	0.4%	0.6%	0.8%
Norfolk	14.9%	9.7%	6.4%	5.7%	5.1%	4.7%	4.6%	4.7%
North Atlantic Other	8.3%	5.6%	7.1%	6.8%	6.6%	6.6%	7.0%	7.4%
North Pacific	11.6%	9.9%	11.9%	12.6%	12.8%	12.8%	11.8%	11.5%
Charleston	**1.8%**	**2.3%**	**2.1%**	**2.1%**	**2.2%**	**2.6%**	**3.3%**	**4.1%**
Jacksonville	1.2%	1.2%	1.1%	1.1%	1.2%	1.3%	1.4%	1.4%
Miami	1.0%	1.3%	1.3%	1.3%	1.4%	1.5%	1.7%	1.9%
Savannah	**2.3%**	**2.6%**	**3.5%**	**3.3%**	**3.2%**	**3.3%**	**3.5%**	**3.6%**
Wilmington	0.4%	0.5%	0.3%	0.3%	0.3%	0.3%	0.5%	0.7%
South Pacific	12.2%	13.2%	12.3%	12.3%	12.7%	13.5%	14.8%	16.2%
Imports								
Port/Port Range	**1995**	**2000**	**2005**	**2010**	**2020**	**2030**	**2040**	**2050**
Alaska	0.2%	0.3%	0.2%	0.2%	0.4%	0.8%	1.4%	2.6%
Gulf Coast	48.4%	45.6%	44.1%	43.1%	40.4%	37.2%	33.8%	30.4%
Great Lakes	7.3%	6.3%	5.3%	5.1%	4.9%	4.8%	4.9%	5.2%
Hawaii	1.5%	1.3%	1.1%	1.2%	1.4%	1.8%	2.3%	2.9%
Norfolk	2.0%	1.7%	1.8%	1.9%	2.0%	2.1%	2.1%	2.1%
US North Atlantic Other	20.2%	20.3%	22.3%	22.2%	22.1%	21.8%	21.3%	20.9%
US North Pacific	4.0%	3.8%	3.4%	3.7%	4.4%	5.1%	5.7%	6.1%
Charleston	**1.2%**	**1.5%**	**1.9%**	**2.1%**	**2.4%**	**2.6%**	**2.9%**	**3.0%**
Jacksonville	2.6%	3.0%	3.4%	3.3%	3.5%	3.9%	4.4%	4.7%
Miami	1.5%	1.5%	1.7%	1.8%	2.0%	2.4%	2.7%	3.0%
Savannah	**1.6%**	**1.8%**	**2.1%**	**2.1%**	**2.2%**	**2.4%**	**2.6%**	**2.8%**
Wilmington	0.7%	0.5%	0.5%	0.6%	0.9%	1.3%	1.8%	2.5%
South Pacific	8.8%	12.4%	12.0%	12.7%	13.4%	13.9%	14.0%	13.8%

Source: QuERI-International.

The competitive position of Savannah relative to Charleston for metric tonnes is projected to improve with respect to imports for the nation but decline with respect to Charleston. Savannah's share of imports (metric tonnes) is expected to rise from 1.8 percent in 2000 to 2.1 percent in 2005 compared to 1.5 percent and 1.9 percent for Charleston. In ensuing years, the market share for metric tonnes of imports between Savannah and Charleston will progressively narrow. Charleston and Savannah are both projected to have a market share of 2.1 percent in 2010. By 2020, Charleston's market share will increase to 2.4 percent, compared to Savannah's 2.2 percent.

Savannah is projected to have a relatively declining and Charleston a relatively flat market share of total export metric tonnes until 2020. Charleston is projected to increase its market share by 2030 and close the gap with Savannah after 2040.

Savannah and Charleston Projections

Table 11 shows Savannah and Charleston TEU exports and imports for the period 1995 to 2050 and compound average annual growth rates for total commodity movements for the periods 1995-2000, 2000-2005, 2005-2010 and 2010-2050. The export projections indicate that Savannah is expected to grow at a higher rate than Charleston per year between 2005 and 2020. For example, average annual growth in export TEUs from Savannah is projected to be 10.6 percent between 2000 and 2005, 0.6 percent between 2005 and 2010, and then 1.4 percent

between 2010 and 2020 compared to 1.6 percent, 2.4 percent, and 2.5 percent for Charleston for the corresponding periods. From 2020 to 2040, Charleston is projected to have higher TEU export growth than Savannah; thereafter, they are projected to have the same average annual growth rate.

Table 11. Savannah and Charleston Compared Trade To and From World in TEUs

Savannah								
Imports	**1995**	**2000**	**2005**	**2010**	**2020**	**2030**	**2040**	**2050**
Total Inbound	196,136	388,714	664,876	916,546	1,310,895	1,848,206	2,585,808	3,527,589
Percent Change	N/A	14.7%	11.3%	6.6%	3.6%	3.5%	3.4%	3.2%
Agriculture	8,260	14,031	10,380	10,755	10,680	10,857	10,876	10,705
Auto	5,961	13,801	26,543	41,936	64,181	89,251	119,983	156,911
Capital	20,852	43,822	73,285	111,196	176,835	273,159	414,885	602,644
Chemicals	22,891	30,140	43,988	52,950	64,141	78,519	99,698	126,618
Consumer	41,485	108,356	234,893	318,951	416,864	547,057	707,241	889,375
Extractive	724	917	590	644	618	604	598	595
Food	10,137	20,616	29,811	38,160	52,287	69,912	92,651	120,744
High Tech	34,285	54,584	70,994	111,176	186,973	286,391	415,585	574,789
Intermediate Manufactures	52,302	63,996	107,436	150,253	244,541	384,769	599,573	902,488
Materials	19,239	38,451	66,956	80,525	93,775	107,687	124,718	142,720
Exports	**1995**	**2000**	**2005**	**2010**	**2020**	**2030**	**2040**	**2050**
Total Outbound	229,687	266,237	440,833	454,179	524,294	678,899	992,854	1,599,101
Percent Change	N/A	3.0%	10.6%	0.6%	1.4%	2.6%	3.9%	4.9%
Agriculture	8,143	14,473	56,421	57,122	60,875	66,201	72,762	80,016
Auto	6,821	15,567	19,649	26,311	38,320	55,160	86,312	145,996
Capital	19,056	19,159	23,021	26,553	34,937	47,415	68,196	105,521
Chemicals	29,183	31,874	46,232	51,292	64,482	88,575	133,253	208,800
Consumer	6,775	4,954	9,654	10,879	14,564	22,245	37,092	63,865
Extractive	1,769	5,800	31,843	33,732	36,146	41,161	47,284	55,734
Food	13,166	25,240	38,222	42,399	43,391	47,616	53,487	58,764
High Tech	10,007	10,246	11,582	15,226	27,305	64,839	182,497	469,632
Intermediate Manufactures	13,082	19,733	29,363	35,270	49,776	71,669	110,220	178,519
Materials	121,685	119,191	174,846	155,395	154,497	174,018	201,752	232,254
Charleston								
Imports	**1995**	**2000**	**2005**	**2010**	**2020**	**2030**	**2040**	**2050**
Total Inbound	273,581	508,175	766,376	1,053,532	1,522,373	2,125,422	2,917,229	3,905,324
Percent Change	N/A	13.2%	8.6%	6.6%	3.7%	3.4%	3.2%	3.0%
Agriculture	10,647	22,765	16,712	17,353	16,336	16,056	15,576	14,896
Auto	16,843	37,452	92,296	162,396	288,559	434,570	601,562	788,289
Capital	27,365	49,863	77,532	113,645	174,986	267,549	409,589	613,994
Chemicals	26,852	46,841	58,144	73,719	91,034	114,081	149,660	196,780
Consumer	51,226	97,687	163,283	220,010	299,102	395,825	515,544	652,828
Extractive	3,402	2,267	497	524	335	248	218	209
Food	18,563	30,218	41,072	47,544	58,010	71,135	86,183	102,577
High Tech	36,482	53,324	69,196	107,528	179,346	272,712	393,002	540,065
Intermediate Manufactures	34,969	83,816	135,036	182,456	272,479	394,599	567,766	800,575
Materials	47,232	83,942	112,608	128,356	142,187	158,648	178,129	195,110
Exports	**1995**	**2000**	**2005**	**2010**	**2020**	**2030**	**2040**	**2050**
Total Outbound	364,677	414,276	449,301	505,916	648,299	895,918	1,364,276	2,196,283
Percent Change	N/A	2.6%	1.6%	2.4%	2.5%	3.3%	4.3%	4.9%
Agriculture	18,490	15,149	25,708	28,289	33,980	41,696	52,409	66,457
Auto	6,832	27,442	55,304	89,659	154,245	225,639	307,924	397,061
Capital	39,893	34,765	38,973	45,405	57,071	73,961	101,171	145,868
Chemicals	70,927	79,218	77,433	88,111	116,416	181,144	328,944	618,713
Consumer	14,824	13,514	12,712	14,062	18,090	27,958	48,183	79,740
Extractive	13,325	30,451	13,683	14,288	14,860	16,000	17,409	19,106
Food	35,397	42,220	35,560	40,263	43,990	50,732	58,738	62,900
High Tech	10,640	9,713	10,940	14,253	25,039	57,561	156,119	389,719
Intermediate Manufactures	35,085	38,794	43,220	51,120	67,578	94,119	150,786	255,533
Materials	119,265	123,011	135,767	120,467	117,030	127,108	142,592	161,186

Source: QuERI-International.

The declining export growth can be attributed to the expected decline in traditional U.S. low technology exports of textiles and low-value raw materials such as extractives. Materials exports (mainly textiles, but including wood and paper products) will grow more slowly. For example, materials export TEUs from Savannah are projected to have no growth after 2005 and then begin to have small growth after 2020.

Table 11 indicates that Savannah will generally continue to have slightly higher growth than Charleston in TEU imports (for example, 11.3 percent between 2000 and 2005 for Savannah compared to 8.6 percent for Charleston). However, for 2010 and ensuing periods, the growth rate of import TEUs for Savannah and Charleston will be nearly the same (for example, 6.6 percent for both between 2005 and 2010 and 3.6 percent for Savannah between 2010 and 2020 compared to 3.7 percent for Charleston). Consequently, Savannah is not expected to close the import TEU gap that separates the two ports.

Table 12 shows the shares of Savannah and Charleston export and import TEUs by major commodity groups for the period 1995 through 2050. The gap in total export market shares beginning in 2005 is nearly one tenth of one percent (6.5% - 6.4% = 0.1%) in favor of Charleston. By 2010, the market share gap has been widened and Charleston's total share of TEU exports is 6.6 percent compared to Savannah's 6.0 percent (6.6% - 6.0% = 0.6%). For total TEU imports, Savannah's market share increases from 4.3 percent in 2000 to 4.8 percent in 2005 to 5.0 percent by 2010 and to 5.4 percent by 2020. The TEU market share difference between Savannah and Charleston changes from 1.3 percent in 2000 (5.6% - 4.3% = 1.3%) to 0.7 percent in 2005 (5.5% – 4.8% = 1.6%). The TEU import market share remains nearly the same thereafter, such as the 0.8 percent in 2010 and 2020 (5.8% - 5.0% = 0.8% for 2010 and 6.2% - 5.4% = 0.8% for 2020).

V. DETAILED OUTPUTS FOR SOUTH ATLANTIC PORTS

Projections of imports and exports for the South Atlantic Coast ports (other than Savannah) consisting of Charleston, Jacksonville, Miami, Wilmington, Norfolk, and Other North Atlantic ports are summarized in a series of tables for total metric tones, containerized tonnes, and TEUs. The data reflect trade routes for the following world regions: (1) Africa; (2) Central America; (3) East Coast South America; (4) Eastern Europe; (5) India; (6) Middle East; (7) Mediterranean; (8) North America; (9) North East Asia; (10) Northern Europe; (11) Oceania; (12) Europe, Other; (13) South East Asia; and (14) West Coast South America.[14] The total volume of annual trade expressed in tonnes or TEUs for all commodities is shown for 1995, 2000, and 2003 and projected for 2004, 2005, 2010, 2015, 2020, 2030, 2040, and 2050.[15] The compound average annual growth rates are shown for total tonnages for the years contained in the summary data set.

Corresponding sets of tables in Appendix A contain the same data for metric tonnes, containerized tonnes, and TEUs for the U.S. South Atlantic ports (including Savannah) and other coasts by world trade route and commodity groups, as well as U.S. South Atlantic ports (including Savannah) by world trade route and for all commodities.

[14] A region concordance is contained in Appendix B.

[15] The full electronic version of the forecast provides annual statistics from 1995 to 2050.

Table 12. Share of Savannah and Charleston Exports and Imports of Containerized Trade, by Commodity Group

Savannah Share of U.S. Trade (TEUs) To/From World, by Commodity									
Trade	Commodity	1995	2000	2005	2010	2020	2030	2040	2050
Export	All	4.0%	5.1%	6.4%	6.0%	5.7%	5.5%	5.2%	5.0%
Import	All	3.2%	4.3%	4.8%	5.0%	5.4%	5.7%	6.1%	6.4%
Export	Agriculture	1.3%	3.1%	9.0%	8.2%	7.7%	7.3%	6.8%	6.2%
Import	Agriculture	3.6%	3.9%	2.0%	1.9%	1.9%	1.8%	1.7%	1.5%
Export	Extractive	1.2%	4.2%	17.1%	17.0%	16.6%	16.6%	16.4%	16.2%
Import	Extractive	2.0%	1.4%	0.7%	0.6%	0.6%	0.6%	0.6%	0.6%
Export	Food	1.3%	2.5%	2.8%	2.6%	2.2%	2.1%	2.0%	2.0%
Import	Food	1.6%	2.4%	2.3%	2.5%	3.2%	3.8%	4.7%	5.6%
Export	Materials	8.5%	9.5%	9.7%	9.7%	10.4%	11.3%	11.9%	11.7%
Import	Materials	4.1%	4.8%	5.0%	4.9%	4.8%	4.7%	4.6%	4.4%
Export	Consumer	2.9%	2.1%	3.9%	3.8%	3.7%	3.4%	2.8%	2.3%
Import	Consumer	2.4%	3.9%	3.6%	3.7%	3.6%	3.5%	3.4%	3.3%
Export	Chemical	3.3%	3.3%	3.8%	3.7%	3.6%	3.3%	3.0%	2.6%
Import	Chemical	5.8%	5.7%	6.0%	5.9%	6.0%	6.1%	6.2%	6.2%
Export	High Tech	7.6%	8.1%	8.1%	8.2%	8.3%	8.6%	9.0%	9.3%
Import	High Tech	8.6%	8.0%	8.1%	8.2%	8.4%	8.5%	8.6%	8.7%
Export	Intermediate	2.6%	5.0%	4.2%	5.3%	5.1%	4.9%	4.5%	4.1%
Import	Intermediate	3.1%	3.9%	5.5%	4.4%	5.1%	5.8%	6.6%	7.2%
Export	Capital Equip	4.6%	5.4%	5.2%	5.4%	5.4%	5.3%	5.3%	5.2%
Import	Capital Equip	3.1%	4.9%	5.0%	5.6%	6.5%	7.4%	8.4%	9.3%
Export	Automobile	2.3%	5.4%	3.2%	5.4%	5.9%	5.9%	5.3%	4.6%
Import	Automobile	1.1%	2.6%	2.6%	3.3%	3.4%	3.4%	3.5%	3.5%
Charleston Share of U.S. Trade (TEUs) To/From World, by Commodity									
Trade	Commodity	1995	2000	2005	2010	2020	2030	2040	2050
Export	ALL	6.4%	7.9%	6.5%	6.6%	7.0%	7.3%	7.2%	6.8%
Import	ALL	4.4%	5.6%	5.5%	5.8%	6.2%	6.6%	6.9%	7.1%
Export	Agriculture	2.9%	3.2%	4.1%	4.1%	4.3%	4.6%	4.9%	5.2%
Import	Agriculture	4.6%	6.8%	3.2%	3.1%	2.9%	2.7%	2.4%	2.1%
Export	Extractive	8.8%	22.3%	7.4%	7.2%	6.8%	6.5%	6.1%	5.6%
Import	Extractive	9.2%	3.5%	0.6%	0.5%	0.4%	0.3%	0.2%	0.2%
Export	Food	3.4%	4.3%	2.6%	2.5%	2.3%	2.2%	2.2%	2.1%
Import	Food	3.0%	3.5%	3.2%	3.2%	3.5%	3.9%	4.4%	4.8%
Export	Materials	8.3%	9.8%	7.5%	7.5%	7.9%	8.2%	8.4%	8.2%
Import	Materials	10.1%	10.5%	8.4%	7.9%	7.3%	6.9%	6.5%	6.0%
Export	Consumer	6.4%	5.6%	5.2%	4.9%	4.6%	4.2%	3.6%	2.8%
Import	Consumer	2.9%	3.5%	3.9%	3.9%	4.0%	4.0%	4.1%	3.9%
Export	Chemical	8.0%	8.2%	6.4%	6.4%	6.4%	6.8%	7.3%	7.6%
Import	Chemical	6.8%	8.9%	8.0%	8.3%	8.6%	8.9%	9.3%	9.6%
Export	High Tech	8.1%	7.7%	7.7%	7.7%	7.7%	7.7%	7.7%	7.7%
Import	High Tech	9.1%	7.9%	7.9%	7.9%	8.0%	8.1%	8.2%	8.2%
Export	Intermediate	6.9%	9.7%	8.0%	7.7%	7.0%	6.4%	6.1%	5.9%
Import	Intermediate	3.4%	5.2%	5.3%	5.4%	5.6%	5.9%	6.2%	6.4%
Export	Capital Equip	9.7%	9.8%	9.3%	9.2%	8.8%	8.3%	7.8%	7.2%
Import	Capital Equip	4.1%	5.6%	5.5%	5.8%	6.4%	7.2%	8.3%	9.5%
Export	Automobile	2.3%	9.5%	14.2%	18.3%	23.7%	24.2%	18.9%	12.5%
Import	Automobile	3.1%	7.0%	11.1%	12.8%	15.4%	16.7%	17.3%	17.6%

Tables 13 and 14 show imports and exports of all commodities (metric tonnes) for all South Atlantic ports other than Savannah.[16] Tables 15 and 16 show imports and exports of containerized commodities for all South Atlantic ports other than Savannah.[17] Tables 17 and 18 show imports and exports of TEUs for all South Atlantic ports other than Savannah.[18]

[16] Refer to Appendix A for Savannah metric tonnages as part of U.S. South Atlantic coast ports and other coasts.
[17] Refer to Appendix A for Savannah container tonnages as part of U.S. South Atlantic coast ports and other coasts.
[18] Refer to Appendix A for Savannah TEUs as part of U.S. South Atlantic coast ports and other coasts.

METRIC TONNES

Tables 13 and 14 depict the major world trade areas for each of the South Atlantic Coast ports for total metric tonnes of imports and exports, respectively, and their historic growth from 1995 to 2003 and projected growth from 2003 to 2050. For example, the predominant trade regions for Charleston Harbor total metric tonnes of imports (Table 13) in 2003 (9.960 million tonnes) are East Coast of South America (2.325 million tonnes), North Europe (2.262 million tonnes), and, to a lesser extent, North East Asia (1.177 million tonnes). Charleston Harbor metric tonnes of imports (all commodities) are expected to grow 7.40 percent between 2003 and 2004 and 8.44 percent between 2004 and 2005, then at an average annual rate of 5.48 percent between 2005 and 2010, slowing to an average annual rate of growth of 3.37 percent between 2010 and 2015, and growing at an average annual rate of less than 3 percent between 2015 and 2050. Although the average annual growth rates vary among the ports (Charleston, Jacksonville, Miami, Wilmington, and Norfolk), there is an apparent basic pattern of declining growth of total metric tonnes of imports after 2005 expressed as an average annual compound growth rate.

For total metric tonnes of exports (Table 14) for the South Atlantic ports (excluding Savannah), the pattern of growth differs from imports. Metric tonnes of exports grow substantially less than imports after 2003, averaging less than 2 percent (compound annual growth rate) until 2020. Export growth is expected to increase after 2020, moving close to import growth by 2040 and surpassing import growth for the period 2040 to 2050. For example, the predominant trade regions for Charleston Harbor total export metric tonnes in 2003 (4.311 million tonnes) are North Europe (1.461 million tonnes) and North East Asia (0.943 million tonnes). Charleston Harbor export metric tonnes (all commodities) are expected to grow 3.64 percent between 2003 and 2004 and 1.29 percent between 2004 and 2005, then at an average annual rate of 1.17 percent between 2005 and 2010, growing to an average annual rate of growth of 1.55 percent between 2010 and 2015, and increasing to 2.32 percent between 2015 and 2020 and 3.17 percent between 2020 and 2030. After 2030, Charleston Harbor's export growth rates increase to 4.66 percent between 2030 and 2040 and 5.64 percent between 2040 and 2050.

CONTAINERIZED TONNES

Tables 15 and 16 depict the major world trade areas for each of the South Atlantic Coast ports for total containerized tonnes of imports and exports, respectively, and their historic growth from 1995 to 2003 and projected growth from 2003 to 2050. For example, the predominant trade regions for Charleston Harbor total container tonnes of imports (Table 15) in 2003 (3.363 million tonnes) are North Europe (0.939 million tonnes) and North East Asia (0.681 million tonnes). Charleston Harbor import container tonnes (all commodities) are expected to grow 4.15 percent between 2003 and 2004 and 8.13 percent between 2004 and 2005, then at an average annual rate of 5.86 percent between 2005 and 2010, slowing to an average annual rate of growth of 3.30 percent between 2010 and 2015, and growing at an average annual rate of less than 3 percent between 2015 and 2050. Although the average annual growth rates vary among the ports (Charleston, Jacksonville, Miami, Wilmington, and Norfolk), there is an apparent basic pattern

Table 13. Metric Tonnes of Imports to U.S. South Atlantic Coast Ports by World Trade Route, All Commodities: 1995 - 2050 (selected years)

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Charleston	World	All Commodities	4,097,103	7,434,344	9,960,208	10,697,651	11,600,373	15,145,150	17,879,077	20,549,886	27,184,692	35,637,899	45,562,525
Charleston	Percent Change	All Commodities	NA	12.66%	10.24%	7.40%	8.44%	5.48%	3.37%	2.82%	2.84%	2.74%	2.49%
Charleston	Africa	All Commodities	44,346	69,857	139,757	148,828	155,931	181,810	202,183	223,211	277,052	342,400	412,213
Charleston	Central America	All Commodities	38,768	149,217	231,806	251,211	264,712	305,467	334,559	359,608	417,082	486,202	565,545
Charleston	East Coast S America	All Commodities	926,143	1,271,197	2,325,682	2,586,504	2,872,600	3,762,052	4,645,920	5,473,302	7,391,875	9,699,711	12,337,940
Charleston	Eastern Europe	All Commodities	77,151	387,749	578,100	611,610	651,498	875,436	1,105,527	1,386,947	2,242,633	3,486,794	4,933,587
Charleston	India	All Commodities	179,330	236,575	490,609	519,014	545,755	715,461	855,377	980,062	1,287,192	1,657,504	2,052,894
Charleston	Middle East	All Commodities	10,356	21,626	47,713	53,123	56,267	73,463	83,964	99,202	141,652	203,085	281,869
Charleston	Mediterranean	All Commodities	312,625	551,096	615,208	684,556	767,986	1,051,037	1,239,923	1,432,974	1,905,965	2,517,733	3,290,967
Charleston	North America	All Commodities	319,254	409,909	287,956	294,242	286,193	261,187	234,319	210,846	185,566	186,451	213,392
Charleston	NE Asia	All Commodities	484,284	942,972	1,177,619	1,248,655	1,359,378	1,939,860	2,391,375	2,871,599	4,112,131	5,749,637	7,691,269
Charleston	North Europe	All Commodities	1,085,060	1,949,477	2,262,347	2,408,307	2,592,197	3,277,009	3,730,334	4,163,245	5,323,561	6,979,599	9,201,662
Charleston	Oceania	All Commodities	290,230	171,046	498,321	483,504	501,561	632,687	724,924	788,773	925,951	1,087,938	1,286,671
Charleston	Europe, Other	All Commodities	33,707	89,253	146,284	146,285	151,337	177,810	199,227	220,184	268,883	321,444	371,479
Charleston	SE Asia	All Commodities	227,697	740,122	276,519	286,495	298,293	354,452	382,835	411,816	469,842	522,228	575,029
Charleston	West Coast S America	All Commodities	68,153	444,248	882,286	975,319	1,096,664	1,537,419	1,748,609	1,928,117	2,235,308	2,397,172	2,348,010
Jacksonville	World	All Commodities	9,061,850	14,263,647	18,204,602	19,497,047	20,494,894	24,079,236	27,153,394	30,630,275	40,439,603	54,232,906	70,450,496
Jacksonville	Percent Change	All Commodities	NA	9.50%	8.47%	7.10%	5.12%	3.28%	2.43%	2.44%	2.82%	2.98%	2.65%
Jacksonville	Africa	All Commodities	25,292	81,508	92,174	102,796	107,347	105,763	109,135	115,034	133,165	161,332	199,183
Jacksonville	Central America	All Commodities	2,539,743	2,898,715	4,039,526	4,388,739	4,568,814	5,182,920	5,622,769	5,979,947	6,786,965	7,698,729	8,654,290
Jacksonville	East Coast S America	All Commodities	1,597,217	3,048,714	3,768,209	4,113,020	4,381,657	5,385,628	6,159,684	6,893,666	8,700,876	11,192,200	14,431,770
Jacksonville	Eastern Europe	All Commodities	784,809	839,880	1,105,694	1,204,662	1,340,680	2,173,088	3,497,107	5,449,423	11,606,722	20,941,315	31,987,532
Jacksonville	India	All Commodities	5,297	7,606	45,885	52,820	61,141	100,667	137,411	177,971	286,944	442,998	644,974
Jacksonville	Middle East	All Commodities	2,299	2,101	3,509	3,692	3,963	5,795	8,391	11,844	21,465	35,582	54,838
Jacksonville	Mediterranean	All Commodities	330,168	218,985	565,752	630,050	700,286	865,965	964,457	1,056,980	1,259,373	1,492,763	1,766,011
Jacksonville	North America	All Commodities	961,950	2,148,726	2,778,415	2,878,973	2,809,147	2,579,958	2,296,029	2,003,544	1,632,755	1,491,605	1,545,815
Jacksonville	NE Asia	All Commodities	451,961	799,965	723,941	772,383	836,977	1,186,682	1,458,956	1,740,898	2,418,572	3,250,043	4,180,473
Jacksonville	North Europe	All Commodities	714,520	885,531	1,307,199	1,355,225	1,394,275	1,506,002	1,545,594	1,555,573	1,574,304	1,599,366	1,638,546
Jacksonville	Oceania	All Commodities	36,087	25,071	36,939	34,861	34,748	38,781	41,769	44,527	50,222	56,623	64,263
Jacksonville	Europe, Other	All Commodities	862	8,257	53,896	54,403	59,084	80,504	104,666	127,169	180,055	243,309	317,460
Jacksonville	SE Asia	All Commodities	66,904	743,314	177,147	189,268	211,864	331,622	384,301	432,447	499,625	507,292	474,134
Jacksonville	West Coast S America	All Commodities	1,544,741	2,555,275	3,506,317	3,716,156	3,984,913	4,535,862	4,823,126	5,041,250	5,288,560	5,119,750	4,491,206

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Miami	World	All Commodities	5,270,227	7,295,091	8,966,361	9,662,011	10,439,979	13,257,224	15,196,766	17,811,726	24,206,574	33,510,833	44,912,030
Miami	Percent Change	All Commodities	NA	6.66%	7.21%	7.76%	8.05%	4.80%	3.17%	2.82%	5.11%	3.25%	3.03%
Miami	Africa	All Commodities	2,315	16,262	33,651	36,689	38,587	41,694	45,901	50,330	59,261	70,009	83,815
Miami	Central America	All Commodities	832,074	1,001,291	1,156,259	1,209,140	1,254,480	1,403,495	1,542,410	1,669,493	1,982,267	2,370,156	2,860,744
Miami	East Coast S America	All Commodities	2,447,231	1,953,677	2,080,257	2,149,540	2,198,126	2,282,039	2,348,938	2,408,935	2,529,584	2,652,188	2,762,803
Miami	Eastern Europe	All Commodities	7,266	106,878	317,477	348,742	394,792	699,969	1,170,686	1,828,000	3,961,822	7,270,989	11,210,941
Miami	India	All Commodities	16,519	31,223	45,542	48,834	52,230	70,212	84,516	97,894	133,435	179,464	229,167
Miami	Middle East	All Commodities	7,869	6,279	12,143	12,983	13,833	16,954	24,442	36,683	55,157	81,070	
Miami	Mediterranean	All Commodities	494,473	1,175,247	1,639,416	1,853,749	2,116,269	2,912,114	3,354,847	3,797,179	4,862,464	6,234,882	8,000,562
Miami	North America	All Commodities	34,000	62,450	135,135	141,489	142,089	148,287	150,310	153,938	154,616	152,215	143,354
Miami	NE Asia	All Commodities	260,852	470,266	715,012	756,794	826,601	1,195,572	1,522,268	1,868,216	2,751,271	3,898,307	5,260,980
Miami	North Europe	All Commodities	629,877	1,665,034	1,964,503	2,198,323	2,458,632	3,370,567	4,023,499	4,574,946	6,201,234	8,766,999	12,325,333
Miami	Oceania	All Commodities	605	4,779	28,688	29,101	30,633	39,469	51,160	64,323	97,890	142,972	200,055
Miami	Europe, Other	All Commodities	4,955	19,480	32,682	35,693	39,635	35,528	35,417	35,975	37,714	39,229	40,572
Miami	SE Asia	All Commodities	101,556	240,224	291,691	310,408	218,728	255,309	271,844	290,880	328,694	362,772	396,979
Miami	West Coast S America	All Commodities	411,093	522,961	603,906	630,527	655,359	786,073	874,929	947,526	1,063,638	1,115,563	1,116,761
Wilmington	World	All Commodities	2,448,975	2,447,581	2,854,866	3,121,860	3,347,959	4,506,198	5,842,877	7,516,245	12,063,526	22,585,840	37,475,137
Wilmington	Percent Change	All Commodities	NA	-0.09%	5.41%	9.35%	7.24%	6.12%	5.33%	5.17%	5.60%	5.71%	5.19%
Wilmington	Africa	All Commodities	28,601	24,335	28,852	30,834	31,717	31,550	30,014	30,956	38,311	52,491	74,152
Wilmington	Central America	All Commodities	380,484	238,121	138,826	157,329	168,634	217,262	275,815	345,046	518,618	894,645	1,509,668
Wilmington	East Coast S America	All Commodities	605,888	240,126	899,526	1,001,891	1,070,253	1,342,087	1,646,759	2,007,195	3,016,770	4,602,478	7,105,474
Wilmington	Eastern Europe	All Commodities	164,241	250,333	289,704	312,809	336,798	447,806	560,256	666,537	870,156	969,806	979,206
Wilmington	India	All Commodities	13,557	48,869	4,335	4,763	5,179	7,478	9,797	11,212	19,001	33,819	62,714
Wilmington	Middle East	All Commodities	4,089	10,090	10,228	11,525	12,821	20,231	29,741	42,274	77,117	128,456	198,596
Wilmington	Mediterranean	All Commodities	96,595	174,962	68,789	67,828	69,884	71,174	74,247	83,420	126,430	222,423	417,378
Wilmington	North America	All Commodities	516,426	347,643	270,304	287,149	290,682	317,731	335,048	349,430	386,186	430,929	484,086
Wilmington	NE Asia	All Commodities	252,357	477,745	449,931	480,442	525,857	785,625	1,023,641	1,278,091	1,929,904	2,796,034	3,892,730
Wilmington	North Europe	All Commodities	244,235	316,567	323,385	348,379	367,790	495,908	624,603	737,238	990,011	1,228,507	1,426,943
Wilmington	Oceania	All Commodities	10,855	566	508	539	610	1,008	1,342	1,750	3,015	5,279	9,324
Wilmington	Europe, Other	All Commodities	4,857	213	10,756	11,466	13,092	22,860	38,249	61,771	146,131	298,946	566,416
Wilmington	SE Asia	All Commodities	74,474	198,467	154,501	165,828	178,173	237,941	300,800	375,370	608,155	963,366	1,471,220
Wilmington	West Coast S America	All Commodities	52,316	109,543	205,221	241,077	276,471	507,526	892,567	1,526,005	4,203,722	9,958,666	19,377,296
Norfolk	World	All Commodities	6,994,318	8,322,228	9,433,485	10,131,565	10,780,474	13,627,474	15,536,302	17,292,126	21,422,507	26,272,184	31,878,838
Norfolk	Percent Change	All Commodities	NA	3.54%	4.27%	7.40%	6.40%	4.80%	2.66%	2.16%	2.17%	2.06%	1.95%
Norfolk	Africa	All Commodities	99,800	72,888	83,974	86,889	90,776	105,438	112,564	119,400	137,579	160,771	187,574
Norfolk	Central America	All Commodities	350,915	173,886	102,865	111,829	116,437	129,048	135,445	138,625	147,150	158,985	175,384
Norfolk	East Coast S America	All Commodities	2,160,946	1,205,440	2,146,842	2,370,197	2,508,878	3,065,412	3,405,806	3,678,272	4,187,982	4,573,793	4,860,650
Norfolk	Eastern Europe	All Commodities	217,077	765,335	726,490	761,833	802,113	988,958	1,129,035	1,253,285	1,423,467	1,611,533	1,917,888
Norfolk	India	All Commodities	84,361	171,711	315,068	328,333	341,344	427,991	495,671	545,564	708,135	910,585	1,129,265
Norfolk	Middle East	All Commodities	6,262	15,489	23,128	25,421	26,747	33,676	36,027	39,892	49,419	61,307	74,690
Norfolk	Mediterranean	All Commodities	870,389	292,620	422,672	451,173	482,944	565,361	615,268	660,590	758,942	859,107	956,596
Norfolk	North America	All Commodities	524,235	1,335,219	1,476,153	1,648,882	1,759,900	2,392,232	2,877,566	3,340,790	4,533,116	6,190,357	8,435,852
Norfolk	NE Asia	All Commodities	320,425	699,201	1,283,559	1,355,248	1,496,083	2,305,526	2,649,452	3,120,563	4,284,839	5,651,261	7,034,720
Norfolk	North Europe	All Commodities	1,405,009	2,070,001	1,867,633	1,964,191	2,073,803	2,384,108	2,577,689	2,737,528	3,088,186	3,480,671	3,919,956
Norfolk	Oceania	All Commodities	37,125	87,903	85,253	89,357	91,891	121,371	137,679	152,078	185,398	222,651	259,592
Norfolk	Europe, Other	All Commodities	23,326	41,474	60,823	61,182	63,011	66,730	71,550	76,790	89,278	102,402	115,637
Norfolk	SE Asia	All Commodities	287,150	433,543	439,407	460,931	488,395	607,076	678,771	760,125	964,617	1,226,387	1,527,611
Norfolk	West Coast S America	All Commodities	608,298	457,507	399,601	420,109	441,377	534,546	613,757	689,623	866,408	1,062,974	1,283,414

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Other N Atlantic	World	All Commodities	70,489,654	97,532,863	116,408,329	128,349,493	136,058,556	162,839,330	179,056,054	192,105,162	223,766,727	263,367,006	313,960,208
Other N Atlantic	Percent Change	All Commodities	NA	6.71%	6.07%	10.26%	6.01%	3.66%	1.92%	1.42%	1.54%	1.64%	1.77%
Other N Atlantic	Africa	All Commodities	8,254,710	7,286,306	8,517,286	9,795,179	10,681,673	13,516,639	14,258,748	14,622,853	15,581,210	16,828,537	18,326,914
Other N Atlantic	Central America	All Commodities	4,396,868	6,926,136	10,789,997	12,563,052	13,176,138	15,036,782	15,348,263	15,210,090	15,064,888	15,146,905	15,717,244
Other N Atlantic	East Coast S America	All Commodities	19,533,066	24,582,522	20,298,181	22,635,865	24,342,050	29,822,259	34,107,482	37,981,170	47,741,624	61,021,054	79,027,366
Other N Atlantic	Eastern Europe	All Commodities	1,418,390	5,772,634	8,821,535	9,859,611	10,414,524	12,467,183	13,892,917	14,789,066	15,792,158	15,920,834	16,889,006
Other N Atlantic	India	All Commodities	461,364	1,164,090	2,037,054	2,239,948	2,396,703	3,223,311	3,881,132	4,468,929	6,014,427	7,970,894	10,222,148
Other N Atlantic	Middle East	All Commodities	120,627	155,636	200,848	217,114	229,353	279,124	295,654	314,535	353,461	397,070	449,653
Other N Atlantic	Mediterranean	All Commodities	2,674,018	3,611,941	3,733,817	4,074,731	4,408,509	5,171,282	5,553,004	5,865,303	6,632,938	7,602,161	8,840,487
Other N Atlantic	North America	All Commodities	11,287,328	15,883,865	21,127,065	23,773,694	25,024,205	30,030,052	33,620,180	36,494,332	42,945,883	51,075,773	61,968,402
Other N Atlantic	NE Asia	All Commodities	4,089,421	4,500,008	5,923,700	6,261,738	6,866,681	9,598,083	11,389,342	13,063,480	16,951,602	21,075,832	24,546,670
Other N Atlantic	North Europe	All Commodities	8,645,170	15,005,898	17,520,521	19,067,090	20,124,260	23,540,380	25,765,044	27,721,529	33,594,511	41,862,678	52,458,546
Other N Atlantic	Oceania	All Commodities	1,485,281	1,105,142	1,240,692	1,237,897	1,352,942	1,931,754	2,196,597	2,451,238	3,064,161	3,768,583	4,497,186
Other N Atlantic	Europe, Other	All Commodities	72,829	185,367	282,709	292,039	309,701	349,384	375,594	401,784	473,717	568,734	683,700
Other N Atlantic	SE Asia	All Commodities	2,348,233	2,940,116	3,776,008	3,892,791	4,108,307	4,381,117	4,345,501	4,341,516	4,533,682	4,874,724	5,306,777
Other N Atlantic	West Coast S America	All Commodities	5,702,349	8,413,201	12,138,914	12,438,743	12,623,507	13,491,979	14,026,597	14,379,338	15,022,464	15,253,228	15,026,106

Table 14. Metric Tonnes of Exports from U.S. South Atlantic Coast Ports by World Trade Route, All Commodities: 1995 - 2050 (selected years)

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Charleston	World	All Commodities	4,471,085	4,943,363	4,311,335	4,468,451	4,525,876	4,796,518	5,178,853	5,808,573	7,936,065	12,518,670	21,669,619
Charleston	Percent Change	All Commodities	NA	2.03%	-4.46%	3.64%	1.29%	1.17%	1.55%	2.32%	3.17%	4.66%	5.64%
Charleston	Africa	All Commodities	60,449	78,441	76,697	76,670	76,853	83,010	90,006	104,276	204,324	590,128	1,600,469
Charleston	Central America	All Commodities	42,713	99,765	122,474	128,407	131,130	146,366	160,769	175,827	232,268	376,563	692,404
Charleston	East Coast S America	All Commodities	139,728	386,768	296,929	313,647	314,979	336,842	352,267	369,284	408,744	452,734	504,447
Charleston	Eastern Europe	All Commodities	144,136	162,741	284,354	301,431	316,269	391,075	438,050	522,388	944,617	2,173,572	4,934,041
Charleston	India	All Commodities	103,015	65,429	186,994	190,244	194,429	225,402	265,843	321,623	516,797	968,016	1,900,266
Charleston	Middle East	All Commodities	86,011	66,868	62,446	62,892	63,294	67,653	72,386	79,858	99,233	124,716	156,991
Charleston	Mediterranean	All Commodities	231,251	336,575	309,947	327,690	339,276	363,182	403,497	464,539	620,055	839,472	1,143,751
Charleston	North America	All Commodities	42,362	31	79	79	75	66	64	69	82	102	126
Charleston	NE Asia	All Commodities	1,217,102	1,527,726	943,708	984,757	985,870	999,956	1,018,132	1,100,989	1,362,016	1,839,099	2,707,706
Charleston	North Europe	All Commodities	1,627,905	1,548,010	1,461,284	1,497,619	1,508,468	1,508,898	1,601,459	1,742,663	2,068,922	2,475,359	2,962,139
Charleston	Oceania	All Commodities	42,476	32,122	24,662	26,196	25,597	26,209	27,666	29,387	33,645	39,096	45,986
Charleston	Europe, Other	All Commodities	8,324	44,451	7,325	7,720	8,012	11,129	13,002	14,807	17,969	20,459	22,325
Charleston	SE Asia	All Commodities	488,029	282,327	250,355	259,254	266,007	303,110	352,898	429,562	731,473	1,415,742	2,923,927
Charleston	West Coast S America	All Commodities	237,582	312,108	284,081	291,845	295,615	333,621	382,813	453,301	695,920	1,203,612	2,075,038
Jacksonville	World	All Commodities	2,910,767	2,482,693	2,247,770	2,338,066	2,384,639	2,613,260	2,806,613	3,073,434	3,872,342	5,222,280	7,457,401
Jacksonville	Percent Change	All Commodities	NA	-3.13%	-3.26%	4.02%	1.99%	1.85%	1.44%	1.83%	2.34%	3.04%	3.63%
Jacksonville	Africa	All Commodities	19,731	5,644	9,573	9,681	9,690	10,335	10,756	11,554	15,059	25,305	49,973
Jacksonville	Central America	All Commodities	422,815	456,710	594,085	618,986	639,151	720,102	769,603	827,559	991,645	1,249,634	1,660,643
Jacksonville	East Coast S America	All Commodities	610,665	295,748	353,741	365,807	364,639	377,015	381,064	386,398	404,318	427,954	458,841
Jacksonville	Eastern Europe	All Commodities	109,533	281,352	117,108	127,030	139,920	184,166	195,381	222,250	316,207	448,228	621,389
Jacksonville	India	All Commodities	881	1,864	1,495	1,559	1,646	2,436	4,129	7,947	35,392	136,255	388,061
Jacksonville	Middle East	All Commodities	13,360	12,333	11,304	11,417	11,376	11,327	10,850	11,004	11,571	12,367	13,461
Jacksonville	Mediterranean	All Commodities	108,153	208,612	168,396	185,056	194,424	215,050	240,628	276,909	366,115	484,225	634,281
Jacksonville	North America	All Commodities	2,795	35	4,781	4,838	4,787	5,651	6,817	8,146	11,068	14,560	18,504
Jacksonville	NE Asia	All Commodities	220,317	120,926	222,732	228,039	231,926	247,625	259,117	270,979	316,869	415,216	622,661
Jacksonville	North Europe	All Commodities	869,487	782,912	434,511	453,542	452,961	472,868	512,803	559,083	660,167	788,609	943,056
Jacksonville	Oceania	All Commodities	46,081	3,018	2,345	2,448	2,506	2,933	3,324	3,775	4,847	6,173	7,787
Jacksonville	Europe, Other	All Commodities	902	343	244	239	238	266	279	298	338	382	429
Jacksonville	SE Asia	All Commodities	61,603	56,043	99,062	105,345	110,638	141,688	174,567	215,918	340,634	572,362	989,014
Jacksonville	West Coast S America	All Commodities	424,443	257,154	228,393	224,079	220,737	221,798	237,295	271,613	398,111	641,009	1,049,301

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Miami	World	All Commodities	2,417,867	2,775,307	2,685,518	2,802,643	2,859,001	3,127,980	3,355,695	3,632,336	4,549,295	6,448,638	9,948,136
Miami	Percent Change	All Commodities	NA	2.80%	-1.09%	4.36%	2.01%	1.81%	1.42%	1.60%	2.28%	3.55%	4.43%
Miami	Africa	All Commodities	2,291	5,151	3,276	3,294	3,311	3,543	3,746	4,057	5,916	11,016	21,186
Miami	Central America	All Commodities	1,039,162	1,620,212	1,574,050	1,639,623	1,684,319	1,876,751	2,013,661	2,159,969	2,651,409	3,654,603	5,400,047
Miami	East Coast S America	All Commodities	527,401	401,144	234,626	248,030	250,488	279,535	293,343	306,150	335,436	368,396	408,495
Miami	Eastern Europe	All Commodities	5,542	5,195	12,673	13,331	13,799	17,694	22,142	29,471	68,450	197,161	510,200
Miami	India	All Commodities	34,492	18,716	31,653	31,156	30,742	29,477	29,590	32,989	61,643	169,052	436,726
Miami	Middle East	All Commodities	3,636	5,666	6,596	6,760	6,996	8,376	9,884	11,600	15,939	21,665	28,895
Miami	Mediterranean	All Commodities	88,240	12,228	40,855	44,833	46,752	50,452	56,822	65,217	85,553	112,544	148,301
Miami	North America	All Commodities	41	3,334	119	119	127	166	167	187	242	329	436
Miami	NE Asia	All Commodities	127,658	143,476	207,158	215,035	213,942	208,239	205,407	215,310	253,014	324,907	458,817
Miami	North Europe	All Commodities	208,779	268,712	308,692	323,993	326,862	323,112	335,091	350,707	380,305	418,218	468,144
Miami	Oceania	All Commodities	2,468	15,818	7,976	8,235	8,200	8,890	9,698	10,566	12,629	15,251	18,436
Miami	Europe, Other	All Commodities	360	890	665	675	682	733	757	789	852	912	967
Miami	SE Asia	All Commodities	26,040	34,106	23,532	24,534	25,458	31,198	38,554	49,955	99,365	232,267	526,031
Miami	West Coast S America	All Commodities	351,757	240,659	233,647	243,025	247,322	289,834	336,830	395,369	578,543	922,318	1,521,456
Wilmington	World	All Commodities	1,118,155	1,142,204	650,285	682,372	683,424	640,118	645,631	706,696	987,658	1,790,944	3,739,136
Wilmington	Percent Change	All Commodities	NA	0.43%	-17.12%	4.93%	0.15%	-1.30%	0.17%	1.82%	3.40%	6.13%	7.64%
Wilmington	Africa	All Commodities	5,101	5,586	4,717	4,926	5,165	5,915	6,496	7,294	10,809	20,466	41,772
Wilmington	Central America	All Commodities	9,219	12,974	5,967	6,277	6,546	8,257	10,912	16,228	52,762	183,658	506,659
Wilmington	East Coast S America	All Commodities	14,784	34,780	4,129	4,511	4,720	6,126	7,473	8,593	11,406	15,944	23,999
Wilmington	Eastern Europe	All Commodities	56,239	5,925	2,623	2,801	3,028	4,350	5,666	7,770	18,990	55,357	143,554
Wilmington	India	All Commodities	1,568	10,893	8,180	8,389	8,569	10,513	13,404	18,966	58,229	213,531	633,372
Wilmington	Middle East	All Commodities	7,955	5,282	4,338	4,343	4,418	4,885	5,286	5,705	6,634	7,679	8,790
Wilmington	Mediterranean	All Commodities	39,747	26,292	21,206	22,114	22,108	20,514	20,130	20,917	23,495	27,400	32,251
Wilmington	North America	All Commodities	41	133,660	15	15	16	20	23	26	32	40	49
Wilmington	NE Asia	All Commodities	596,011	434,031	257,332	268,359	270,898	286,689	298,776	322,586	393,944	522,409	756,852
Wilmington	North Europe	All Commodities	288,885	316,548	277,403	292,379	286,317	201,166	165,732	159,435	150,835	149,241	153,779
Wilmington	Oceania	All Commodities	2,497	1,956	3,553	3,743	3,743	4,304	4,938	5,643	7,370	9,652	12,657
Wilmington	Europe, Other	All Commodities	2,977	3,395	2,008	2,045	2,074	1,785	1,597	1,630	1,698	1,724	1,706
Wilmington	SE Asia	All Commodities	58,472	114,306	56,393	59,868	63,076	81,684	99,563	122,355	217,291	460,278	1,074,062
Wilmington	West Coast S America	All Commodities	34,664	36,576	2,421	2,602	2,746	3,909	5,833	9,550	34,172	123,563	349,632
Norfolk	World	All Commodities	37,366,365	20,704,378	13,453,664	13,662,523	13,834,626	13,328,551	13,119,746	13,246,731	14,255,089	17,425,599	24,880,576
Norfolk	Percent Change	All Commodities	NA	-11.14%	-13.39%	1.55%	1.26%	-0.74%	-0.32%	0.19%	0.74%	2.03%	3.63%
Norfolk	Africa	All Commodities	500,919	198,419	79,025	79,062	78,093	82,842	86,327	93,714	128,540	227,208	442,088
Norfolk	Central America	All Commodities	43,881	69,622	136,461	142,476	147,758	171,327	186,671	207,307	279,555	447,834	805,722
Norfolk	East Coast S America	All Commodities	3,703,011	3,249,477	1,822,142	1,836,807	1,916,628	2,081,412	2,137,999	2,171,610	2,275,842	2,381,149	2,488,270
Norfolk	Eastern Europe	All Commodities	1,437,813	1,090,049	407,043	434,793	467,543	583,264	648,756	728,849	1,150,907	2,547,960	6,079,323
Norfolk	India	All Commodities	87,151	153,331	216,445	220,286	224,612	253,142	294,905	355,525	601,616	1,243,376	2,626,398
Norfolk	Middle East	All Commodities	169,527	84,583	71,968	73,485	76,003	87,748	94,790	101,878	115,602	128,481	140,159
Norfolk	Mediterranean	All Commodities	3,951,346	2,349,985	1,817,624	1,844,320	1,893,963	1,806,234	1,783,502	1,804,490	1,878,212	1,992,758	2,156,263
Norfolk	North America	All Commodities	7,257	24,880	10,396	11,554	10,443	6,689	5,088	4,317	3,299	2,857	2,752
Norfolk	NE Asia	All Commodities	7,807,707	3,041,520	1,201,290	1,242,944	1,255,864	1,305,940	1,351,541	1,436,823	1,695,249	2,155,884	2,994,989
Norfolk	North Europe	All Commodities	18,953,051	9,968,362	7,235,957	7,305,328	7,290,766	6,442,828	5,984,730	5,729,918	5,291,472	5,027,139	4,911,719
Norfolk	Oceania	All Commodities	136,984	92,146	86,798	94,414	90,420	98,022	111,952	128,538	169,152	223,129	292,585
Norfolk	Europe, Other	All Commodities	72,766	17,267	6,718	6,915	7,056	9,286	11,425	14,145	21,234	30,217	40,434
Norfolk	SE Asia	All Commodities	425,269	330,976	309,887	316,419	321,110	338,968	355,336	393,651	527,612	777,025	1,374,023
Norfolk	West Coast S America	All Commodities	69,482	33,762	51,908	53,719	54,367	60,850	66,925	75,966	117,699	240,583	525,850

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Other N Atlantic	World	All Commodities	20,978,097	11,951,303	14,924,707	15,412,014	15,501,700	15,759,479	16,108,345	16,976,977	20,046,958	26,428,802	39,299,488
Other N Atlantic	Percent Change	All Commodities	NA	-10.64%	7.69%	3.27%	0.58%	0.33%	0.44%	1.06%	1.68%	2.80%	4.05%
Other N Atlantic	Africa	All Commodities	214,446	230,781	110,549	111,466	113,117	121,225	126,813	137,111	196,777	361,469	665,932
Other N Atlantic	Central America	All Commodities	330,312	724,192	924,223	957,919	988,563	1,118,596	1,194,332	1,287,273	1,532,858	1,873,001	2,352,584
Other N Atlantic	East Coast S America	All Commodities	1,634,481	813,999	575,932	605,118	616,181	698,373	749,712	799,867	904,668	1,015,630	1,136,408
Other N Atlantic	Eastern Europe	All Commodities	955,762	119,629	216,804	227,480	237,868	294,669	348,979	440,017	947,123	2,566,514	6,570,895
Other N Atlantic	India	All Commodities	636,494	286,359	535,560	539,359	543,844	575,058	614,789	670,783	900,870	1,497,342	2,695,464
Other N Atlantic	Middle East	All Commodities	691,315	183,733	137,422	139,679	143,549	158,933	169,273	181,146	206,395	233,197	260,616
Other N Atlantic	Mediterranean	All Commodities	2,728,047	715,128	1,080,983	1,102,656	1,133,426	1,097,186	1,101,792	1,135,243	1,227,359	1,357,341	1,534,294
Other N Atlantic	North America	All Commodities	425,869	964,811	596,429	611,756	585,875	572,198	576,078	589,903	638,364	625,322	733,241
Other N Atlantic	NE Asia	All Commodities	4,348,793	2,180,700	5,258,293	5,497,231	5,481,836	5,431,643	5,411,196	5,663,344	6,534,422	8,074,842	10,888,581
Other N Atlantic	North Europe	All Commodities	7,407,570	4,581,269	3,589,764	3,644,379	3,668,710	3,658,111	3,758,498	3,900,800	4,268,266	4,801,769	5,526,720
Other N Atlantic	Oceania	All Commodities	103,070	121,433	150,789	164,486	160,458	175,070	195,093	217,189	268,336	330,781	403,508
Other N Atlantic	Europe, Other	All Commodities	25,470	18,019	21,171	22,398	23,399	34,064	45,643	60,042	97,822	147,587	207,121
Other N Atlantic	SE Asia	All Commodities	929,252	724,363	1,289,745	1,336,517	1,348,748	1,324,821	1,281,295	1,320,070	1,608,785	2,528,076	4,763,093
Other N Atlantic	West Coast S America	All Commodities	547,215	286,887	437,044	451,571	456,126	499,532	534,851	574,189	714,913	1,015,930	1,561,030

Table 15. Containerized Tonnes of Imports to U.S. South Atlantic Coast Ports by World Trade Route, All Commodities: 1995 - 2050 (selected years)

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Charleston	World	All Commodities	1,261,537	2,437,615	3,363,179	3,502,757	3,787,706	5,035,660	5,924,561	6,823,126	9,112,316	12,093,056	15,727,325
Charleston	Percent Change	All Commodities	NA	14.08%	11.33%	4.15%	8.13%	5.86%	3.30%	2.86%	2.94%	2.87%	2.66%
Charleston	Africa	All Commodities	18,764	25,520	55,783	58,007	61,673	82,354	97,885	113,701	149,896	192,064	234,835
Charleston	Central America	All Commodities	7,672	26,580	40,844	40,447	43,866	51,309	56,648	61,353	72,982	87,169	104,462
Charleston	East Coast S America	All Commodities	87,206	266,001	505,279	540,424	594,010	773,031	935,957	1,089,428	1,452,887	1,890,056	2,384,763
Charleston	Eastern Europe	All Commodities	24,055	96,831	107,852	108,699	114,915	158,013	198,316	244,167	375,649	561,457	781,146
Charleston	India	All Commodities	96,147	124,838	291,973	294,034	306,181	402,085	475,595	540,906	706,400	910,656	1,139,111
Charleston	Middle East	All Commodities	6,105	13,032	30,114	32,603	34,490	45,794	52,079	61,440	88,007	127,286	178,925
Charleston	Mediterranean	All Commodities	49,997	148,357	183,270	194,637	215,504	288,711	337,651	388,520	514,991	677,542	881,708
Charleston	North America	All Commodities	12,189	8,682	6,310	6,672	6,865	7,792	8,824	10,079	13,568	18,837	26,646
Charleston	NE Asia	All Commodities	280,597	510,264	681,299	711,650	777,788	1,124,025	1,379,152	1,654,360	2,385,573	3,381,944	4,608,093
Charleston	North Europe	All Commodities	455,836	791,270	939,191	1,003,383	1,088,091	1,396,494	1,594,875	1,797,641	2,336,638	3,089,429	4,112,837
Charleston	Oceania	All Commodities	49,315	28,349	77,442	72,718	75,171	96,230	110,470	120,917	144,935	176,041	218,066
Charleston	Europe, Other	All Commodities	10,983	46,594	80,727	64,491	66,061	76,438	84,334	92,402	110,435	128,950	145,259
Charleston	SE Asia	All Commodities	131,649	245,861	165,044	167,554	175,845	208,310	224,050	242,104	284,754	328,351	374,447
Charleston	West Coast S America	All Commodities	31,022	105,434	198,050	207,438	227,247	325,072	368,726	406,107	475,602	523,275	537,027
Jacksonville	World	All Commodities	1,280,854	2,059,019	2,696,401	2,823,007	3,042,724	3,902,856	4,547,446	5,245,877	7,159,019	9,845,401	13,154,390
Jacksonville	Percent Change	All Commodities	NA	9.96%	9.41%	4.70%	7.78%	5.11%	3.10%	2.90%	3.16%	3.24%	2.94%
Jacksonville	Africa	All Commodities	3,563	11,660	13,894	15,720	17,564	22,093	27,035	32,880	47,253	66,795	89,781
Jacksonville	Central America	All Commodities	177,211	240,384	352,548	347,722	376,788	419,764	454,517	478,938	542,867	622,777	726,863
Jacksonville	East Coast S America	All Commodities	329,053	595,605	809,481	859,578	921,930	1,179,201	1,340,471	1,500,420	1,925,717	2,560,187	3,426,988
Jacksonville	Eastern Europe	All Commodities	105,813	122,379	158,867	167,965	186,154	302,173	481,683	746,069	1,584,109	2,869,973	4,433,044
Jacksonville	India	All Commodities	2,757	3,312	23,873	24,736	28,270	44,488	57,391	72,180	113,299	174,217	257,891
Jacksonville	Middle East	All Commodities	863	1,291	1,484	1,523	1,633	2,397	3,329	4,423	7,375	11,841	18,341
Jacksonville	Mediterranean	All Commodities	57,984	41,884	98,698	108,689	122,433	154,995	173,000	190,346	227,820	270,075	320,928
Jacksonville	North America	All Commodities	56,835	104,011	109,200	116,784	122,178	141,032	151,069	157,583	176,607	204,822	245,494
Jacksonville	NE Asia	All Commodities	155,803	274,536	285,902	296,997	324,111	485,977	619,076	760,451	1,122,223	1,606,031	2,193,685
Jacksonville	North Europe	All Commodities	209,443	234,164	411,269	431,746	440,910	488,597	496,971	489,990	483,557	483,993	497,347
Jacksonville	Oceania	All Commodities	13,756	9,361	12,440	11,719	10,128	12,755	15,007	16,099	17,797	19,798	22,349
Jacksonville	Europe, Other	All Commodities	232	4,532	29,329	21,614	23,600	34,314	46,404	57,771	80,622	100,680	114,004
Jacksonville	SE Asia	All Commodities	47,013	176,462	76,604	82,128	96,380	132,311	149,707	168,385	205,173	232,491	253,453
Jacksonville	West Coast S America	All Commodities	120,529	239,437	312,810	336,086	370,644	482,759	531,785	570,342	624,602	621,721	554,223

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Miami	World	All Commodities	1,364,825	2,237,289	3,023,402	3,171,822	3,444,352	4,499,876	5,292,710	6,121,626	8,351,668	11,460,791	13,562,893
Miami	Percent Change	All Commodities	NA	10.39%	10.56%	4.91%	8.59%	5.49%	3.39%	2.95%	3.16%	3.22%	3.11%
Miami	Africa	All Commodities	899	5,040	8,631	9,399	10,431	13,110	15,536	18,177	23,653	30,275	38,075
Miami	Central America	All Commodities	271,200	525,560	651,902	644,221	671,315	756,619	831,266	904,593	1,093,728	1,333,035	1,643,538
Miami	East Coast S America	All Commodities	407,524	351,901	390,079	391,960	401,018	425,338	440,814	455,462	487,897	521,597	553,459
Miami	Eastern Europe	All Commodities	2,235	20,321	49,084	52,077	58,433	101,986	166,656	256,334	548,225	1,005,555	1,564,543
Miami	India	All Commodities	8,869	15,603	23,431	25,484	26,952	35,491	41,351	46,796	62,408	83,347	106,773
Miami	Middle East	All Commodities	4,787	3,724	6,976	7,193	7,595	8,995	10,035	11,339	15,079	21,126	30,435
Miami	Mediterranean	All Commodities	98,839	227,525	323,364	357,495	407,383	567,382	650,212	732,209	931,823	1,193,369	1,538,801
Miami	North America	All Commodities	843	9,113	17,071	17,456	17,586	18,575	18,931	19,579	20,116	20,362	19,858
Miami	NE Asia	All Commodities	180,368	267,390	448,904	468,029	512,744	749,772	954,293	1,174,218	1,748,370	2,509,853	3,449,684
Miami	North Europe	All Commodities	213,204	526,213	721,106	819,348	936,853	1,351,331	1,642,320	1,928,875	2,727,209	3,922,334	5,664,204
Miami	Oceania	All Commodities	380	2,754	17,742	17,497	18,221	23,623	30,504	38,172	57,979	85,079	120,408
Miami	Europe, Other	All Commodities	1,707	11,304	20,199	21,358	23,633	21,213	20,987	21,182	21,849	22,190	22,217
Miami	SE Asia	All Commodities	67,918	120,409	119,435	120,034	126,693	153,936	166,225	180,603	215,247	251,105	288,606
Miami	West Coast S America	All Commodities	106,047	155,451	223,428	220,270	225,497	272,513	303,586	334,092	398,085	461,583	529,293
Wilmington	World	All Commodities	500,971	636,237	733,502	772,656	839,625	1,209,221	1,581,015	2,015,153	3,362,706	5,615,288	9,310,141
Wilmington	Percent Change	All Commodities	NA	4.90%	4.86%	5.34%	8.67%	7.57%	5.51%	4.97%	5.25%	5.26%	4.96%
Wilmington	Africa	All Commodities	2,218	581	2,775	3,384	4,425	6,348	7,991	10,040	15,413	23,416	35,335
Wilmington	Central America	All Commodities	16,540	13,965	46,534	46,187	53,624	72,804	93,736	118,811	193,319	321,568	553,810
Wilmington	East Coast S America	All Commodities	80,832	24,068	80,855	87,601	94,008	126,744	165,648	216,454	380,409	685,772	1,246,079
Wilmington	Eastern Europe	All Commodities	25,989	55,773	54,263	55,640	59,176	76,211	91,941	106,621	136,927	155,011	162,862
Wilmington	India	All Commodities	7,523	18,852	2,572	2,658	2,864	4,104	5,270	5,835	9,848	17,900	34,656
Wilmington	Middle East	All Commodities	1,566	4,048	4,118	4,497	4,978	7,820	11,118	14,932	25,296	41,106	64,247
Wilmington	Mediterranean	All Commodities	6,458	15,245	7,253	8,130	9,731	12,214	13,856	16,141	24,581	42,789	80,128
Wilmington	North America	All Commodities	46,092	24,777	10,586	10,709	10,689	9,891	9,187	8,795	9,070	10,569	13,295
Wilmington	NE Asia	All Commodities	165,412	274,084	297,222	312,466	343,075	518,984	674,295	841,290	1,272,979	1,847,125	2,369,341
Wilmington	North Europe	All Commodities	77,216	91,851	88,958	97,210	100,174	139,967	173,952	196,199	254,873	317,814	382,842
Wilmington	Oceania	All Commodities	5,696	347	380	392	441	736	974	1,267	2,184	3,849	6,880
Wilmington	Europe, Other	All Commodities	1,163	165	5,456	2,539	3,019	5,392	9,159	15,064	37,098	79,554	152,423
Wilmington	SE Asia	All Commodities	52,922	103,860	104,300	108,066	115,395	154,941	194,161	241,625	389,999	615,333	942,360
Wilmington	West Coast S America	All Commodities	11,234	8,621	28,230	32,768	38,024	73,084	129,728	222,079	610,708	1,453,485	2,865,883
Norfolk	World	All Commodities	1,654,417	2,412,844	3,230,294	3,333,337	3,541,441	4,605,270	5,282,095	5,960,689	7,609,389	9,541,578	11,711,690
Norfolk	Percent Change	All Commodities	NA	7.84%	10.21%	3.19%	6.24%	5.39%	2.78%	2.45%	2.47%	2.29%	2.07%
Norfolk	Africa	All Commodities	14,323	27,955	35,392	36,979	39,868	47,624	51,309	54,925	64,079	76,375	91,807
Norfolk	Central America	All Commodities	15,947	12,217	17,155	17,482	18,199	20,457	22,171	23,728	28,037	33,849	40,707
Norfolk	East Coast S America	All Commodities	254,861	545,574	486,799	525,101	548,574	738,239	839,672	938,639	1,117,880	1,222,930	1,265,911
Norfolk	Eastern Europe	All Commodities	48,326	149,126	149,690	151,460	158,769	196,176	221,770	240,045	281,624	328,162	399,154
Norfolk	India	All Commodities	46,446	98,035	184,728	186,240	192,453	243,041	279,666	307,133	399,310	517,470	650,584
Norfolk	Middle East	All Commodities	3,409	9,143	14,329	15,353	16,370	21,076	22,430	24,993	31,123	38,966	47,846
Norfolk	Mediterranean	All Commodities	204,750	204,032	162,669	170,052	183,419	213,899	232,334	249,682	289,087	328,302	363,760
Norfolk	North America	All Commodities	51,362	51,884	56,928	62,327	67,078	86,445	98,986	109,428	134,889	169,677	219,074
Norfolk	NE Asia	All Commodities	176,906	423,387	829,377	881,305	938,147	1,398,787	1,685,498	1,999,427	2,798,771	3,779,313	4,840,816
Norfolk	North Europe	All Commodities	655,652	805,150	894,659	914,569	962,672	1,113,912	1,213,401	1,305,427	1,498,941	1,708,564	1,934,993
Norfolk	Oceania	All Commodities	12,970	32,769	35,210	32,406	34,646	47,547	52,150	54,755	64,138	74,674	85,560
Norfolk	Europe, Other	All Commodities	11,092	23,166	34,474	33,250	33,814	35,976	38,281	40,316	45,965	52,515	59,867
Norfolk	SE Asia	All Commodities	148,550	219,142	256,104	262,654	275,100	350,237	394,650	450,210	600,099	803,320	1,039,968
Norfolk	West Coast S America	All Commodities	9,734	13,255	72,581	73,958	75,334	101,855	129,837	162,102	255,436	407,520	641,641

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Other N Atlantic	World	All Commodities	10,549,036	16,187,158	20,439,880	21,534,362	23,001,096	28,498,222	32,106,756	35,452,847	43,862,675	54,418,313	67,491,475
Other N Atlantic	Percent Change	All Commodities	NA	8.94%	8.09%	5.35%	6.81%	4.38%	2.41%	2.00%	2.15%	2.18%	2.18%
Other N Atlantic	Africa	All Commodities	192,969	305,511	356,137	404,043	452,855	541,683	573,525	596,079	642,069	708,424	791,058
Other N Atlantic	Central America	All Commodities	330,539	494,128	504,049	524,383	542,870	590,397	602,437	599,104	607,938	642,976	715,212
Other N Atlantic	East Coast S America	All Commodities	1,916,370	2,970,442	2,917,028	3,165,815	3,436,342	4,302,625	4,974,341	5,649,399	7,458,600	9,983,563	13,464,366
Other N Atlantic	Eastern Europe	All Commodities	268,512	967,504	1,383,047	1,465,088	1,530,366	1,809,911	1,977,090	2,074,439	2,177,083	2,171,357	2,291,631
Other N Atlantic	India	All Commodities	262,508	619,505	836,366	870,730	923,431	1,282,683	1,529,189	1,741,195	2,339,635	3,118,515	4,025,653
Other N Atlantic	Middle East	All Commodities	58,737	79,547	106,981	113,130	119,635	149,808	158,838	170,686	197,341	229,013	267,622
Other N Atlantic	Mediterranean	All Commodities	541,178	794,499	898,567	980,834	1,082,520	1,312,086	1,430,458	1,524,885	1,762,274	2,026,954	2,317,097
Other N Atlantic	North America	All Commodities	870,152	1,078,177	1,908,427	2,096,107	2,208,208	2,564,394	2,811,671	2,982,200	3,358,188	3,852,745	4,628,620
Other N Atlantic	NE Asia	All Commodities	1,277,813	2,032,612	3,120,006	3,184,292	3,473,318	4,825,871	5,701,394	6,534,918	8,547,172	10,831,582	12,930,597
Other N Atlantic	North Europe	All Commodities	3,189,858	4,691,783	5,540,049	5,826,917	6,224,875	7,447,296	8,365,800	9,301,226	11,682,324	14,739,809	18,665,265
Other N Atlantic	Oceania	All Commodities	273,778	331,380	487,062	444,959	483,803	692,784	737,034	757,833	862,725	985,079	1,102,844
Other N Atlantic	Europe, Other	All Commodities	34,138	100,185	140,856	137,672	143,526	157,782	169,074	179,701	213,079	260,210	320,562
Other N Atlantic	SE Asia	All Commodities	731,753	969,836	1,185,885	1,264,162	1,304,048	1,567,777	1,691,168	1,825,877	2,152,083	2,539,367	2,970,350
Other N Atlantic	West Coast S America	All Commodities	600,731	752,047	1,055,420	1,056,230	1,075,298	1,253,125	1,384,737	1,515,306	1,862,163	2,328,719	3,000,597

Table 16. Containerized Tonnes of Exports from U.S. South Atlantic Coast Ports by World Trade Route, All Commodities: 1995 - 2050 (selected years)

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Charleston	World	All Commodities	2,056,106	2,521,756	2,522,798	2,579,246	2,586,736	2,764,538	2,997,287	3,392,062	4,811,514	8,128,076	15,054,946
Charleston	Percent Change	All Commodities	NA	4.17%	0.01%	2.24%	0.29%	1.34%	1.63%	2.51%	3.56%	5.38%	6.36%
Charleston	Africa	All Commodities	24,683	38,174	38,599	37,311	37,261	41,568	46,553	55,579	118,327	366,120	1,033,667
Charleston	Central America	All Commodities	23,226	56,685	73,938	76,380	77,442	87,549	98,094	111,313	169,892	343,376	750,417
Charleston	East Coast S America	All Commodities	82,113	221,299	168,372	174,372	173,812	188,672	200,693	214,567	249,233	293,167	345,864
Charleston	Eastern Europe	All Commodities	61,868	79,077	170,924	176,786	178,815	220,386	249,725	300,937	565,196	1,381,033	3,302,069
Charleston	India	All Commodities	54,827	36,923	118,143	119,766	117,953	133,848	156,591	189,298	313,805	633,945	1,337,068
Charleston	Middle East	All Commodities	52,084	41,257	42,977	42,643	42,640	46,782	50,454	56,044	71,569	94,413	123,899
Charleston	Mediterranean	All Commodities	106,522	194,194	198,634	204,905	208,779	221,371	247,459	285,434	390,376	550,775	773,468
Charleston	North America	All Commodities	486	22	43	43	41	39	40	44	56	74	97
Charleston	NE Asia	All Commodities	614,250	813,289	597,366	610,208	604,161	611,866	626,603	687,184	888,335	1,276,063	1,967,663
Charleston	North Europe	All Commodities	654,377	708,962	791,866	803,703	817,538	843,258	895,964	980,936	1,198,110	1,508,960	1,896,146
Charleston	Oceania	All Commodities	22,282	16,535	16,039	16,697	16,252	16,838	17,973	19,396	23,055	28,072	34,134
Charleston	Europe, Other	All Commodities	3,675	9,902	2,056	2,103	2,150	2,633	2,969	3,351	4,137	4,952	5,680
Charleston	SE Asia	All Commodities	227,626	147,315	148,900	155,688	149,163	166,748	192,218	234,925	416,510	894,659	2,064,331
Charleston	West Coast S America	All Commodities	128,088	158,120	154,941	158,641	160,729	182,982	211,949	253,053	402,913	752,465	1,420,443
Jacksonville	World	All Commodities	1,398,365	1,251,813	1,173,510	1,189,435	1,193,458	1,320,171	1,445,293	1,609,538	2,158,057	3,274,494	5,351,643
Jacksonville	Percent Change	All Commodities	NA	-2.19%	-2.13%	1.36%	0.34%	2.04%	1.83%	2.18%	2.98%	4.26%	5.04%
Jacksonville	Africa	All Commodities	8,039	3,417	3,446	3,378	3,350	3,553	3,747	4,201	7,063	16,811	42,029
Jacksonville	Central America	All Commodities	192,989	266,796	283,247	283,479	282,411	315,776	342,700	376,646	488,690	719,266	1,144,515
Jacksonville	East Coast S America	All Commodities	341,322	183,729	223,346	226,523	224,068	234,951	242,062	249,862	272,407	302,593	337,929
Jacksonville	Eastern Europe	All Commodities	45,594	117,662	54,612	58,058	63,366	84,357	91,004	105,478	158,968	248,179	382,169
Jacksonville	India	All Commodities	524	1,033	1,224	1,260	1,330	2,069	3,662	7,278	34,224	139,740	416,846
Jacksonville	Middle East	All Commodities	6,388	8,336	7,764	7,567	7,404	7,347	7,221	7,538	8,510	9,932	11,654
Jacksonville	Mediterranean	All Commodities	39,361	88,406	77,917	82,390	83,301	100,903	126,917	153,973	224,664	324,919	452,288
Jacksonville	North America	All Commodities	459	22	847	841	825	981	1,195	1,447	2,046	2,846	3,785
Jacksonville	NE Asia	All Commodities	109,186	77,465	134,942	134,598	135,583	146,316	155,187	163,519	198,533	279,715	450,928
Jacksonville	North Europe	All Commodities	370,529	341,138	205,904	210,607	210,144	223,906	242,407	264,402	318,102	394,349	488,104
Jacksonville	Oceania	All Commodities	24,850	2,229	1,938	1,990	2,033	2,474	2,896	3,411	4,664	6,340	8,385
Jacksonville	Europe, Other	All Commodities	537	167	195	186	184	209	225	246	298	362	431
Jacksonville	SE Asia	All Commodities	27,631	25,130	46,505	48,495	50,551	65,873	83,249	106,417	187,895	391,304	836,359
Jacksonville	West Coast S America	All Commodities	230,955	136,283	131,623	130,062	128,910	131,457	142,821	165,119	251,992	438,137	776,222

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Miami	World	All Commodities	1,420,889	1,708,092	1,787,942	1,833,501	1,854,147	2,049,118	2,229,217	2,451,796	3,236,686	5,007,451	8,411,104
Miami	Percent Change	All Commodities	NA	3.75%	1.53%	2.55%	1.13%	2.02%	1.70%	1.92%	2.82%	4.46%	5.32%
Miami	Africa	All Commodities	1,167	3,000	1,831	1,798	1,809	1,988	2,165	2,448	4,158	9,324	21,170
Miami	Central America	All Commodities	648,626	1,036,097	1,097,900	1,122,122	1,139,643	1,273,053	1,379,491	1,502,836	1,944,990	2,912,624	4,637,999
Miami	East Coast S America	All Commodities	343,230	263,230	161,610	168,455	169,189	192,377	207,209	221,039	254,171	294,950	342,887
Miami	Eastern Europe	All Commodities	2,993	2,637	6,538	6,755	7,023	9,011	11,402	13,379	37,298	116,525	319,888
Miami	India	All Commodities	13,312	12,596	23,427	22,583	22,072	21,459	22,079	25,571	54,107	166,532	460,211
Miami	Middle East	All Commodities	1,913	3,851	4,721	4,767	4,911	6,050	7,100	8,292	11,528	16,320	22,593
Miami	Mediterranean	All Commodities	21,410	8,015	22,507	24,015	24,776	27,526	33,502	39,836	56,447	80,393	112,708
Miami	North America	All Commodities	34	562	43	44	46	61	69	81	115	167	233
Miami	NE Asia	All Commodities	62,428	78,235	136,934	139,066	136,986	133,791	133,909	148,426	189,332	256,226	400,054
Miami	North Europe	All Commodities	97,283	123,949	158,564	163,284	164,115	165,722	174,470	184,547	206,449	239,811	282,172
Miami	Oceania	All Commodities	1,751	11,189	5,316	5,423	5,332	5,885	6,582	7,402	9,433	12,217	15,582
Miami	Europe, Other	All Commodities	224	380	332	324	324	353	371	398	461	539	619
Miami	SE Asia	All Commodities	16,274	19,266	15,306	15,698	16,038	19,686	24,806	33,435	76,020	223,137	594,846
Miami	West Coast S America	All Commodities	210,244	145,081	152,914	159,167	161,885	192,285	226,062	267,087	401,177	678,683	1,199,922
Wilmington	World	All Commodities	524,501	463,829	424,611	434,999	432,760	428,855	441,631	494,482	755,784	1,606,095	3,816,954
Wilmington	Percent Change	All Commodities	NA	-2.43%	-2.90%	2.45%	-0.53%	-0.18%	0.59%	2.29%	4.33%	7.83%	9.04%
Wilmington	Africa	All Commodities	2,172	2,844	1,840	1,866	1,958	2,420	2,894	3,545	6,638	15,700	36,996
Wilmington	Central America	All Commodities	6,686	6,768	4,904	5,102	5,326	7,104	10,039	16,059	58,804	221,679	645,996
Wilmington	East Coast S America	All Commodities	11,105	19,958	4,415	4,734	4,917	6,457	7,991	9,326	12,183	16,229	25,603
Wilmington	Eastern Europe	All Commodities	23,595	3,097	1,650	1,711	1,808	2,673	3,640	5,197	13,932	47,378	135,837
Wilmington	India	All Commodities	908	5,788	5,248	5,765	5,484	6,875	9,317	14,395	52,495	213,976	673,531
Wilmington	Middle East	All Commodities	4,784	3,447	3,216	3,175	3,217	3,703	4,151	4,608	5,712	7,117	8,650
Wilmington	Mediterranean	All Commodities	18,668	14,104	16,066	16,438	16,307	15,369	15,343	16,224	19,094	23,651	29,228
Wilmington	North America	All Commodities	34	6,994	14	14	18	21	24	31	41	52	52
Wilmington	NE Asia	All Commodities	272,216	169,146	172,130	176,042	176,304	188,720	199,895	219,856	283,305	405,791	630,266
Wilmington	North Europe	All Commodities	127,906	156,483	171,899	179,595	179,625	145,889	125,911	123,260	122,473	129,396	141,180
Wilmington	Oceania	All Commodities	1,913	1,887	2,406	2,478	2,495	3,017	3,566	4,218	5,855	8,151	11,136
Wilmington	Europe, Other	All Commodities	1,332	1,471	999	993	998	883	810	841	918	992	1,038
Wilmington	SE Asia	All Commodities	32,428	55,459	37,384	34,473	31,510	41,843	52,316	67,691	141,452	389,559	1,194,397
Wilmington	West Coast S America	All Commodities	20,754	16,383	2,440	2,612	2,738	3,885	5,737	9,241	32,890	126,435	375,104
Norfolk	World	All Commodities	2,563,015	2,222,774	2,404,368	2,439,637	2,439,894	2,588,696	2,756,113	3,031,907	4,166,594	6,907,680	13,247,342
Norfolk	Percent Change	All Commodities	NA	-2.81%	2.65%	1.47%	0.01%	1.19%	1.26%	1.93%	3.08%	5.34%	6.78%
Norfolk	Africa	All Commodities	39,326	23,669	38,074	36,718	34,859	37,821	40,996	46,303	72,825	151,249	330,682
Norfolk	Central America	All Commodities	22,405	27,068	48,381	52,802	56,902	67,709	77,430	91,792	153,134	325,091	718,463
Norfolk	East Coast S America	All Commodities	201,753	208,331	158,024	165,191	166,228	190,660	208,649	226,337	268,873	323,082	382,833
Norfolk	Eastern Europe	All Commodities	155,073	109,198	121,546	126,325	135,376	159,995	176,294	219,440	500,822	1,559,003	4,385,798
Norfolk	India	All Commodities	29,940	84,238	133,490	123,392	122,504	137,051	159,690	194,826	351,683	807,180	1,865,576
Norfolk	Middle East	All Commodities	29,488	53,844	50,847	50,978	52,308	61,355	67,319	73,377	86,503	101,218	114,969
Norfolk	Mediterranean	All Commodities	152,746	162,876	149,887	150,961	153,462	161,881	167,935	175,444	195,145	221,123	248,054
Norfolk	North America	All Commodities	3,225	10,394	4,791	5,220	4,680	3,028	2,333	2,010	1,603	1,473	1,489
Norfolk	NE Asia	All Commodities	646,587	610,453	723,321	732,653	729,233	768,359	809,978	879,203	1,089,106	1,472,269	2,129,365
Norfolk	North Europe	All Commodities	929,075	679,837	700,258	714,405	705,344	704,248	723,446	754,397	840,785	971,953	1,132,777
Norfolk	Oceania	All Commodities	83,336	55,086	58,615	62,533	59,552	66,168	77,209	90,598	125,360	175,582	240,874
Norfolk	Europe, Other	All Commodities	44,616	7,237	3,239	3,350	3,435	4,754	6,049	7,701	12,287	18,696	26,332
Norfolk	SE Asia	All Commodities	200,734	169,739	178,231	179,186	179,612	184,826	193,099	216,845	313,542	547,090	1,089,217
Norfolk	West Coast S America	All Commodities	24,622	20,806	35,661	35,821	36,400	40,842	45,696	53,635	94,896	232,642	580,914

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Other N Atlantic	World	All Commodities	4,389,059	3,899,241	6,203,920	6,349,270	6,371,192	6,688,957	7,104,069	7,782,771	10,129,036	15,191,757	25,135,406
Other N Atlantic	Percent Change	All Commodities	NA	-2.34%	16.74%	2.34%	0.35%	0.98%	1.21%	1.84%	2.67%	4.14%	5.16%
Other N Atlantic	Africa	All Commodities	81,298	48,848	66,676	63,253	62,715	68,897	75,505	84,676	130,071	249,384	469,916
Other N Atlantic	Central America	All Commodities	132,933	214,880	247,122	281,941	321,291	373,389	411,619	459,725	600,097	850,254	1,259,802
Other N Atlantic	East Coast S America	All Commodities	355,873	310,823	254,531	269,473	270,304	313,468	345,008	377,525	451,092	541,929	640,157
Other N Atlantic	Eastern Europe	All Commodities	105,152	70,437	127,987	131,887	136,913	168,243	204,869	268,345	624,394	1,793,891	4,702,576
Other N Atlantic	India	All Commodities	193,920	161,769	364,584	342,394	338,376	351,157	372,676	408,861	571,785	1,035,127	2,044,701
Other N Atlantic	Middle East	All Commodities	82,141	82,761	81,827	81,632	83,549	93,696	101,418	110,011	129,978	154,320	179,275
Other N Atlantic	Mediterranean	All Commodities	269,097	184,753	194,929	197,624	202,454	212,717	230,202	250,590	301,524	371,307	455,081
Other N Atlantic	North America	All Commodities	19,057	67,070	58,405	61,584	58,674	61,523	63,429	68,278	82,246	98,974	128,919
Other N Atlantic	NE Asia	All Commodities	1,139,066	971,172	2,613,463	2,690,811	2,659,440	2,637,912	2,668,854	2,841,192	3,466,407	4,682,659	6,893,030
Other N Atlantic	North Europe	All Commodities	1,322,246	1,136,246	1,330,358	1,343,099	1,350,160	1,490,649	1,657,511	1,830,828	2,265,792	2,875,625	3,642,514
Other N Atlantic	Oceania	All Commodities	59,484	66,903	105,829	112,674	108,616	118,881	134,682	153,456	201,018	266,255	344,844
Other N Atlantic	Europe, Other	All Commodities	15,127	7,621	10,129	11,211	12,071	17,889	24,403	32,841	56,456	90,823	134,030
Other N Atlantic	SE Asia	All Commodities	398,998	415,960	503,430	510,665	508,499	496,142	505,471	558,492	800,259	1,477,082	3,034,587
Other N Atlantic	West Coast S America	All Commodities	214,666	159,999	244,648	251,023	258,129	284,395	308,421	337,951	447,918	704,127	1,205,974

of declining growth of container tonnage imports after 2005 expressed as an average annual compound growth rate.[19]

For total containerized tonnes of exports (Table 16) the pattern of growth differs from imports. Export containerized tonnes grow substantially less than imports after 2003, generally averaging less than 2 percent (compound annual growth rate) until 2020. Export growth is expected to increase after 2020, moving close to import growth by 2040 and surpassing import growth for the period 2040 to 2050. For example, the predominant trade regions for Charleston Harbor total metric export tonnes in 2003 (2.522 million tones) are North Europe (0.791 million tonnes) and North East Asia (0.597 million tonnes). Charleston Harbor export containerized metric tonnes (all commodities) are expected to grow 2.24 percent between 2003 and 2004 and 0.29 percent between 2004 and 2005, then at an average annual rate of 1.34 percent between 2005 and 2010, at 1.63 percent between 2010 and 2015, at 2.51 percent between 2015 and 2020, and at 3.56 percent between 2020 and 2030 (Table 16). After 2030, Charleston Harbor's export growth rates increase to 5.38 percent between 2030 and 2040 and 6.36 percent between 2040 and 2050.

TEUs

Tables 17 and 18 depict the major world trade areas for each of the South Atlantic Coast ports for total TEUs of imports and exports, respectively, and their growth from 1995. For example, the predominant trade regions for Charleston Harbor import TEUs (Table 17) in 2003 (0.756 million) are North Europe (0.273 million) and North East Asia (0.174 million). Charleston Harbor TEUs of exports (Table 18) in 2003 (0.427 million TEUs) are predominantly to North Europe (0.159 million TEUs) and North East Asia (0.094 million TEUs).

Charleston Harbor import TEUs (all commodities) are expected to decline by 5.71 percent between 2003 and 2004, then increase by 7.43 percent between 2004 and 2005, then at an average annual rate of 6.57 percent between 2005 and 2010, slowing to an average annual rate of growth of 4.01 percent between 2010 and 2015, and growing at an average annual rate of approximately 3 to 3.5 percent between 2015 and 2050. For total export TEUs, the pattern of growth differs from imports. Export TEUs grow substantially less than imports after 2003, generally averaging less than 2 percent (compound annual growth rate) until 2015. Export growth is expected to increase after 2020, moving close to import growth by 2030 and surpassing imports for the period 2030 to 2050.

VI. DETAILED OUTPUTS FOR SAVANNAH HARBOR

The results of detailed commodity and world trade projections of imports and exports for Savannah Harbor are summarized in a series of tables for total metric tonnes, containerized tonnes, and TEUs. The data reflect trade routes for the following world regions: (1) Africa; (2) Central America; (3) East Coast South America; (4) Eastern Europe; (5) India; (6) Middle East; (7) Mediterranean; (8) North America; (9) North East Asia; (10) Northern Europe; (11) Oceania; (12) Europe, Other; (13) South East Asia; and (14) West Coast South America. The commodity groups are aggregated to ten categories as follows: (1) Agriculture; (2) Extractive; (3) Food; (4) Materials; (5) Consumer Goods; (6) Chemicals; (7) High

[19] Wilmington has slightly higher average annual growth than the other ports after 2020, but from a much smaller cargo base.

Table 17. TEUs of Imports to U.S. South Atlantic Coast Ports by World Trade Route, All Commodities: 1995 - 2050 (selected years)

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Charleston	World	All Commodities	273,581	564,694	756,533	713,361	766,376	1,053,532	1,282,451	1,522,373	2,125,422	2,917,229	3,905,324
Charleston	Percent Change	All Commodities	NA	15.60%	10.24%	-5.71%	7.43%	6.57%	4.01%	3.49%	3.39%	3.22%	2.96%
Charleston	Africa	All Commodities	5,025	8,875	13,662	13,023	13,996	18,742	22,637	26,812	36,535	47,624	59,790
Charleston	Central America	All Commodities	1,229	6,111	9,331	8,708	9,266	11,299	13,397	15,709	21,746	30,070	41,265
Charleston	East Coast S America	All Commodities	9,424	27,594	50,896	48,532	51,571	67,694	78,533	88,543	107,842	127,660	151,404
Charleston	Eastern Europe	All Commodities	5,026	8,711	13,616	12,243	12,529	14,723	15,935	16,960	19,082	21,432	24,325
Charleston	India	All Commodities	20,045	30,633	79,093	74,441	77,894	102,067	121,575	139,073	179,882	227,727	279,255
Charleston	Middle East	All Commodities	3,592	7,203	12,411	12,027	12,661	15,784	17,576	19,810	25,914	34,595	45,858
Charleston	Mediterranean	All Commodities	14,485	32,599	39,164	38,958	43,737	62,409	79,507	97,987	146,012	212,123	299,184
Charleston	North America	All Commodities	183	329	1,560	1,412	1,595	2,040	2,564	2,800	3,225	3,807	4,653
Charleston	NE Asia	All Commodities	73,923	144,489	174,165	165,831	181,777	272,874	346,313	428,115	647,354	958,669	1,371,783
Charleston	North Europe	All Commodities	95,939	223,567	273,094	254,635	272,962	375,057	457,816	544,126	758,110	1,029,679	1,356,128
Charleston	Oceania	All Commodities	2,212	877	2,353	2,172	2,415	3,404	4,098	4,843	6,696	9,165	12,207
Charleston	Europe, Other	All Commodities	1,588	7,385	8,901	7,893	8,218	10,144	11,625	12,991	16,497	21,008	26,334
Charleston	SE Asia	All Commodities	34,367	42,817	55,223	51,336	53,782	65,687	73,841	82,026	100,335	120,100	140,179
Charleston	West Coast S America	All Commodities	6,542	23,502	23,062	22,149	23,973	31,609	37,034	42,578	56,191	73,571	92,958
Jacksonville	World	All Commodities	22,148	26,885	39,632	195,591	207,389	285,008	360,091	453,996	722,891	1,093,184	1,540,227
Jacksonville	Percent Change	All Commodities	NA	3.95%	13.81%	393.52%	6.03%	6.56%	4.79%	4.74%	4.76%	4.22%	3.49%
Jacksonville	Africa	All Commodities	38	168	243	1,191	1,234	1,419	1,562	1,712	2,046	2,389	2,720
Jacksonville	Central America	All Commodities	3,282	2,733	1,846	9,222	9,868	12,736	15,501	18,672	26,802	37,280	49,458
Jacksonville	East Coast S America	All Commodities	5,214	6,425	13,403	67,194	72,330	102,772	141,501	196,627	363,013	590,376	849,213
Jacksonville	Eastern Europe	All Commodities	201	329	290	1,441	1,514	1,826	2,145	2,522	3,391	4,561	6,084
Jacksonville	India	All Commodities	36	35	77	399	436	613	721	844	1,150	1,551	2,065
Jacksonville	Middle East	All Commodities	8	28	22	109	115	141	156	172	214	270	341
Jacksonville	Mediterranean	All Commodities	836	296	359	1,753	1,831	2,072	2,161	2,261	2,588	3,128	3,899
Jacksonville	North America	All Commodities	159	165	144	751	808	964	1,054	1,123	1,284	1,493	1,759
Jacksonville	NE Asia	All Commodities	4,854	8,253	9,668	49,393	54,181	85,328	113,508	144,848	227,305	344,714	503,853
Jacksonville	North Europe	All Commodities	2,262	4,306	7,707	35,485	35,291	40,785	41,991	41,750	42,785	44,444	46,313
Jacksonville	Oceania	All Commodities	568	14	41	205	230	346	438	531	780	1,112	1,508
Jacksonville	Europe, Other	All Commodities	5	143	329	1,580	1,677	2,099	2,415	2,722	3,404	4,101	4,712
Jacksonville	SE Asia	All Commodities	1,822	3,090	2,926	14,265	14,678	18,615	21,071	24,115	31,508	40,540	50,687
Jacksonville	West Coast S America	All Commodities	2,864	901	2,575	12,602	13,197	15,292	15,868	16,098	16,622	17,224	17,615

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Miami	World	All Commodities	191,197	363,908	484,732	533,234	567,097	717,307	822,175	928,160	1,190,658	1,517,631	1,909,779
Miami	Percent Change	All Commodities	NA	13.74%	10.03%	10.01%	6.35%	4.81%	2.77%	2.45%	2.52%	2.46%	2.32%
Miami	Africa	All Commodities	23	763	995	1,147	1,255	1,738	2,373	3,279	6,524	12,065	19,968
Miami	Central America	All Commodities	55,590	145,454	142,125	155,226	162,669	186,837	206,464	225,196	268,042	315,875	369,057
Miami	East Coast S America	All Commodities	26,133	25,872	34,743	38,178	39,766	47,259	52,542	57,405	68,641	83,123	102,749
Miami	Eastern Europe	All Commodities	549	844	1,146	1,226	1,248	1,309	1,290	1,279	1,282	1,323	1,430
Miami	India	All Commodities	1,895	3,114	4,416	4,849	5,049	6,296	6,940	7,571	9,245	11,272	13,175
Miami	Middle East	All Commodities	1,912	991	1,797	1,997	2,091	2,408	2,569	2,711	2,988	3,264	3,514
Miami	Mediterranean	All Commodities	8,001	18,006	43,639	45,360	47,458	71,156	79,958	87,259	106,370	130,142	159,711
Miami	North America	All Commodities	1,154	612	2,017	2,288	2,612	3,837	4,867	5,757	7,192	8,138	8,739
Miami	NE Asia	All Commodities	40,232	58,022	103,217	114,885	124,234	177,459	221,092	266,742	383,451	533,465	713,422
Miami	North Europe	All Commodities	27,402	59,595	71,607	82,117	90,626	108,040	119,632	131,535	162,380	202,855	252,975
Miami	Oceania	All Commodities	58	396	2,369	2,336	2,614	4,313	5,702	7,176	10,765	16,183	24,187
Miami	Europe, Other	All Commodities	156	1,002	1,748	1,855	1,929	2,414	2,860	3,334	4,561	6,048	7,549
Miami	SE Asia	All Commodities	13,620	22,162	27,491	30,098	31,874	41,700	48,412	56,270	74,735	96,201	121,010
Miami	West Coast S America	All Commodities	14,472	27,074	47,422	51,652	53,672	62,631	67,474	72,646	84,481	97,677	112,291
Wilmington	World	All Commodities	26,268	40,285	45,717	85,683	92,810	139,503	182,438	230,356	357,183	533,105	770,210
Wilmington	Percent Change	All Commodities	NA	8.93%	4.31%	87.42%	8.32%	8.49%	5.51%	4.77%	4.48%	4.09%	3.75%
Wilmington	Africa	All Commodities	8	13	62	123	139	215	316	471	1,091	2,570	5,810
Wilmington	Central America	All Commodities	122	108	280	557	612	990	1,437	1,978	3,517	5,870	9,308
Wilmington	East Coast S America	All Commodities	415	261	1,855	3,608	3,995	5,959	8,435	11,599	21,332	38,006	65,804
Wilmington	Eastern Europe	All Commodities	522	151	263	509	560	833	1,160	1,474	2,463	3,663	4,842
Wilmington	India	All Commodities	273	321	141	277	312	499	649	840	1,435	2,549	4,742
Wilmington	Middle East	All Commodities	16	23	23	45	50	75	95	118	175	255	365
Wilmington	Mediterranean	All Commodities	201	649	278	498	530	752	865	1,013	1,427	2,078	3,114
Wilmington	North America	All Commodities	10	35	46	93	104	160	205	259	420	703	1,227
Wilmington	NE Asia	All Commodities	16,370	27,163	29,233	55,138	60,299	93,431	122,639	153,782	230,480	328,280	447,867
Wilmington	North Europe	All Commodities	2,380	1,976	2,781	5,112	5,496	8,725	12,201	16,327	30,862	55,220	90,200
Wilmington	Oceania	All Commodities	15	37	79	147	168	274	345	420	608	868	1,213
Wilmington	Europe, Other	All Commodities	18	18	80	149	165	255	380	557	1,184	2,404	4,543
Wilmington	SE Asia	All Commodities	5,571	9,134	9,697	17,714	18,443	24,099	28,585	34,289	50,127	74,439	112,067
Wilmington	West Coast S America	All Commodities	347	396	899	1,715	1,936	3,257	5,126	7,230	12,062	16,199	19,108
Norfolk	World	All Commodities	252,672	439,601	631,842	699,550	747,670	986,995	1,137,987	1,297,150	1,719,736	2,294,811	3,028,714
Norfolk	Percent Change	All Commodities	NA	11.71%	12.85%	10.72%	6.88%	5.71%	2.89%	2.65%	2.86%	2.93%	2.81%
Norfolk	Africa	All Commodities	1,234	3,228	6,560	7,297	7,851	9,448	10,008	10,213	10,987	11,875	13,168
Norfolk	Central America	All Commodities	2,586	2,238	15,700	16,721	17,485	18,706	19,454	20,417	23,489	27,609	32,526
Norfolk	East Coast S America	All Commodities	30,600	53,915	82,209	96,745	103,745	135,683	151,219	164,122	188,724	216,186	254,825
Norfolk	Eastern Europe	All Commodities	3,573	9,276	10,355	10,922	11,228	13,639	15,372	16,990	20,892	25,435	30,816
Norfolk	India	All Commodities	8,365	17,955	34,479	37,298	38,327	46,748	52,613	57,615	71,774	88,296	104,576
Norfolk	Middle East	All Commodities	3,642	3,716	5,094	5,887	5,994	6,651	6,661	6,949	7,937	9,458	11,426
Norfolk	Mediterranean	All Commodities	24,347	32,421	41,293	45,408	48,508	58,659	63,873	67,052	78,969	94,160	111,501
Norfolk	North America	All Commodities	208	270	894	1,062	1,126	1,640	2,072	2,542	3,752	5,328	7,196
Norfolk	NE Asia	All Commodities	36,420	96,550	181,253	202,452	224,834	352,943	442,793	541,945	805,356	1,170,381	1,642,146
Norfolk	North Europe	All Commodities	121,200	175,594	185,250	200,572	208,250	233,341	244,119	253,264	277,728	308,855	343,863
Norfolk	Oceania	All Commodities	1,223	1,891	2,222	2,320	2,453	2,983	3,203	3,413	3,926	4,553	5,257
Norfolk	Europe, Other	All Commodities	1,713	3,914	3,790	4,053	4,232	4,861	5,317	5,694	6,492	7,351	8,220
Norfolk	SE Asia	All Commodities	16,722	37,851	59,474	65,340	70,114	97,827	117,157	142,507	214,445	318,795	454,890
Norfolk	West Coast S America	All Commodities	842	782	3,267	3,472	3,523	3,865	4,123	4,427	5,267	6,528	8,304

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Other N Atlantic	World	All Commodities	1,159,283	1,866,836	2,608,418	2,425,426	2,623,821	3,414,396	3,921,006	4,433,331	5,797,003	7,617,592	9,900,757
Other N Atlantic	Percent Change	All Commodities	NA	10.00%	11.80%	-7.02%	8.18%	5.41%	2.81%	2.49%	2.72%	2.77%	2.66%
Other N Atlantic	Africa	All Commodities	12,258	22,158	40,165	38,908	43,192	56,502	63,013	66,781	77,745	85,174	92,898
Other N Atlantic	Central America	All Commodities	16,407	23,556	38,932	35,108	36,577	39,901	42,770	46,023	55,698	68,411	83,797
Other N Atlantic	East Coast S America	All Commodities	93,786	145,752	242,058	231,049	250,145	336,913	387,330	435,222	549,436	696,921	897,071
Other N Atlantic	Eastern Europe	All Commodities	17,918	45,552	61,998	55,901	59,726	77,061	89,056	101,240	129,981	163,382	202,145
Other N Atlantic	India	All Commodities	57,505	111,836	160,674	148,984	155,512	207,886	246,393	278,815	364,992	472,193	590,981
Other N Atlantic	Middle East	All Commodities	18,150	38,133	47,546	45,116	48,132	61,183	69,942	80,195	106,759	142,635	188,087
Other N Atlantic	Mediterranean	All Commodities	70,296	115,858	148,045	141,127	154,756	185,664	204,395	218,091	255,532	293,641	328,726
Other N Atlantic	North America	All Commodities	6,374	3,059	4,842	4,648	5,206	6,472	7,503	8,481	11,734	17,285	25,702
Other N Atlantic	NE Asia	All Commodities	244,821	378,991	625,896	578,819	634,792	913,818	1,120,746	1,346,177	1,958,705	2,825,303	3,969,913
Other N Atlantic	North Europe	All Commodities	478,399	752,660	863,483	808,930	876,554	1,060,839	1,157,172	1,245,840	1,485,467	1,786,592	2,125,154
Other N Atlantic	Oceania	All Commodities	24,571	31,989	53,371	44,987	48,863	69,800	72,431	74,975	80,047	83,574	84,164
Other N Atlantic	Europe, Other	All Commodities	6,194	15,782	15,475	13,851	15,104	17,925	20,488	21,798	25,072	30,233	37,601
Other N Atlantic	SE Asia	All Commodities	85,269	128,525	177,743	163,742	178,779	247,199	294,348	350,609	498,285	694,824	931,885
Other N Atlantic	West Coast S America	All Commodities	27,335	52,984	128,190	114,255	116,481	133,233	145,419	159,084	197,549	257,425	342,633

Table 18. TEUs of Exports from U.S. South Atlantic Coast Ports by World Trade Route, All Commodities: 1995 - 2050 (selected years)

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Charleston	World	All Commodities	364,677	414,276	427,016	443,365	449,301	505,916	567,983	648,299	895,918	1,364,276	2,196,283
Charleston	Percent Change	All Commodities	NA	2.58%	1.01%	3.83%	1.34%	2.40%	2.34%	2.68%	3.29%	4.29%	4.88%
Charleston	Africa	All Commodities	5,517	6,052	5,592	5,498	5,474	5,895	6,118	6,439	7,739	10,512	15,593
Charleston	Central America	All Commodities	5,409	13,335	17,652	18,562	19,041	21,404	23,624	26,329	37,621	65,784	123,108
Charleston	East Coast S America	All Commodities	20,283	37,670	31,001	33,098	33,598	38,456	42,588	46,495	54,753	63,909	74,473
Charleston	Eastern Europe	All Commodities	5,872	7,875	13,824	14,271	14,777	17,385	19,710	23,881	45,097	105,708	231,626
Charleston	India	All Commodities	6,158	4,801	17,450	17,865	18,363	22,451	28,060	36,225	71,404	165,422	383,307
Charleston	Middle East	All Commodities	10,780	7,774	3,268	3,289	3,320	3,495	3,614	3,794	4,209	4,672	5,167
Charleston	Mediterranean	All Commodities	24,760	27,593	35,173	36,147	36,517	41,013	45,529	51,025	63,966	79,583	98,083
Charleston	North America	All Commodities	2	2	1	1	1	2	2	2	3	3	4
Charleston	NE Asia	All Commodities	102,109	108,882	94,201	97,799	98,431	102,245	106,386	116,831	148,562	204,566	297,809
Charleston	North Europe	All Commodities	123,746	150,358	159,233	165,600	168,498	198,778	231,411	265,883	344,621	436,016	534,658
Charleston	Oceania	All Commodities	5,667	2,850	2,559	2,775	2,692	2,826	3,134	3,546	4,487	5,552	6,674
Charleston	Europe, Other	All Commodities	400	1,227	372	378	385	413	436	463	529	606	689
Charleston	SE Asia	All Commodities	31,376	19,770	22,592	23,169	23,179	23,400	24,498	27,324	40,318	72,667	133,503
Charleston	West Coast S America	All Commodities	22,601	26,088	24,099	24,914	25,025	28,153	32,873	40,061	72,610	149,278	291,589
Jacksonville	World	All Commodities	124,569	85,307	94,269	97,729	99,299	112,183	122,307	135,491	181,511	285,999	500,993
Jacksonville	Percent Change	All Commodities	NA	-7.29%	3.39%	3.67%	1.61%	2.47%	1.74%	2.07%	2.97%	4.65%	5.77%
Jacksonville	Africa	All Commodities	1,679	199	369	368	366	419	476	548	812	1,500	3,011
Jacksonville	Central America	All Commodities	17,815	17,602	16,220	16,672	17,091	18,713	19,440	20,620	27,082	45,452	84,278
Jacksonville	East Coast S America	All Commodities	48,126	35,277	30,604	32,522	32,852	37,201	40,284	42,807	47,621	52,281	57,344
Jacksonville	Eastern Europe	All Commodities	2,106	2,502	1,243	1,303	1,410	1,750	1,881	2,217	3,792	7,519	14,949
Jacksonville	India	All Commodities	78	144	204	193	204	294	468	828	3,255	11,935	33,414
Jacksonville	Middle East	All Commodities	117	1,361	1,482	1,488	1,478	1,480	1,484	1,536	1,670	1,828	2,004
Jacksonville	Mediterranean	All Commodities	1,435	822	2,970	3,094	3,247	5,125	6,527	8,296	12,399	17,019	21,872
Jacksonville	North America	All Commodities	2	2	1	1	1	2	2	2	3	3	4
Jacksonville	NE Asia	All Commodities	8,957	6,232	12,212	12,610	13,051	14,741	16,174	18,934	27,245	42,415	70,508
Jacksonville	North Europe	All Commodities	24,114	13,361	14,337	14,725	14,964	17,477	19,427	21,240	24,559	27,533	30,386
Jacksonville	Oceania	All Commodities	5,104	697	511	532	538	613	676	739	907	1,128	1,405
Jacksonville	Europe, Other	All Commodities	90	32	19	18	18	20	22	23	26	30	33
Jacksonville	SE Asia	All Commodities	1,580	1,021	5,636	5,698	5,741	6,063	6,707	7,938	15,295	37,928	89,838
Jacksonville	West Coast S America	All Commodities	13,365	6,055	8,462	8,503	8,339	8,285	8,739	9,763	16,845	39,428	91,946

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Miami	World	All Commodities	300,850	258,875	278,640	295,065	301,741	343,887	383,650	431,894	584,994	877,896	1,392,760
Miami	Percent Change	All Commodities	NA	-2.96%	2.48%	5.89%	2.26%	2.65%	2.21%	2.40%	3.08%	4.14%	4.72%
Miami	Africa	All Commodities	155	522	431	432	433	461	488	526	723	1,278	2,497
Miami	Central America	All Commodities	120,696	159,594	166,634	177,636	183,704	211,713	236,761	266,538	359,614	529,984	805,715
Miami	East Coast S America	All Commodities	89,467	45,825	25,542	27,697	28,194	33,216	36,552	38,849	42,917	46,381	50,031
Miami	Eastern Europe	All Commodities	705	582	902	940	975	1,308	1,679	2,198	4,068	8,056	15,497
Miami	India	All Commodities	1,072	1,325	3,676	3,607	3,603	3,690	3,938	4,497	7,811	18,390	43,053
Miami	Middle East	All Commodities	1,409	295	743	742	740	792	822	854	952	1,078	1,210
Miami	Mediterranean	All Commodities	2,327	1,949	5,516	3,746	5,960	8,741	10,927	13,713	20,375	28,302	37,323
Miami	North America	All Commodities	2	2	1	1	1	2	2	2	3	4	5
Miami	NE Asia	All Commodities	14,782	8,500	12,775	13,238	13,341	13,937	15,063	17,291	24,857	39,761	68,610
Miami	North Europe	All Commodities	17,257	11,363	30,333	31,356	30,691	30,423	31,554	33,302	38,147	44,699	52,513
Miami	Oceania	All Commodities	482	633	570	592	600	660	707	757	901	1,103	1,370
Miami	Europe, Other	All Commodities	144	60	18	18	17	20	21	23	26	29	33
Miami	SE Asia	All Commodities	3,484	1,884	2,284	2,394	2,491	3,081	4,019	5,615	13,464	36,191	87,520
Miami	West Coast S America	All Commodities	48,868	26,341	29,195	30,666	30,990	35,823	41,115	47,731	71,137	122,640	227,083
Wilmington	World	All Commodities	54,094	22,298	19,557	20,479	21,143	24,479	28,956	36,222	71,517	178,500	435,375
Wilmington	Percent Change	All Commodities	NA	-16.24%	-4.26%	4.71%	3.24%	2.97%	3.42%	4.58%	7.04%	9.58%	9.33%
Wilmington	Africa	All Commodities	108	78	75	78	81	105	131	166	338	914	2,357
Wilmington	Central America	All Commodities	1,369	709	874	932	993	1,398	1,993	3,066	9,855	33,242	89,926
Wilmington	East Coast S America	All Commodities	3,044	1,586	807	890	926	1,197	1,444	1,628	2,028	2,519	3,268
Wilmington	Eastern Europe	All Commodities	777	212	197	207	225	309	391	496	903	1,868	3,868
Wilmington	India	All Commodities	161	299	290	281	290	394	586	996	3,991	15,840	47,813
Wilmington	Middle East	All Commodities	285	214	264	270	282	354	421	484	622	779	949
Wilmington	Mediterranean	All Commodities	2,080	1,471	905	942	957	897	899	950	1,092	1,284	1,536
Wilmington	North America	All Commodities	3	2	1	1	1	1	2	2	2	3	3
Wilmington	NE Asia	All Commodities	26,735	8,945	8,495	8,878	9,116	10,446	11,941	14,104	21,224	35,337	63,266
Wilmington	North Europe	All Commodities	13,040	4,754	4,571	4,718	4,815	4,756	4,827	5,091	5,862	6,986	8,617
Wilmington	Oceania	All Commodities	753	385	465	484	489	554	608	662	897	997	1,242
Wilmington	Europe, Other	All Commodities	41	13	12	12	12	14	15	16	19	22	25
Wilmington	SE Asia	All Commodities	4,201	2,768	1,977	2,114	2,245	3,027	4,137	5,976	13,456	45,099	117,626
Wilmington	West Coast S America	All Commodities	1,497	863	624	671	710	1,027	1,561	2,586	9,317	33,612	94,879
Norfolk	World	All Commodities	368,035	353,597	380,268	388,786	391,428	419,754	447,089	488,878	640,788	993,433	1,720,759
Norfolk	Percent Change	All Commodities	NA	-0.80%	2.45%	2.23%	0.69%	1.41%	1.27%	1.80%	2.74%	4.48%	5.65%
Norfolk	Africa	All Commodities	3,033	5,770	7,748	7,751	7,805	8,949	9,915	10,949	14,000	19,726	30,344
Norfolk	Central America	All Commodities	3,917	4,721	10,200	10,813	11,333	14,068	15,999	18,309	27,717	52,473	105,522
Norfolk	East Coast S America	All Commodities	33,903	37,096	22,833	24,106	24,290	27,084	28,819	30,243	33,107	36,169	39,757
Norfolk	Eastern Europe	All Commodities	13,937	11,433	15,897	16,355	17,529	21,044	23,639	29,193	60,182	157,833	388,415
Norfolk	India	All Commodities	2,546	8,528	15,651	15,756	16,128	18,209	20,882	24,906	42,356	86,137	170,070
Norfolk	Middle East	All Commodities	4,403	6,790	4,305	4,337	4,382	4,803	5,155	5,535	6,317	7,144	8,010
Norfolk	Mediterranean	All Commodities	22,400	31,471	31,498	31,919	32,059	34,274	34,187	34,690	36,374	39,186	43,468
Norfolk	North America	All Commodities	17	97	113	113	116	133	148	158	169	173	170
Norfolk	NE Asia	All Commodities	73,620	78,387	110,577	113,324	114,054	118,994	125,373	136,310	168,796	231,189	353,020
Norfolk	North Europe	All Commodities	149,256	130,760	116,719	117,910	117,382	121,023	125,659	131,981	148,689	171,396	200,761
Norfolk	Oceania	All Commodities	15,985	11,851	10,981	11,721	11,496	12,717	14,483	16,717	23,726	36,032	56,735
Norfolk	Europe, Other	All Commodities	1,134	1,740	1,046	1,020	979	1,096	1,151	1,215	1,371	1,560	1,782
Norfolk	SE Asia	All Commodities	25,756	22,178	24,148	24,657	25,110	27,746	31,009	36,003	54,893	98,684	188,144
Norfolk	West Coast S America	All Commodities	4,139	2,787	8,548	8,752	8,764	9,612	10,688	12,671	23,091	55,741	134,562

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Other N Atlantic	World	All Commodities	740,845	663,327	952,192	977,979	983,430	1,042,163	1,111,109	1,224,451	1,634,357	2,586,973	4,574,573
Other N Atlantic	Percent Change	All Commodities	NA	-2.19%	12.81%	2.71%	0.56%	1.17%	1.29%	1.96%	2.93%	4.70%	5.87%
Other N Atlantic	Africa	All Commodities	16,023	11,123	18,302	18,151	18,326	20,912	22,769	24,530	29,598	37,949	50,468
Other N Atlantic	Central America	All Commodities	38,666	40,530	47,861	51,266	54,127	67,381	76,532	86,262	113,810	158,980	226,434
Other N Atlantic	East Coast S America	All Commodities	73,878	56,390	43,749	46,849	47,159	53,282	57,344	60,752	67,705	74,978	83,146
Other N Atlantic	Eastern Europe	All Commodities	14,277	10,529	26,492	27,768	29,438	37,585	46,090	60,791	143,862	424,427	1,121,252
Other N Atlantic	India	All Commodities	15,738	19,171	48,631	48,474	48,795	51,948	56,605	64,188	97,691	184,613	359,475
Other N Atlantic	Middle East	All Commodities	18,520	22,384	18,305	18,582	18,990	21,780	24,061	26,420	31,450	36,834	42,491
Other N Atlantic	Mediterranean	All Commodities	42,138	35,471	47,808	49,930	50,912	58,188	62,142	66,710	77,067	89,316	103,655
Other N Atlantic	North America	All Commodities	144	249	468	454	460	494	549	654	887	1,153	1,429
Other N Atlantic	NE Asia	All Commodities	189,203	157,650	316,929	322,757	319,725	314,735	325,800	360,349	473,325	700,716	1,161,151
Other N Atlantic	North Europe	All Commodities	220,190	218,505	246,450	251,900	254,086	264,026	270,066	277,047	293,790	315,558	341,553
Other N Atlantic	Oceania	All Commodities	14,156	12,116	26,307	29,137	28,382	31,658	36,229	41,724	55,973	76,819	106,912
Other N Atlantic	Europe, Other	All Commodities	3,270	1,538	1,340	1,383	1,434	1,890	2,224	2,563	3,299	4,120	5,030
Other N Atlantic	SE Asia	All Commodities	54,349	50,191	71,741	72,605	73,273	77,606	86,604	102,873	171,890	347,199	717,183
Other N Atlantic	West Coast S America	All Commodities	40,295	27,481	37,808	38,723	38,323	40,677	44,096	49,589	74,010	134,310	254,395

Technology; (8) Intermediate Manufacturing; (9) Capital Equipment; and (10) Motor Vehicles.[20] The total volumes of annual trade expressed in tonnes or TEUs for all commodities are shown for 1995, 2000, and 2003 and projected for 2004, 2005, 2010, 2015, 2020, 2030, 2040, and 2050.[21] The compound average annual growth rates are shown for total tonnages for the years contained in the summary data set.

Tables 19 and 20 show imports and exports for all trade routes and all commodities (metric tonnes) for Savannah Harbor; and tables 21 and 22 show imports and exports of containerized commodities for all trade routes and all commodities (metric tonnes) for Savannah Harbor. Tables 23 and 24 show imports and exports of TEUs for all trade routes and all commodities for Savannah Harbor.

METRIC TONNES

Tables 19 and 20 depict the major world trade areas for each of the ten commodity groups for Savannah Harbor total metric tonne imports and exports, respectively, and their historic growth from 1995 to 2003 and projected growth from 2003 to 2050. For example, the predominant trade regions for Savannah Harbor total import metric tonnes (Table 19) in 2003 (11.107 million tonnes) are East Coast of South America (2.957 million tonnes), North East Asia (2.747 million tonnes), North Europe (1.109 million tonnes), and South East Asia (0.639 million tonnes). The leading commodity groups (metric tonnes) for East Coast of South America imports in 2003 are Extractive (1.724 million tonnes) and Chemicals (0.738 million tonnes). The leading commodity groups (metric tonnes) for North East Asia imports in 2003 are Intermediate Manufacturing (0.729 million tonnes), Consumer Goods (0.692 million tonnes), and Capital Equipment (0.442 million tonnes). The leading commodity groups (metric tonnes) for North Europe imports in 2003 are Chemicals (0.547 million tonnes), Intermediate Manufacturing (0.174 million tonnes), and Motor Vehicles (0.153 million tonnes). The leading commodity groups (metric tonnes) for South East Asia imports are Food (0.185 million tonnes) and Consumer Goods (0.110 metric tonnes).

Savannah Harbor total import metric tonnes (all commodities) are expected to grow 7.11 percent between 2003 and 2004 and 6.44 percent between 2004 and 2005, grow at an average annual rate of 3.99 percent between 2005 and 2010, and grow thereafter at an average annual rate of between 2.24 percent and 2.69 percent between 2010 and 2050. By 2010, the largest trade will be North East Asia (4.584 million tonnes), followed by the East Coast of South America (3.634 million tonnes), North Europe (1.664 million tonnes), and South East Asia (0.823 million tonnes). Between 2003 and 2010, import total metric tonnes from North East Asia will grow nearly two-thirds (4.584/2.747 = 1.67), while total import metric tonnes from the East Coast of South America will grow nearly one-quarter (3.634/2.957 = 1.23), total import metric tonnes from North Europe will grow 50 percent (1.664/1.109 = 1.50), and total import metric tonnes from South East Asia will grow nearly 30 percent (0.823/0.639 = 1.29).

[20] A product concordance is contained in Appendix C.
[21] The full electronic version of the forecast provides annual statistics from 1995 to 2050.

Table 19. Metric Tonnes of Imports to Savannah Harbor by World Trade Route and Commodity Groups: 1995 - 2050 (selected years)

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	All Commodities	349,618,044	480,643,870	523,345,733	572,541,999	609,407,813	732,752,219	807,862,915	870,072,437	1,028,642,640	1,237,230,419	1,503,326,524
USA	Percent Change	All Commodities	NA	6.57%	2.88%	9.40%	6.44%	3.76%	1.97%	1.49%	1.69%	1.86%	1.97%
Savannah	World	All Commodities	5,584,624	8,605,861	11,107,024	11,896,397	12,662,126	15,399,479	17,335,371	19,362,813	24,908,258	32,474,072	41,380,610
Savannah	Percent Change	All Commodities	NA	9.03%	8.88%	7.11%	6.44%	3.99%	2.40%	2.24%	2.55%	2.69%	2.45%
Savannah	Africa	All Commodities	50,629	53,216	34,740	36,457	37,956	42,317	43,103	43,367	45,321	48,755	53,381
Savannah	Africa	Agriculture	771	7,612	6,848	6,618	6,625	6,701	6,678	6,635	6,601	6,605	6,694
Savannah	Africa	Extractive	13,193	19,674	9,542	11,000	12,043	14,716	14,013	12,722	10,696	9,154	7,942
Savannah	Africa	Food	8,321	1,834	658	718	790	1,037	1,160	1,278	1,523	1,777	2,038
Savannah	Africa	Materials	4,605	3,674	6,235	5,793	5,611	5,781	5,987	6,262	7,079	8,232	9,705
Savannah	Africa	Consumer Goods	325	387	2,669	2,760	2,872	3,386	3,755	4,085	4,773	5,492	6,183
Savannah	Africa	Chemicals	20	3,090	870	972	1,052	1,356	1,719	2,089	2,703	3,390	4,251
Savannah	Africa	High Technology	14	15	45	51	58	93	115	140	200	276	369
Savannah	Africa	Intermed. Manufact.	21,940	16,403	6,507	7,019	7,225	6,709	6,521	6,386	6,553	7,047	7,972
Savannah	Africa	Capital Equipment	349	484	193	219	246	358	438	521	733	1,010	1,365
Savannah	Africa	Motor Vehicles	1,093	44	1,174	1,308	1,433	2,180	2,718	3,248	4,459	5,772	6,863
Savannah	Central America	All Commodities	623,681	592,215	1,668,524	1,800,077	1,871,933	2,142,177	2,302,367	2,430,646	2,711,773	3,032,082	3,371,231
Savannah	Central America	Agriculture	23,191	141	341	354	360	330	330	309	274	236	200
Savannah	Central America	Extractive	499,311	461,664	1,324,268	1,436,844	1,492,618	1,688,912	1,811,608	1,910,752	2,133,987	2,389,211	2,645,679
Savannah	Central America	Food	9,248	83,393	175,469	177,567	184,257	224,700	248,932	275,608	332,580	395,470	467,558
Savannah	Central America	Materials	1,914	276	362	334	316	305	307	315	335	354	365
Savannah	Central America	Consumer Goods	4,089	946	3,608	3,702	3,871	4,532	5,108	5,701	7,056	8,431	9,711
Savannah	Central America	Chemicals	56,996	40,556	130,511	143,663	148,574	158,307	164,928	167,480	174,248	183,694	199,651
Savannah	Central America	High Technology	189	321	824	904	1,023	1,517	1,963	2,451	3,722	5,484	7,844
Savannah	Central America	Intermed. Manufact.	5,806	244	119	133	149	182	221	253	324	406	497
Savannah	Central America	Capital Equipment	42	75	38	42	47	59	67	74	91	110	130
Savannah	Central America	Motor Vehicles	22,894	4,598	32,984	36,533	40,718	63,334	68,903	67,705	59,156	48,687	39,596
Savannah	East Coast S America	All Commodities	1,543,543	2,451,715	2,957,043	3,243,541	3,448,048	3,634,015	3,666,660	3,660,397	3,787,047	4,059,661	4,433,359
Savannah	East Coast S America	Agriculture	65,810	106,959	67,263	66,178	67,104	67,607	68,059	66,929	65,694	61,227	52,390
Savannah	East Coast S America	Extractive	924,036	1,585,824	1,724,150	1,896,806	2,023,864	1,945,268	1,756,306	1,539,557	1,213,299	977,590	796,689
Savannah	East Coast S America	Food	76,299	58,391	144,214	155,237	166,601	220,065	263,072	310,317	416,698	533,175	657,865
Savannah	East Coast S America	Materials	181,537	84,980	130,604	130,672	134,291	155,200	153,924	149,232	138,437	124,251	105,363
Savannah	East Coast S America	Consumer Goods	8,514	7,612	5,700	5,904	5,966	6,551	6,591	6,618	6,545	6,284	5,965
Savannah	East Coast S America	Chemicals	163,476	378,177	738,319	831,082	878,686	1,031,369	1,177,343	1,318,344	1,619,367	1,969,925	2,366,513
Savannah	East Coast S America	High Technology	227	541	761	877	1,011	1,716	2,416	3,237	5,486	8,830	13,576
Savannah	East Coast S America	Intermed. Manufact.	117,267	215,237	138,468	148,895	162,407	196,846	229,037	255,968	310,667	366,763	422,423
Savannah	East Coast S America	Capital Equipment	4,054	12,099	5,079	5,818	5,507	6,510	7,110	7,533	8,608	9,931	11,522
Savannah	East Coast S America	Motor Vehicles	2,322	1,895	2,484	2,573	2,611	2,883	2,801	2,661	2,247	1,686	1,055

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Savannah	Eastern Europe	All Commodities	431,784	360,401	249,838	269,329	297,586	479,272	754,779	1,145,930	2,385,923	4,270,839	6,504,645
Savannah	Eastern Europe	Agriculture	743	4,476	15,877	15,932	16,047	15,828	14,928	12,568	9,990	7,171	4,653
Savannah	Eastern Europe	Extractive	4,691	201,255	265	285	290	266	210	153	78	39	19
Savannah	Eastern Europe	Food	1,753	1,522	1,022	1,006	1,047	1,197	1,248	1,296	1,371	1,409	1,399
Savannah	Eastern Europe	Materials	11,240	10,525	9,007	8,381	8,272	10,250	11,283	11,923	13,064	14,127	15,086
Savannah	Eastern Europe	Consumer Goods	698	1,301	1,049	1,105	1,164	1,299	1,309	1,315	1,303	1,262	1,189
Savannah	Eastern Europe	Chemicals	305,237	91,153	193,563	212,014	237,952	402,132	663,723	1,044,022	2,257,841	4,114,662	6,317,498
Savannah	Eastern Europe	High Technology	135	736	267	295	330	506	677	873	1,395	2,134	3,142
Savannah	Eastern Europe	Intermed. Manufact.	100,140	42,863	19,862	21,013	22,822	33,821	42,942	49,855	63,544	75,933	86,452
Savannah	Eastern Europe	Capital Equipment	6,203	5,080	1,734	1,974	2,167	2,951	3,563	4,261	6,036	8,372	11,360
Savannah	Eastern Europe	Motor Vehicles	945	1,489	7,191	7,323	7,494	11,023	14,897	19,664	31,301	45,729	63,848
Savannah	India	All Commodities	38,573	140,771	153,994	163,743	174,548	230,900	274,203	315,670	417,559	543,630	674,498
Savannah	India	Agriculture	2,973	4,525	2,149	2,199	2,214	2,225	2,250	1,300	1,328	1,361	1,332
Savannah	India	Extractive	3,245	2,808	1,300	1,414	1,507	2,249	2,982	3,752	5,667	7,873	9,913
Savannah	India	Food	462	3,034	1,682	1,714	1,731	2,029	2,202	2,370	2,716	3,037	3,280
Savannah	India	Materials	9,236	53,767	56,314	57,843	61,702	78,261	88,212	98,058	120,862	146,413	160,433
Savannah	India	Consumer Goods	1,558	26,444	21,848	23,007	23,830	30,925	37,177	42,090	51,487	60,914	70,063
Savannah	India	Chemicals	2,207	8,995	7,999	8,724	9,181	10,980	12,286	13,230	15,138	17,085	19,080
Savannah	India	High Technology	241	502	690	778	890	1,456	1,863	2,346	3,630	5,480	8,081
Savannah	India	Intermed. Manufact.	17,503	35,252	54,304	60,197	65,883	93,232	116,226	140,101	200,999	281,999	378,923
Savannah	India	Capital Equipment	426	5,061	7,243	7,440	7,193	9,057	10,477	11,874	15,135	18,819	22,690
Savannah	India	Motor Vehicles	722	383	466	428	416	486	528	549	599	649	703
Savannah	Middle East	All Commodities	9,601	25,607	31,473	34,529	36,807	48,255	57,835	70,297	103,936	152,293	217,628
Savannah	Middle East	Agriculture	613	528	142	152	152	142	139	121	105	93	86
Savannah	Middle East	Extractive	0	0	0	0	0	0	0	0	0	0	0
Savannah	Middle East	Food	52	105	137	147	159	202	228	261	335	418	506
Savannah	Middle East	Materials	1,025	9,809	8,677	9,371	9,209	9,246	8,522	8,150	7,673	7,452	7,405
Savannah	Middle East	Consumer Goods	2,990	4,583	4,195	4,544	4,844	6,370	6,753	7,382	8,508	9,409	9,921
Savannah	Middle East	Chemicals	1,404	1,650	7,626	8,620	9,605	15,338	22,838	32,696	60,282	100,912	156,463
Savannah	Middle East	High Technology	128	268	257	286	319	486	591	704	973	1,319	1,753
Savannah	Middle East	Intermed. Manufact.	2,881	7,538	7,943	8,658	9,438	11,779	13,069	14,220	16,559	19,220	22,406
Savannah	Middle East	Capital Equipment	366	1,099	564	613	686	1,107	1,541	2,065	3,608	6,085	9,842
Savannah	Middle East	Motor Vehicles	142	26	1,930	2,138	2,395	3,585	4,153	4,698	5,893	7,385	9,247
Savannah	Mediterranean	All Commodities	234,311	382,364	392,276	410,045	450,682	532,561	572,071	619,018	744,713	917,857	1,148,693
Savannah	Mediterranean	Agriculture	148	2,369	514	522	556	678	749	731	812	866	887
Savannah	Mediterranean	Extractive	92,384	194,905	135,367	123,912	135,395	123,330	100,775	86,900	68,325	58,603	55,818
Savannah	Mediterranean	Food	7,220	15,742	13,593	14,084	14,754	18,686	21,014	23,200	27,874	33,141	39,220
Savannah	Mediterranean	Materials	6,498	18,566	31,179	31,540	33,284	35,804	36,725	38,342	43,218	49,567	56,731
Savannah	Mediterranean	Consumer Goods	1,003	3,547	6,802	7,545	8,377	9,155	10,894	12,629	17,010	22,783	30,380
Savannah	Mediterranean	Chemicals	24,111	65,763	75,215	84,746	89,859	110,219	129,635	148,031	192,553	252,876	338,394
Savannah	Mediterranean	High Technology	149	437	541	614	697	1,127	1,420	1,733	2,504	3,517	4,823
Savannah	Mediterranean	Intermed. Manufact.	100,861	73,085	116,391	133,534	153,248	215,233	249,458	283,152	362,335	461,097	582,498
Savannah	Mediterranean	Capital Equipment	1,117	3,606	9,016	9,343	9,679	12,106	13,163	13,911	14,481	13,454	10,805
Savannah	Mediterranean	Motor Vehicles	821	4,344	3,659	4,205	4,833	6,223	8,237	10,389	15,601	21,953	29,137

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Savannah	North America	All Commodities	771,668	712,083	745,632	770,536	760,732	730,113	691,503	659,821	649,153	712,774	863,130
Savannah	North America	Agriculture	19,166	0	33,529	39,612	45,434	58,375	63,625	64,539	62,792	58,080	52,012
Savannah	North America	Extractive	596,677	695,631	606,117	610,895	588,348	514,048	432,466	356,863	241,922	162,120	107,225
Savannah	North America	Food	0	0	2	2	3	3	2	2	2	2	1
Savannah	North America	Materials	2,665	0	2	3	3	3	4	4	4	4	4
Savannah	North America	Consumer Goods	0	1	11	12	11	15	18	20	26	32	39
Savannah	North America	Chemicals	153,148	16,212	105,922	119,956	126,871	157,565	195,239	238,194	344,068	491,995	703,020
Savannah	North America	High Technology	9	80	40	46	50	87	124	170	299	492	769
Savannah	North America	Intermed. Manufact.	1	0	0	0	0	0	0	0	0	0	0
Savannah	North America	Capital Equipment	1	19	8	10	11	17	23	29	39	50	59
Savannah	North America	Motor Vehicles	0	141	1	1	1	1	1	1	1	1	1
Savannah	NE Asia	All Commodities	999,213	1,858,395	2,747,031	2,925,210	3,202,187	4,584,018	5,632,347	6,745,261	9,569,560	13,169,934	17,160,532
Savannah	NE Asia	Agriculture	1,969	1,515	6,326	6,180	6,462	7,252	7,815	5,788	6,383	6,732	6,532
Savannah	NE Asia	Extractive	970	3,641	6,728	7,064	7,622	10,498	13,778	17,588	26,399	34,426	38,462
Savannah	NE Asia	Food	26,876	17,596	30,510	29,194	30,239	33,249	34,464	35,801	37,792	37,407	32,306
Savannah	NE Asia	Materials	35,810	71,205	177,481	182,224	193,442	245,065	274,394	294,258	336,663	361,149	332,159
Savannah	NE Asia	Consumer Goods	117,492	310,169	692,261	710,545	779,104	1,133,911	1,306,963	1,507,775	1,994,757	2,509,070	2,824,751
Savannah	NE Asia	Chemicals	128,004	247,898	264,868	278,248	292,991	351,867	391,679	419,402	466,268	467,404	391,210
Savannah	NE Asia	High Technology	109,740	197,588	220,430	234,659	260,736	433,280	596,263	773,512	1,216,007	1,789,040	2,492,189
Savannah	NE Asia	Intermed. Manufact.	371,346	581,540	729,468	775,916	840,952	1,101,183	1,332,623	1,555,393	2,073,651	2,679,271	3,318,488
Savannah	NE Asia	Capital Equipment	139,501	284,497	442,369	498,358	558,316	865,192	1,133,747	1,444,122	2,327,358	3,669,653	5,445,573
Savannah	NE Asia	Motor Vehicles	67,506	142,746	176,592	202,821	232,324	402,521	540,620	691,622	1,084,284	1,615,781	2,278,861
Savannah	North Europe	All Commodities	496,009	1,083,685	1,109,766	1,199,026	1,287,276	1,664,448	1,914,898	2,139,107	2,737,493	3,574,644	4,658,374
Savannah	North Europe	Agriculture	39,423	75,735	45,252	45,872	45,131	43,686	36,803	27,649	14,244	6,509	2,736
Savannah	North Europe	Extractive	1,633	1,822	178	175	170	169	135	106	71	51	38
Savannah	North Europe	Food	53,913	86,740	57,662	61,202	66,952	66,244	63,555	61,985	59,525	56,636	52,839
Savannah	North Europe	Materials	28,570	39,798	33,906	33,836	34,640	34,250	31,663	28,192	20,018	11,890	6,031
Savannah	North Europe	Consumer Goods	15,900	16,389	16,899	17,992	19,154	22,209	24,938	26,904	31,814	38,933	48,082
Savannah	North Europe	Chemicals	118,846	298,379	547,962	590,130	616,233	726,884	795,503	841,478	963,775	1,129,524	1,323,800
Savannah	North Europe	High Technology	6,227	5,425	7,534	7,863	8,719	13,389	16,827	20,548	29,896	42,441	58,980
Savannah	North Europe	Intermed. Manufact.	161,813	343,673	174,471	194,916	220,651	324,607	400,475	466,136	651,953	935,373	1,346,276
Savannah	North Europe	Capital Equipment	42,594	90,338	72,155	80,194	91,093	124,949	149,387	176,262	239,932	318,478	410,984
Savannah	North Europe	Motor Vehicles	27,091	125,388	153,748	166,846	184,530	308,063	395,612	489,848	726,264	1,034,808	1,408,608
Savannah	Oceania	All Commodities	85,347	64,271	178,980	176,305	188,878	246,126	280,178	309,775	385,286	501,259	680,403
Savannah	Oceania	Agriculture	74	5,539	17,319	16,591	17,108	16,953	16,991	16,162	16,694	16,728	15,686
Savannah	Oceania	Extractive	22,047	8,851	39,006	42,656	47,063	55,901	51,650	45,214	33,418	23,044	15,006
Savannah	Oceania	Food	62,207	33,726	64,737	60,070	65,406	100,994	131,849	164,040	242,589	361,046	541,173
Savannah	Oceania	Materials	12	3,597	17,901	16,838	16,410	17,538	18,357	19,339	20,694	21,439	21,920
Savannah	Oceania	Consumer Goods	40	177	457	501	544	794	983	1,179	1,659	2,278	3,039
Savannah	Oceania	Chemicals	48	7,521	20,936	20,325	21,063	26,487	30,274	32,833	38,263	44,522	51,993
Savannah	Oceania	High Technology	117	213	377	392	445	724	904	1,094	1,572	2,213	3,054
Savannah	Oceania	Intermed. Manufact.	398	2,510	7,487	8,022	8,994	10,179	10,299	9,102	6,485	4,742	3,913
Savannah	Oceania	Capital Equipment	49	2,099	8,024	8,258	9,291	12,303	13,789	15,033	16,942	17,497	16,342
Savannah	Oceania	Motor Vehicles	355	38	2,736	2,651	2,552	4,252	5,082	5,780	6,970	7,749	8,277

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Savannah	Europe, Other	All Commodities	9,711	57,208	40,318	38,956	39,496	42,372	43,784	44,570	44,660	42,385	40,191
Savannah	Europe, Other	Agriculture	0	42,991	24,206	23,161	23,840	24,986	25,650	25,487	22,223	15,474	8,676
Savannah	Europe, Other	Extractive	1,042	1,636	1,341	1,501	1,589	1,722	1,614	1,478	1,253	1,064	907
Savannah	Europe, Other	Food	78	250	152	172	193	166	155	148	133	116	98
Savannah	Europe, Other	Materials	4,130	5,677	8,773	7,907	7,138	6,808	5,971	5,636	6,157	7,412	8,798
Savannah	Europe, Other	Consumer Goods	601	668	239	239	265	295	348	339	307	327	399
Savannah	Europe, Other	Chemicals	633	335	318	329	344	460	544	623	818	1,106	1,484
Savannah	Europe, Other	High Technology	30	209	61	62	70	105	132	160	225	305	399
Savannah	Europe, Other	Intermed. Manufact.	2,596	3,884	3,111	3,321	3,584	4,379	5,163	5,802	7,207	8,716	9,983
Savannah	Europe, Other	Capital Equipment	559	1,456	1,636	1,712	1,844	2,469	2,945	3,393	4,423	5,672	7,163
Savannah	Europe, Other	Motor Vehicles	42	102	481	553	628	982	1,264	1,505	1,914	2,195	2,285
Savannah	SE Asia	All Commodities	248,912	722,583	639,328	666,594	698,683	823,911	875,821	925,296	1,012,402	1,071,159	1,129,297
Savannah	SE Asia	Agriculture	9,141	21,012	43,922	46,089	48,109	46,029	44,278	40,883	38,057	33,157	26,371
Savannah	SE Asia	Extractive	170	442	374	389	378	371	320	258	162	99	60
Savannah	SE Asia	Food	51,812	142,481	185,726	190,354	192,718	191,741	189,280	189,769	190,362	189,078	184,340
Savannah	SE Asia	Materials	75,942	129,521	93,067	96,852	100,834	110,677	116,094	120,003	125,052	126,866	123,040
Savannah	SE Asia	Consumer Goods	14,826	63,866	110,844	114,692	121,899	160,434	176,146	196,281	234,721	261,342	281,787
Savannah	SE Asia	Chemicals	37,875	16,637	37,029	39,700	41,842	49,760	58,458	66,991	87,316	114,573	152,586
Savannah	SE Asia	High Technology	42,470	64,635	60,169	61,527	62,955	79,532	89,821	102,184	131,701	167,107	207,145
Savannah	SE Asia	Intermed. Manufact.	14,870	272,265	94,790	102,719	114,694	165,685	177,278	180,070	164,156	121,652	74,449
Savannah	SE Asia	Capital Equipment	1,669	11,461	12,482	13,320	14,195	18,264	22,487	27,020	38,779	55,139	77,488
Savannah	SE Asia	Motor Vehicles	137	262	925	953	1,059	1,416	1,660	1,838	2,094	2,145	2,030
Savannah	West Coast S America	All Commodities	41,642	101,347	158,081	162,047	167,315	198,991	225,820	253,658	313,431	376,803	445,248
Savannah	West Coast S America	Agriculture	12,884	637	5,039	5,141	5,378	6,193	6,390	6,495	6,764	6,997	7,117
Savannah	West Coast S America	Extractive	2,241	28,418	40,914	41,242	42,277	41,261	40,835	40,305	38,888	36,954	34,268
Savannah	West Coast S America	Food	21,739	1,544	98,112	101,175	104,342	132,517	157,842	184,912	244,271	309,305	381,813
Savannah	West Coast S America	Materials	828	5,863	4,910	4,480	4,341	5,243	5,781	6,122	6,684	7,159	7,573
Savannah	West Coast S America	Consumer Goods	598	1,585	1,287	1,332	1,382	1,527	1,583	1,618	1,697	1,778	1,855
Savannah	West Coast S America	Chemicals	3,035	34,482	1,830	2,020	2,144	2,594	2,941	3,181	3,395	3,000	2,084
Savannah	West Coast S America	High Technology	7	26	49	56	64	102	129	160	239	347	490
Savannah	West Coast S America	Intermed. Manufact.	284	28,652	5,603	6,234	6,995	9,043	9,731	10,208	10,689	10,296	8,909
Savannah	West Coast S America	Capital Equipment	26	122	331	362	388	504	583	651	800	964	1,136
Savannah	West Coast S America	Motor Vehicles	0	18	5	6	6	7	6	5	4	4	3

Table 20. Metric Tonnes of Exports from Savannah Harbor by World Trade Route and Commodity Groups: 1995 - 2050 (selected years)

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	All Commodities	251,370,211	212,856,887	206,987,701	214,095,492	217,671,381	232,098,313	243,272,392	258,521,722	303,739,049	379,462,039	531,306,089
USA	Percent Change	All Commodities	NA	-3.27%	-0.93%	3.43%	1.67%	1.29%	0.94%	1.22%	1.62%	2.25%	3.42%
Savannah	World	All Commodities	5,838,559	5,527,534	7,244,210	7,576,866	7,633,734	7,670,422	7,817,503	8,344,201	10,062,735	13,254,459	19,254,265
Savannah	Percent Change	All Commodities	NA	-1.09%	9.43%	4.59%	0.75%	0.10%	0.38%	1.31%	1.89%	2.79%	3.80%
Savannah	Africa	All Commodities	55,844	37,964	32,476	32,679	32,555	35,260	38,759	45,843	92,027	255,753	660,035
Savannah	Africa	Agriculture	13,129	4,707	256	252	247	245	242	240	236	231	228
Savannah	Africa	Extractive	5,790	2,136	130	132	129	122	113	106	95	86	78
Savannah	Africa	Food	360	3,602	1,855	1,809	1,772	1,621	1,372	1,186	921	739	605
Savannah	Africa	Materials	25,050	9,132	15,321	15,260	14,708	15,325	17,305	22,095	55,805	183,367	515,774
Savannah	Africa	Consumer Goods	490	605	880	853	875	960	1,028	1,103	1,354	1,782	2,328
Savannah	Africa	Chemicals	5,996	10,968	6,972	7,006	7,088	7,812	8,685	10,092	19,594	49,444	108,302
Savannah	Africa	High Technology	262	273	252	260	267	343	438	592	1,575	5,338	15,509
Savannah	Africa	Intermed. Manufact.	1,445	560	1,772	1,714	1,661	1,860	2,022	2,151	2,411	2,671	2,937
Savannah	Africa	Capital Equipment	2,722	2,318	1,787	1,768	1,831	2,180	2,521	2,896	4,107	5,936	8,152
Savannah	Africa	Motor Vehicles	2,600	3,663	3,251	3,624	3,977	4,792	5,033	5,381	5,928	6,160	6,121
Savannah	Central America	All Commodities	116,887	127,332	282,906	299,062	306,626	338,453	362,220	387,594	465,031	632,906	976,824
Savannah	Central America	Agriculture	4,925	16,152	11,795	12,204	12,682	14,479	15,532	16,170	16,973	17,399	17,555
Savannah	Central America	Extractive	769	2,751	3,369	3,467	3,596	4,099	4,312	4,572	5,266	6,019	6,806
Savannah	Central America	Food	43,239	39,998	68,131	70,881	73,235	81,522	80,876	79,170	75,657	71,895	67,571
Savannah	Central America	Materials	51,045	32,031	140,178	151,977	156,078	173,846	192,709	213,621	257,342	305,066	357,238
Savannah	Central America	Consumer Goods	3,810	814	3,211	3,279	3,334	3,518	3,680	3,822	4,164	4,606	5,093
Savannah	Central America	Chemicals	7,443	26,954	49,478	50,260	50,452	52,105	53,630	53,577	53,772	53,438	52,039
Savannah	Central America	High Technology	1,745	2,030	2,308	2,497	2,705	4,202	6,787	11,975	46,703	168,415	463,784
Savannah	Central America	Intermed. Manufact.	2,356	5,119	3,063	3,077	3,077	3,015	2,946	2,881	3,201	3,941	4,416
Savannah	Central America	Capital Equipment	966	1,120	962	984	1,004	1,092	1,136	1,160	1,227	1,316	1,420
Savannah	Central America	Motor Vehicles	588	363	410	437	463	575	612	645	725	812	901
Savannah	East Coast S America	All Commodities	427,259	397,006	247,045	254,718	255,543	269,526	279,370	300,348	351,901	415,213	493,628
Savannah	East Coast S America	Agriculture	3,855	4,530	23,895	24,465	24,767	26,088	27,213	27,193	26,630	25,587	24,224
Savannah	East Coast S America	Extractive	80,523	41,560	43,555	44,317	46,048	52,467	57,963	64,583	80,657	101,092	126,830
Savannah	East Coast S America	Food	42,794	16,510	10,356	10,338	10,169	10,663	8,698	7,168	4,904	3,327	2,231
Savannah	East Coast S America	Materials	186,208	186,124	118,239	120,871	119,263	119,320	119,921	132,034	161,655	196,550	237,177
Savannah	East Coast S America	Consumer Goods	6,833	3,605	1,570	1,673	1,737	2,066	2,289	2,450	2,785	3,151	3,560
Savannah	East Coast S America	Chemicals	72,272	102,152	38,669	41,447	41,620	44,586	46,905	48,992	53,744	58,692	63,842
Savannah	East Coast S America	High Technology	5,676	7,690	3,785	4,145	4,349	5,690	6,990	8,071	10,833	15,397	23,633
Savannah	East Coast S America	Intermed. Manufact.	12,790	16,147	2,847	3,035	3,081	3,428	3,732	3,969	4,462	4,992	5,590
Savannah	East Coast S America	Capital Equipment	14,874	16,822	3,065	3,281	3,365	3,917	4,258	4,424	4,687	4,876	5,038
Savannah	East Coast S America	Motor Vehicles	1,435	1,867	1,062	1,144	1,143	1,300	1,402	1,463	1,543	1,549	1,504

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Savannah	Eastern Europe	All Commodities	30,357	41,744	109,859	115,682	122,770	151,058	169,607	197,840	311,334	575,502	1,095,196
Savannah	Eastern Europe	Agriculture	422	1,276	1,172	1,227	1,273	1,517	1,667	1,763	1,906	2,036	2,170
Savannah	Eastern Europe	Extractive	160	195	3,525	3,777	4,055	5,141	5,770	6,101	6,774	7,480	7,959
Savannah	Eastern Europe	Food	14,672	22,013	55,557	60,295	66,456	87,268	99,042	114,966	160,260	217,416	282,690
Savannah	Eastern Europe	Materials	7,803	12,435	38,577	38,683	38,840	40,862	42,095	45,895	65,818	108,932	161,889
Savannah	Eastern Europe	Consumer Goods	258	113	157	165	179	243	329	464	1,069	2,423	4,683
Savannah	Eastern Europe	Chemicals	1,740	1,980	5,074	5,421	5,499	7,411	10,183	15,630	51,650	184,010	317,365
Savannah	Eastern Europe	High Technology	364	509	810	861	929	1,373	1,973	2,974	8,902	29,783	83,527
Savannah	Eastern Europe	Interned. Manufact.	2,591	1,141	1,722	1,801	1,799	2,000	2,104	2,243	3,030	4,835	7,149
Savannah	Eastern Europe	Capital Equipment	1,766	1,011	2,063	2,162	2,322	3,141	3,779	4,457	6,945	11,609	18,377
Savannah	Eastern Europe	Motor Vehicles	581	1,071	1,202	1,289	1,418	2,102	2,665	3,347	4,982	6,977	9,388
Savannah	India	All Commodities	68,195	70,117	120,498	121,195	121,781	131,057	143,567	162,280	234,738	424,086	847,328
Savannah	India	Agriculture	9,810	3,108	34,689	35,903	36,594	44,217	50,454	55,938	67,559	81,089	97,485
Savannah	India	Extractive	5,572	8,379	7,205	7,901	8,668	13,162	18,577	24,834	39,534	56,314	75,496
Savannah	India	Food	4,007	841	949	1,045	1,090	1,383	1,573	1,842	2,439	3,049	3,624
Savannah	India	Materials	33,056	43,181	62,625	61,059	59,691	53,700	49,673	48,147	46,040	44,570	41,574
Savannah	India	Consumer Goods	92	696	549	542	552	680	839	1,057	1,751	2,931	4,585
Savannah	India	Chemicals	9,662	5,610	8,529	8,525	8,645	9,063	9,840	11,287	18,354	33,883	54,356
Savannah	India	High Technology	322	399	777	854	962	1,880	3,818	8,212	41,434	171,717	514,938
Savannah	India	Interned. Manufact	953	3,068	2,093	2,221	2,340	3,079	4,092	5,242	8,730	15,704	29,594
Savannah	India	Capital Equipment	4,710	4,786	2,340	2,385	2,530	3,033	3,636	4,360	6,738	11,659	21,143
Savannah	India	Motor Vehicles	11	48	744	759	770	861	1,063	1,362	2,160	3,170	4,532
Savannah	Middle East	All Commodities	160,731	115,066	100,381	101,015	100,773	104,852	109,153	118,297	142,851	176,318	219,763
Savannah	Middle East	Agriculture	1,179	3,382	674	736	784	1,017	1,131	1,225	1,408	1,588	1,772
Savannah	Middle East	Extractive	9,504	3,548	1,193	1,193	1,202	1,405	1,532	1,687	2,050	2,507	3,044
Savannah	Middle East	Food	8,428	11,483	13,791	14,682	15,737	22,039	28,930	36,838	57,197	84,842	120,545
Savannah	Middle East	Materials	116,425	68,403	66,978	66,960	65,439	62,542	59,448	60,051	62,514	66,167	71,175
Savannah	Middle East	Consumer Goods	1,755	1,688	1,221	1,244	1,299	1,585	1,869	2,144	2,824	3,754	4,985
Savannah	Middle East	Chemicals	12,673	15,981	10,769	10,317	10,256	9,116	8,158	7,532	6,596	5,753	4,998
Savannah	Middle East	High Technology	239	475	460	470	492	641	773	907	1,211	1,573	2,000
Savannah	Middle East	Interned. Manufact	5,734	4,800	2,820	2,890	2,941	3,301	3,692	4,007	4,638	5,284	5,957
Savannah	Middle East	Capital Equipment	4,016	4,794	2,233	2,272	2,361	2,930	3,362	3,660	4,193	4,657	5,124
Savannah	Middle East	Motor Vehicles	778	513	242	250	263	275	256	244	220	192	165
Savannah	Mediterranean	All Commodities	259,127	223,764	254,933	267,683	276,478	263,279	271,566	300,196	379,743	496,049	657,091
Savannah	Mediterranean	Agriculture	2,762	11,605	20,853	21,950	22,038	25,020	27,026	29,138	34,000	39,687	45,801
Savannah	Mediterranean	Extractive	12,924	18,347	37,106	37,469	38,486	34,578	32,476	31,458	30,404	30,246	31,200
Savannah	Mediterranean	Food	36,793	18,353	35,992	40,435	42,969	48,799	55,657	66,748	94,970	133,853	184,869
Savannah	Mediterranean	Materials	191,958	154,717	134,936	140,811	145,014	118,276	110,580	116,469	135,631	165,002	205,528
Savannah	Mediterranean	Consumer Goods	905	1,936	1,877	1,987	2,092	2,665	3,221	3,857	5,501	7,809	10,637
Savannah	Mediterranean	Chemicals	6,075	9,778	11,300	11,665	11,986	15,872	20,698	26,870	44,788	73,826	119,370
Savannah	Mediterranean	High Technology	475	602	603	613	633	801	939	1,095	1,488	2,000	2,647
Savannah	Mediterranean	Interned. Manufact.	2,302	2,743	3,973	4,191	4,457	5,976	7,481	8,635	10,802	13,035	15,535
Savannah	Mediterranean	Capital Equipment	4,611	3,573	5,315	5,506	5,689	6,557	7,245	7,875	9,271	10,893	12,809
Savannah	Mediterranean	Motor Vehicles	321	2,090	2,976	3,056	3,114	4,736	6,242	8,051	12,888	19,701	28,675

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Savannah	North America	All Commodities	54,596	83,963	26,842	26,270	27,024	29,983	32,280	34,365	39,352	45,419	51,748
Savannah	North America	Agriculture	0	5	0	0	0	0	0	0	0	0	0
Savannah	North America	Extractive	54,554	81,452	26,636	26,064	26,825	29,681	31,831	33,719	38,110	43,228	48,144
Savannah	North America	Food	0	0	0	0	0	0	0	0	0	0	1
Savannah	North America	Materials	0	0	18	18	17	12	10	9	9	8	8
Savannah	North America	Consumer Goods	0	0	0	0	0	0	0	0	0	0	0
Savannah	North America	Chemicals	0	2,480	168	168	161	261	403	593	1,154	2,055	3,416
Savannah	North America	High Technology	41	24	15	15	15	21	23	27	34	43	54
Savannah	North America	Intermed. Manufact.	0	2	5	5	5	9	13	18	45	84	124
Savannah	North America	Capital Equipment	0	0	0	0	0	0	0	0	0	0	0
Savannah	North America	Motor Vehicles	0	0	0	0	0	0	0	0	0	0	0
Savannah	NE Asia	All Commodities	2,222,822	2,340,863	3,532,113	3,734,699	3,758,319	3,843,614	3,874,712	4,090,831	4,768,222	5,876,663	7,818,874
Savannah	NE Asia	Agriculture	123,402	75,458	293,294	311,854	315,807	332,577	339,315	336,346	335,552	341,316	355,038
Savannah	NE Asia	Extractive	1,097,062	1,250,116	1,666,032	1,807,105	1,835,906	1,944,823	1,978,294	2,083,978	2,373,117	2,726,128	3,213,308
Savannah	NE Asia	Food	70,271	158,456	267,138	269,796	269,929	280,773	253,230	236,958	209,447	184,256	125,653
Savannah	NE Asia	Materials	654,542	596,262	784,865	801,411	773,251	642,652	561,742	564,115	594,471	656,349	735,055
Savannah	NE Asia	Consumer Goods	6,384	4,333	14,759	15,983	17,009	20,921	26,124	33,604	57,749	103,681	192,034
Savannah	NE Asia	Chemicals	200,302	182,277	390,215	406,179	416,832	463,258	522,834	604,720	854,575	1,326,357	2,302,626
Savannah	NE Asia	High Technology	11,089	9,780	10,683	11,640	12,544	17,256	22,702	30,266	56,216	109,264	217,138
Savannah	NE Asia	Intermed. Manufact.	22,809	29,955	53,168	55,353	57,468	68,817	82,564	95,000	132,488	199,820	324,202
Savannah	NE Asia	Capital Equipment	30,920	19,480	25,792	27,441	29,393	38,339	49,313	62,398	99,805	161,897	272,412
Savannah	NE Asia	Motor Vehicles	6,041	14,748	26,166	27,938	30,179	34,199	38,594	43,445	54,801	67,596	81,408
Savannah	North Europe	All Commodities	1,866,619	1,433,913	1,668,097	1,708,483	1,707,908	1,470,661	1,378,859	1,374,088	1,395,627	1,477,292	1,619,477
Savannah	North Europe	Agriculture	20,276	51,955	19,045	20,543	21,494	22,167	22,975	23,387	23,945	24,496	25,401
Savannah	North Europe	Extractive	1,004,341	738,226	810,951	816,020	813,432	703,059	640,744	603,397	535,933	487,367	453,682
Savannah	North Europe	Food	23,656	23,021	28,587	30,078	30,164	29,563	30,771	32,429	35,472	39,352	44,405
Savannah	North Europe	Materials	702,378	488,222	605,724	639,640	641,116	477,197	412,916	414,309	436,950	492,789	585,497
Savannah	North Europe	Consumer Goods	2,842	4,518	4,323	4,401	4,469	4,785	4,998	5,256	5,839	6,485	7,173
Savannah	North Europe	Chemicals	76,776	65,537	143,137	140,016	137,348	160,046	181,001	199,491	240,103	286,125	337,954
Savannah	North Europe	High Technology	5,587	7,153	7,281	7,259	7,400	8,481	9,148	9,999	12,211	15,262	19,714
Savannah	North Europe	Intermed. Manufact.	10,646	15,368	9,939	10,178	10,866	13,387	15,995	18,138	22,199	26,228	30,233
Savannah	North Europe	Capital Equipment	15,598	18,710	20,182	21,088	21,971	24,839	26,725	28,281	31,787	35,859	40,324
Savannah	North Europe	Motor Vehicles	4,520	21,202	18,928	19,259	19,649	27,137	33,585	39,403	51,189	63,329	75,094
Savannah	Oceania	All Commodities	236,223	267,747	312,376	334,429	325,710	353,463	398,666	452,837	587,149	765,115	991,050
Savannah	Oceania	Agriculture	5,098	1,069	1,226	1,292	1,112	699	525	416	267	198	169
Savannah	Oceania	Extractive	36,231	27,156	56,140	54,524	54,022	54,247	53,676	53,137	53,453	55,353	57,733
Savannah	Oceania	Food	10,012	15,561	21,422	22,612	21,148	19,845	20,248	20,805	21,562	22,153	22,364
Savannah	Oceania	Materials	46,185	80,209	66,800	73,309	70,021	66,853	71,366	81,989	105,635	131,418	154,976
Savannah	Oceania	Consumer Goods	2,247	3,241	13,094	13,469	14,208	18,384	21,747	25,422	34,324	45,353	58,019
Savannah	Oceania	Chemicals	48,759	47,452	47,901	51,254	47,965	43,198	42,810	42,918	44,922	48,690	54,482
Savannah	Oceania	High Technology	1,151	1,841	1,660	1,713	1,796	2,231	2,596	3,000	3,975	5,207	6,755
Savannah	Oceania	Intermed. Manufact.	15,245	15,490	20,589	22,677	22,238	24,914	29,413	34,193	46,182	61,659	81,426
Savannah	Oceania	Capital Equipment	48,860	52,588	49,990	56,397	53,828	63,089	74,343	84,861	109,765	141,186	180,476
Savannah	Oceania	Motor Vehicles	22,435	23,139	33,555	37,182	39,373	60,003	81,941	106,096	167,065	253,898	374,649

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Savannah	Europe, Other	All Commodities	5,255	12,831	8,962	9,507	9,365	6,823	5,715	5,595	5,333	5,153	5,160
Savannah	Europe, Other	Agriculture	7	59	197	201	200	211	213	214	212	207	199
Savannah	Europe, Other	Extractive	723	2,905	394	417	423	392	380	376	374	372	360
Savannah	Europe, Other	Food	221	179	44	39	35	18	10	5	2	1	0
Savannah	Europe, Other	Materials	3,789	5,129	6,788	7,262	7,069	3,998	2,604	2,207	1,446	824	422
Savannah	Europe, Other	Consumer Goods	11	286	139	141	143	147	151	156	169	181	192
Savannah	Europe, Other	Chemicals	42	13	362	372	379	465	564	677	933	1,261	1,667
Savannah	Europe, Other	High Technology	135	131	195	189	188	214	229	249	292	340	390
Savannah	Europe, Other	Intermed. Manufact.	84	98	90	89	88	87	88	90	95	99	101
Savannah	Europe, Other	Capital Equipment	120	186	249	249	256	265	275	288	316	347	380
Savannah	Europe, Other	Motor Vehicles	124	3,844	504	549	584	1,026	1,202	1,333	1,494	1,522	1,448
Savannah	SE Asia	All Commodities	206,246	265,435	418,187	440,731	457,649	533,981	602,982	704,536	1,044,476	1,671,480	2,957,945
Savannah	SE Asia	Agriculture	7,984	6,438	78,911	85,368	90,376	114,099	123,923	133,486	156,481	123,683	162,710
Savannah	SE Asia	Extractive	69,564	102,243	116,132	126,292	133,235	154,736	165,073	181,030	210,706	234,347	252,710
Savannah	SE Asia	Food	4,393	26,418	30,458	34,621	38,895	66,775	101,886	149,390	301,064	560,811	965,038
Savannah	SE Asia	Materials	102,228	75,501	95,706	94,592	93,121	85,990	82,141	82,453	84,163	87,294	91,283
Savannah	SE Asia	Consumer Goods	529	2,226	4,421	4,633	4,774	5,648	6,746	8,533	15,432	27,596	41,477
Savannah	SE Asia	Chemicals	4,435	30,045	61,554	62,025	62,188	61,947	64,241	70,111	101,551	189,035	365,706
Savannah	SE Asia	High Technology	3,560	3,139	3,664	3,997	4,343	6,492	10,027	16,533	54,302	180,364	490,938
Savannah	SE Asia	Intermed. Manufact	2,434	11,437	13,739	14,520	15,122	19,011	24,509	31,029	55,152	112,782	239,869
Savannah	SE Asia	Capital Equipment	7,624	6,257	9,108	9,687	10,228	12,749	16,049	20,072	31,934	51,384	83,337
Savannah	SE Asia	Motor Vehicles	3,495	1,731	4,495	4,997	5,367	6,534	8,388	11,901	33,690	104,185	264,877
Savannah	West Coast S America	All Commodities	128,397	109,787	129,534	130,711	131,232	138,411	150,045	169,552	244,951	437,511	860,144
Savannah	West Coast S America	Agriculture	3,034	22,080	14,681	14,743	15,422	17,677	19,164	20,838	23,902	26,922	29,859
Savannah	West Coast S America	Extractive	21,685	31,100	33,533	34,329	34,738	37,012	39,968	44,214	53,267	63,618	74,416
Savannah	West Coast S America	Food	12,785	1,582	4,289	4,399	4,663	6,442	7,845	9,421	13,020	17,204	21,833
Savannah	West Coast S America	Materials	59,467	34,668	48,453	47,147	45,721	40,707	38,019	37,409	39,590	44,426	50,703
Savannah	West Coast S America	Consumer Goods	2,030	933	500	522	541	663	791	918	1,237	1,677	2,243
Savannah	West Coast S America	Chemicals	13,100	11,407	17,465	18,216	18,653	22,267	27,407	34,522	59,341	110,933	197,321
Savannah	West Coast S America	High Technology	1,738	1,755	2,019	2,190	2,331	3,506	5,557	9,690	39,002	153,399	460,113
Savannah	West Coast S America	Intermed. Manufact.	9,763	5,052	6,038	6,455	6,438	7,012	7,785	8,639	10,721	13,293	16,357
Savannah	West Coast S America	Capital Equipment	4,263	886	1,913	2,010	2,024	2,268	2,517	2,762	3,391	4,160	4,991
Savannah	West Coast S America	Motor Vehicles	532	325	644	701	702	859	993	1,139	1,480	1,879	2,309

The predominant trade regions for Savannah Harbor total export metric tonnes (Table 20) in 2003 (7.244 million tonnes) are North East Asia (3.532 million tonnes), North Europe (1.668 million tonnes), and South East Asia (0.418 million tonnes). The leading commodity groups for Savannah Harbor export metric tonnes in 2003 to North East Asia are Extractive (1.666 million tonnes) and Materials (0.784 million tonnes). The leading commodity groups for Savannah Harbor export metric tonnes in 2003 to North Europe are Extractive (0.810 million tonnes) and Materials (0.605 million tonnes). The leading commodity groups for Savannah Harbor export metric tonnes in 2003 to South East Asia are Extractive (0.116 million tonnes) and Materials (0.095 million tonnes).

Savannah Harbor export metric tonnes (all commodities) are expected to grow 4.59 percent between 2003 and 2004 and 0.75 percent between 2004 and 2005, grow at an average annual rate of 0.10 percent between 2005 and 2010 and 0.38 percent between 2010 and 2015, and grow thereafter at an average annual rate of less than 2 percent between 2015 and 2030 and increasing to 2.79 percent between 2030 and 2040 and 3.80 percent between 2040 and 2050. As a result of very slow export growth, the trade picture will be largely unchanged by 2010 and during ensuing periods. For example, by 2010 the largest trade will be North East Asia (3.843 million tonnes) followed by North Europe (1.470 million tonnes) and South East Asia (0.533 million tonnes). Between 2003 and 2010, total export metric tonnes to North East Asia will grow only 9 percent (3.843/3.532 = 1.09), while total export metric tonnes to North Europe will decline 12 percent (1.470/1.668 = 0.88) and total export metric tonnes to South East Asia will grow nearly 30 percent (0.533/0.418 = 1.28).

CONTAINERIZED TONNES

Tables 21 and 22 depict the major world trade areas for each of the 10 commodity groups for total containerized (metric) tonnes of Savannah Harbor imports and exports, respectively, and their historic growth from 1995 to 2003 and projected growth from 2003 to 2050. For example, the predominant trade regions for Savannah Harbor total import containerized tonnes (Table 21) in 2003 (3.154 million tonnes) are North East Asia (1.546 million tonnes), North Europe (0.367 million tonnes), and South East Asia (0.346 million tonnes). The leading commodity groups (metric tonnes) for North East Asia containerized imports in 2003 are Consumer Goods (0.471 million tonnes), Intermediate Manufacturing (0.394 million tonnes), and Capital Equipment (0.255 million tonnes). The leading commodity groups (metric tonnes) for North Europe containerized imports in 2003 are Chemicals (0.121 million tonnes), Intermediate Manufacturing (0.056 million tonnes), and Capital Equipment (0.053 million tonnes). The leading commodity groups for containerized imports from South East Asia are Food (0.097 million tonnes), Consumer Goods (0.084 million tonnes), and High Technology (0.048 million tonnes).

Savannah Harbor import containerized tonnes (all commodities) are expected to grow 4.21 percent between 2003 and 2004 and 8.13 percent between 2004 and 2005, then at an average annual rate of 5.98 percent between 2005 and 2010, slowing to an average annual rate of growth of 3.28 percent between 2010 and 2015, and growing thereafter at an average annual rate of between 2.71 percent and 3.13 percent between 2015 and 2050. By 2010, the largest trade will be North East Asia (2.556 million tonnes), followed by North Europe (0.573 million tonnes) and South East Asia (0.450 million tonnes). Between 2003 and 2010, total import containerized

Table 21. Containerized Tonnes of Imports to Savannah Harbor by World Trade Route and Commodity Groups: 1995 - 2050 (selected years)

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	All Commodities	43,668,120	70,432,286	83,924,683	87,715,698	94,183,075	121,619,709	140,610,872	159,479,498	208,004,390	271,444,015	351,291,751
USA	Percent Change	All Commodities	NA	10.03%	6.02%	4.52%	7.37%	5.25%	2.94%	2.55%	2.69%	2.70%	2.61%
Savannah	World	All Commodities	1,307,526	2,106,325	3,154,499	3,287,391	3,554,627	4,753,187	5,586,015	6,473,756	8,808,387	11,895,628	15,548,339
Savannah	Percent Change	All Commodities	NA	10.01%	14.41%	4.21%	8.13%	5.98%	3.28%	2.99%	3.13%	3.05%	2.71%
Savannah	Africa	All Commodities	10,724	10,636	11,203	10,025	10,048	11,703	12,911	14,134	17,064	20,586	24,429
Savannah	Africa	Agriculture	370	3,920	3,268	2,151	1,936	2,077	2,127	2,138	2,309	2,546	2,875
Savannah	Africa	Extractive	115	208	91	122	137	163	159	148	132	121	113
Savannah	Africa	Food	2,897	749	277	337	442	572	632	690	811	940	1,081
Savannah	Africa	Materials	2,494	1,832	3,847	3,469	3,348	3,459	3,554	3,701	4,178	4,882	5,822
Savannah	Africa	Consumer Goods	196	205	1,394	1,399	1,450	1,714	1,887	2,043	2,383	2,756	3,138
Savannah	Africa	Chemicals	6	414	138	160	203	290	379	486	712	1,026	1,486
Savannah	Africa	High Technology	11	12	40	45	51	81	100	121	173	239	324
Savannah	Africa	Intermed. Manufact.	3,820	2,927	1,334	1,459	1,513	1,880	2,264	2,656	3,406	4,179	4,782
Savannah	Africa	Capital Equipment	243	346	146	162	181	263	320	379	532	737	1,008
Savannah	Africa	Motor Vehicles	571	23	668	723	789	1,204	1,490	1,772	2,429	3,160	3,800
Savannah	Central America	All Commodities	39,516	50,030	152,333	146,419	153,645	177,948	189,687	201,271	229,631	263,664	308,956
Savannah	Central America	Agriculture	12,113	75	194	196	198	182	181	169	149	129	111
Savannah	Central America	Extractive	4,347	4,119	12,569	13,238	13,699	15,544	16,548	17,374	19,375	21,798	24,417
Savannah	Central America	Food	5,233	35,876	81,634	76,830	77,297	90,409	97,727	107,260	130,487	157,350	191,670
Savannah	Central America	Materials	1,083	160	224	200	189	183	182	186	198	210	219
Savannah	Central America	Consumer Goods	2,848	675	2,740	2,729	2,842	3,337	3,733	4,147	5,125	6,153	7,170
Savannah	Central America	Chemicals	7,443	8,107	49,550	47,401	52,940	58,281	60,261	60,915	63,281	67,037	73,703
Savannah	Central America	High Technology	144	229	626	666	751	1,117	1,435	1,783	2,704	4,002	5,791
Savannah	Central America	Intermed. Manufact.	3,286	118	73	80	89	109	131	149	191	241	298
Savannah	Central America	Capital Equipment	29	54	28	31	34	43	49	54	66	80	96
Savannah	Central America	Motor Vehicles	2,990	615	4,696	5,049	5,606	8,744	9,441	9,234	8,056	6,663	5,481
Savannah	East Coast S America	All Commodities	228,841	234,303	309,058	325,509	343,740	401,423	438,834	474,941	558,515	654,438	762,215
Savannah	East Coast S America	Agriculture	34,375	57,261	38,305	36,583	36,953	37,334	37,301	36,515	35,787	33,516	29,010
Savannah	East Coast S America	Extractive	23,186	18,873	16,365	17,476	18,575	17,904	16,043	13,999	11,016	8,919	7,353
Savannah	East Coast S America	Food	27,401	22,376	54,752	57,209	61,163	81,017	96,121	112,867	151,330	194,576	242,855
Savannah	East Coast S America	Materials	92,111	31,225	57,999	61,495	65,524	73,838	72,566	70,655	66,474	60,505	52,114
Savannah	East Coast S America	Consumer Goods	5,930	5,433	4,328	4,352	4,381	4,824	4,817	4,814	4,754	4,587	4,404
Savannah	East Coast S America	Chemicals	21,347	50,615	105,116	114,854	120,970	142,387	161,316	179,813	220,536	269,588	327,605
Savannah	East Coast S America	High Technology	188	459	635	761	881	1,500	2,096	2,796	4,731	7,653	11,813
Savannah	East Coast S America	Intermed. Manufact.	20,418	38,409	26,285	27,436	29,812	36,234	41,843	46,550	56,412	66,923	77,970
Savannah	East Coast S America	Capital Equipment	2,673	8,636	3,857	3,920	4,043	4,793	5,196	5,480	6,252	7,248	8,507
Savannah	East Coast S America	Motor Vehicles	1,213	1,014	1,415	1,422	1,438	1,592	1,535	1,452	1,224	923	584

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Savannah	Eastern Europe	All Commodities	69,252	33,856	44,104	45,272	49,133	75,734	113,888	167,442	337,999	599,989	919,166
Savannah	Eastern Europe	Agriculture	388	2,123	4,308	3,905	3,916	3,833	3,571	2,980	2,347	1,681	1,096
Savannah	Eastern Europe	Extractive	41	1,796	3	4	5	5	4	3	1	1	0
Savannah	Eastern Europe	Food	610	543	388	371	384	441	456	471	498	514	516
Savannah	Eastern Europe	Materials	5,539	5,642	5,557	5,019	4,851	5,959	6,506	6,834	7,466	8,112	8,770
Savannah	Eastern Europe	Consumer Goods	471	728	548	560	588	657	658	658	651	633	603
Savannah	Eastern Europe	Chemicals	39,859	12,200	27,558	29,300	32,759	55,517	90,941	142,397	307,488	563,099	874,554
Savannah	Eastern Europe	High Technology	94	525	203	217	243	372	495	635	1,013	1,557	2,320
Savannah	Eastern Europe	Intermed. Manufact.	17,436	7,649	3,770	3,872	4,189	6,226	7,845	9,067	11,538	13,856	15,957
Savannah	Eastern Europe	Capital Equipment	4,320	2,209	742	823	850	1,118	1,294	1,503	2,045	2,769	3,713
Savannah	Eastern Europe	Motor Vehicles	494	442	1,028	1,201	1,347	1,607	2,118	2,894	4,950	7,766	11,636
Savannah	India	All Commodities	18,845	75,547	90,099	90,220	95,110	123,611	142,601	160,914	207,438	266,213	329,040
Savannah	India	Agriculture	1,553	2,423	1,224	1,216	1,219	1,229	1,233	615	583	575	556
Savannah	India	Extractive	244	98	37	40	42	63	83	104	157	220	280
Savannah	India	Food	261	1,760	1,037	1,026	1,033	1,214	1,308	1,401	1,603	1,801	1,968
Savannah	India	Materials	5,226	31,183	34,743	34,640	36,810	46,819	52,375	57,956	71,325	86,827	96,240
Savannah	India	Consumer Goods	1,085	18,876	16,590	16,958	17,497	22,770	27,168	30,617	37,396	44,460	51,728
Savannah	India	Chemicals	769	3,210	3,037	3,215	3,371	4,042	4,489	4,812	5,497	6,235	7,044
Savannah	India	High Technology	199	426	524	573	654	1,072	1,361	1,707	2,636	4,000	5,966
Savannah	India	Intermed. Manufact.	8,834	13,754	28,051	27,945	30,197	40,815	48,069	56,258	78,589	109,846	150,098
Savannah	India	Capital Equipment	297	3,612	4,592	4,371	4,058	5,319	6,225	7,144	9,325	11,894	14,770
Savannah	India	Motor Vehicles	377	205	266	236	229	268	289	299	326	355	389
Savannah	Middle East	All Commodities	5,566	15,291	18,260	19,379	20,487	26,334	30,085	34,645	46,611	64,131	89,076
Savannah	Middle East	Agriculture	320	283	81	84	84	79	76	66	57	51	48
Savannah	Middle East	Extractive	0	0	0	0	0	0	0	0	0	0	0
Savannah	Middle East	Food	30	61	84	88	95	121	136	155	198	248	303
Savannah	Middle East	Materials	579	5,689	5,353	5,612	5,494	5,531	5,060	4,817	4,528	4,419	4,442
Savannah	Middle East	Consumer Goods	2,082	3,271	3,186	3,349	3,557	4,690	4,935	5,370	6,179	6,868	7,325
Savannah	Middle East	Chemicals	489	589	2,895	3,177	3,526	5,647	8,204	11,160	19,206	31,521	49,595
Savannah	Middle East	High Technology	106	227	232	250	278	425	513	608	840	1,143	1,537
Savannah	Middle East	Intermed. Manufact.	1,630	4,372	4,901	5,185	5,630	7,047	7,759	8,405	9,772	11,398	13,441
Savannah	Middle East	Capital Equipment	255	785	429	452	504	815	1,126	1,502	2,621	4,441	7,266
Savannah	Middle East	Motor Vehicles	74	14	1,099	1,182	1,319	1,980	2,276	2,563	3,210	4,043	5,121
Savannah	Mediterranean	All Commodities	34,845	58,828	81,774	88,452	99,706	126,041	139,319	152,544	183,232	222,790	275,543
Savannah	Mediterranean	Agriculture	77	1,268	293	289	306	374	410	399	443	474	491
Savannah	Mediterranean	Extractive	3,141	5,053	6,474	9,214	13,730	18,194	18,035	17,731	15,508	13,367	12,879
Savannah	Mediterranean	Food	4,086	9,130	8,386	8,434	8,802	11,179	12,477	13,712	16,450	19,654	23,527
Savannah	Mediterranean	Materials	3,677	10,768	19,236	18,888	19,857	21,419	21,805	22,662	25,505	29,394	34,032
Savannah	Mediterranean	Consumer Goods	698	2,532	5,165	5,561	6,151	6,741	7,961	9,187	12,355	16,629	22,430
Savannah	Mediterranean	Chemicals	4,275	11,765	10,709	11,712	12,371	15,216	17,762	20,190	26,223	34,607	46,845
Savannah	Mediterranean	High Technology	123	371	488	537	591	948	1,161	1,383	1,939	2,693	3,712
Savannah	Mediterranean	Intermed. Manufact.	17,561	13,042	22,094	24,606	28,130	39,619	45,573	51,493	65,794	84,136	107,516
Savannah	Mediterranean	Capital Equipment	778	2,574	6,846	6,887	7,107	8,914	9,619	10,119	10,518	9,820	7,977
Savannah	Mediterranean	Motor Vehicles	429	2,326	2,084	2,325	2,662	3,436	4,514	5,668	8,499	12,017	16,134

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Savannah	North America	All Commodities	26,962	8,511	24,162	26,167	27,558	32,583	37,356	42,536	55,891	75,487	104,798
Savannah	North America	Agriculture	834	0	3,287	3,915	4,643	6,019	6,544	6,657	6,392	6,284	5,877
Savannah	North America	Extractive	5,194	6,207	5,753	5,628	5,400	4,731	3,950	3,245	2,196	1,479	990
Savannah	North America	Food	0	0	1	1	2	2	1	1	1	1	1
Savannah	North America	Materials	928	0	1	1	1	1	1	1	1	1	2
Savannah	North America	Consumer Goods	0	1	6	6	6	8	9	10	13	16	20
Savannah	North America	Chemicals	19,999	2,170	15,080	16,578	17,466	21,753	26,751	32,488	46,857	67,330	97,322
Savannah	North America	High Technology	6	57	30	34	37	64	91	124	217	359	568
Savannah	North America	Intermed. Manufact.	0	0	0	0	0	0	0	0	0	0	0
Savannah	North America	Capital Equipment	0	6	3	3	4	6	7	9	13	16	19
Savannah	North America	Motor Vehicles	0	71	0	0	0	0	0	0	0	0	0
Savannah	NE Asia	All Commodities	524,914	876,766	1,546,205	1,628,253	1,788,766	2,556,181	3,109,187	3,708,564	5,278,444	7,336,021	9,681,474
Savannah	NE Asia	Agriculture	771	566	2,866	2,755	2,979	3,602	3,938	2,746	3,206	3,595	3,617
Savannah	NE Asia	Extractive	135	141	368	379	343	485	646	835	1,292	1,750	2,038
Savannah	NE Asia	Food	13,474	10,205	18,823	17,483	18,040	19,891	20,463	21,160	22,302	22,184	19,380
Savannah	NE Asia	Materials	20,264	41,297	109,496	109,127	115,402	146,609	162,919	173,917	198,679	214,171	199,255
Savannah	NE Asia	Consumer Goods	81,827	221,401	471,612	469,793	512,499	744,695	853,780	984,039	1,310,541	1,668,660	1,911,885
Savannah	NE Asia	Chemicals	44,574	88,476	100,559	102,543	107,563	129,540	137,846	139,234	144,338	145,900	131,069
Savannah	NE Asia	High Technology	90,759	146,941	167,377	172,957	191,444	319,024	435,724	562,676	883,220	1,305,779	1,840,015
Savannah	NE Asia	Intermed. Manufact.	170,500	188,710	394,041	443,739	492,730	640,356	767,972	896,751	1,213,535	1,588,875	1,990,692
Savannah	NE Asia	Capital Equipment	93,796	159,924	255,921	281,448	315,780	496,409	651,824	832,874	1,352,764	2,153,561	3,240,776
Savannah	NE Asia	Motor Vehicles	8,815	19,105	25,142	28,030	31,984	55,570	74,074	94,333	148,568	231,547	342,747
Savannah	North Europe	All Commodities	176,612	364,035	367,166	404,129	433,877	573,892	662,379	743,190	972,477	1,303,299	1,748,675
Savannah	North Europe	Agriculture	9,655	20,524	11,906	12,070	11,355	11,058	9,042	6,251	2,889	1,220	492
Savannah	North Europe	Extractive	67	75	5	5	3	3	2	2	1	1	1
Savannah	North Europe	Food	30,508	50,307	35,574	36,651	39,942	39,630	37,735	36,635	35,128	33,587	31,697
Savannah	North Europe	Materials	16,167	23,081	20,918	20,263	20,665	20,490	18,800	16,662	11,814	7,051	3,618
Savannah	North Europe	Consumer Goods	11,073	11,698	12,831	13,262	14,064	16,352	18,224	19,571	23,107	28,416	35,500
Savannah	North Europe	Chemicals	33,361	69,827	121,440	137,931	139,441	171,854	184,949	184,597	205,583	254,799	324,029
Savannah	North Europe	High Technology	5,150	4,599	6,092	5,973	6,442	9,859	12,297	14,947	21,714	30,977	43,546
Savannah	North Europe	Intermed. Manufact.	32,217	86,351	56,364	66,147	79,420	134,364	175,380	218,877	329,193	480,447	692,069
Savannah	North Europe	Capital Equipment	29,664	64,484	53,589	58,011	65,355	90,710	107,879	127,178	174,065	232,450	303,435
Savannah	North Europe	Motor Vehicles	8,750	33,090	48,446	53,816	57,189	79,573	98,073	118,469	168,982	234,352	314,289
Savannah	Oceania	All Commodities	22,739	27,406	72,612	67,368	69,661	96,878	117,936	137,347	185,596	258,502	370,814
Savannah	Oceania	Agriculture	39	2,965	9,800	7,939	7,590	6,562	5,635	4,571	4,122	3,887	3,582
Savannah	Oceania	Extractive	349	319	829	393	432	515	472	411	303	210	138
Savannah	Oceania	Food	21,662	19,560	39,939	35,974	39,020	60,419	78,284	96,954	143,162	214,110	324,638
Savannah	Oceania	Materials	6	1,284	8,252	7,920	6,519	8,571	10,598	11,430	12,212	12,714	13,149
Savannah	Oceania	Consumer Goods	28	126	347	370	400	585	719	857	1,205	1,663	2,244
Savannah	Oceania	Chemicals	6	1,007	2,981	2,809	2,900	3,657	4,148	4,478	5,211	6,093	7,198
Savannah	Oceania	High Technology	82	178	286	289	327	533	660	796	1,142	1,615	2,255
Savannah	Oceania	Intermed. Manufact.	225	448	2,764	4,641	5,365	6,090	6,115	5,380	3,827	2,812	2,347
Savannah	Oceania	Capital Equipment	34	1,498	5,856	5,570	5,703	7,599	8,520	9,316	10,615	11,156	10,679
Savannah	Oceania	Motor Vehicles	108	20	1,558	1,465	1,405	2,348	2,785	3,153	3,797	4,242	4,583

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Savannah	Europe, Other	All Commodities	2,949	30,541	21,317	13,268	13,212	14,312	14,716	15,123	15,954	16,422	16,731
Savannah	Europe, Other	Agriculture	0	23,016	12,040	4,532	4,647	4,884	4,976	4,922	4,285	2,998	1,701
Savannah	Europe, Other	Extractive	227	365	318	346	365	396	368	336	284	243	209
Savannah	Europe, Other	Food	27	145	94	103	115	99	92	87	79	69	59
Savannah	Europe, Other	Materials	1,438	3,292	5,413	4,735	4,258	4,073	3,545	3,331	3,633	4,396	5,278
Savannah	Europe, Other	Consumer Goods	288	477	181	176	194	217	254	247	223	239	294
Savannah	Europe, Other	Chemicals	220	119	121	121	126	169	199	227	297	403	548
Savannah	Europe, Other	High Technology	21	164	46	46	52	77	96	116	164	222	295
Savannah	Europe, Other	Intermed. Manufact.	542	1,932	1,919	1,989	2,138	2,620	3,065	3,429	3,890	3,995	3,633
Savannah	Europe, Other	Capital Equipment	170	982	1,005	1,027	1,107	1,463	1,719	1,952	2,489	3,151	3,967
Savannah	Europe, Other	Motor Vehicles	15	48	181	194	209	313	400	477	610	707	748
Savannah	SE Asia	All Commodities	126,602	304,707	346,835	353,757	378,700	450,313	477,552	506,272	569,841	626,062	684,825
Savannah	SE Asia	Agriculture	4,775	11,249	25,013	25,478	26,493	25,419	24,267	22,305	20,732	18,151	14,603
Savannah	SE Asia	Extractive	37	99	35	46	57	56	48	38	24	15	9
Savannah	SE Asia	Food	29,319	82,634	97,008	94,009	97,831	110,800	112,383	112,161	112,341	112,128	110,582
Savannah	SE Asia	Materials	32,237	52,644	50,925	55,345	59,233	62,631	63,612	64,337	64,602	62,616	58,563
Savannah	SE Asia	Consumer Goods	10,325	45,588	84,166	84,335	89,504	118,128	128,720	142,780	170,485	190,748	208,047
Savannah	SE Asia	Chemicals	6,488	4,097	13,501	14,630	15,361	18,319	21,359	24,366	31,710	41,812	56,328
Savannah	SE Asia	High Technology	35,124	51,926	48,882	48,579	49,578	63,392	72,028	83,134	111,721	144,836	181,614
Savannah	SE Asia	Intermed. Manufact.	7,063	48,586	17,994	22,353	31,848	40,652	42,135	41,977	37,585	27,810	17,184
Savannah	SE Asia	Capital Equipment	1,163	7,744	8,785	8,312	8,280	10,229	12,199	14,293	19,639	26,912	36,903
Savannah	SE Asia	Motor Vehicles	71	140	527	471	516	688	800	881	1,004	1,035	993
Savannah	West Coast S America	All Commodities	19,160	15,868	69,373	69,172	70,984	86,232	99,563	114,835	149,693	188,025	232,598
Savannah	West Coast S America	Agriculture	4,780	341	2,870	2,842	2,962	3,420	3,502	3,544	3,685	3,830	3,941
Savannah	West Coast S America	Extractive	69	254	388	380	388	380	373	366	353	337	316
Savannah	West Coast S America	Food	12,301	896	60,530	60,590	62,164	75,751	88,449	103,301	137,372	175,121	219,342
Savannah	West Coast S America	Materials	469	3,400	3,029	2,683	2,590	3,137	3,432	3,618	3,944	4,245	4,543
Savannah	West Coast S America	Consumer Goods	417	1,131	977	982	1,014	1,125	1,157	1,177	1,233	1,298	1,369
Savannah	West Coast S America	Chemicals	1,057	4,615	261	279	295	358	403	434	462	411	288
Savannah	West Coast S America	High Technology	6	22	37	41	51	83	105	129	194	285	411
Savannah	West Coast S America	Intermed. Manufact.	49	5,113	1,064	1,149	1,284	1,665	1,778	1,856	1,941	1,879	1,644
Savannah	West Coast S America	Capital Equipment	13	87	215	224	233	311	362	407	506	618	742
Savannah	West Coast S America	Motor Vehicles	0	9	3	3	3	3	3	3	2	2	1

Table 22. Containerized Tonnes of Exports from Savannah Harbor by World Trade Route and Commodity Groups: 1995 - 2050 (selected years)

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	All Commodities	52,079,407	51,663,424	59,866,360	61,938,701	62,671,860	68,156,505	73,311,464	81,026,976	106,038,449	157,207,098	257,492,921
USA	Percent Change	All Commodities	NA	-0.16%	5.03%	3.46%	1.18%	1.69%	1.47%	2.02%	2.73%	4.02%	5.06%
Savannah	World	All Commodities	2,461,566	2,535,755	3,879,928	4,042,908	4,042,517	4,097,605	4,204,825	4,546,836	5,751,825	8,260,339	13,182,596
Savannah	Percent Change	All Commodities	NA	0.60%	15.23%	4.20%	-0.01%	0.27%	0.52%	1.58%	2.38%	3.69%	4.79%
Savannah	Africa	All Commodities	20,059	16,411	18,401	17,603	17,529	20,055	22,993	28,201	63,118	194,904	540,350
Savannah	Africa	Agriculture	2,869	996	54	57	58	58	58	60	63	68	73
Savannah	Africa	Extractive	1,780	557	53	52	51	48	45	43	40	38	37
Savannah	Africa	Food	148	2,443	855	818	795	734	629	552	513	503	477
Savannah	Africa	Materials	9,468	4,365	10,266	9,592	9,413	10,917	12,893	16,703	43,976	152,903	450,259
Savannah	Africa	Consumer Goods	402	505	811	771	784	869	942	1,026	1,314	1,678	2,085
Savannah	Africa	Chemicals	2,463	4,579	3,214	3,167	3,177	3,536	3,982	4,695	9,502	25,372	57,549
Savannah	Africa	High Technology	245	271	232	235	239	311	408	594	1,814	6,506	19,788
Savannah	Africa	Intermed. Manufact	965	380	1,327	1,259	1,210	1,368	1,507	1,626	1,900	2,227	2,564
Savannah	Africa	Capital Equipment	1,257	1,460	1,026	1,038	1,134	1,400	1,663	1,963	2,918	4,424	6,285
Savannah	Africa	Motor Vehicles	461	855	562	614	669	813	865	939	1,078	1,185	1,233
Savannah	Central America	All Commodities	75,537	77,185	195,950	204,409	208,072	231,475	250,378	273,550	356,218	561,999	1,006,657
Savannah	Central America	Agriculture	2,062	9,018	7,412	8,274	8,528	9,832	10,682	11,284	12,346	13,392	13,891
Savannah	Central America	Extractive	58	807	778	681	613	678	703	733	817	921	1,024
Savannah	Central America	Food	28,861	27,133	51,035	52,061	53,349	58,282	56,488	54,726	52,240	50,791	48,787
Savannah	Central America	Materials	34,072	21,729	105,002	111,626	113,695	127,879	143,580	161,488	202,794	254,384	311,861
Savannah	Central America	Consumer Goods	3,130	680	2,960	2,964	2,989	3,185	3,375	3,556	4,039	4,727	5,473
Savannah	Central America	Chemicals	3,057	11,252	22,808	22,717	22,617	23,586	24,590	24,924	26,077	27,421	27,956
Savannah	Central America	High Technology	1,702	2,013	2,527	2,680	2,880	4,517	7,391	13,231	53,790	205,251	591,738
Savannah	Central America	Intermed. Manufact	1,573	3,473	2,295	2,260	2,241	2,218	2,195	2,178	2,522	3,286	3,855
Savannah	Central America	Capital Equipment	794	935	887	890	901	989	1,041	1,079	1,190	1,351	1,525
Savannah	Central America	Motor Vehicles	227	145	248	256	261	310	333	352	403	473	548
Savannah	East Coast S America	All Commodities	232,511	232,577	148,617	150,606	149,524	158,012	165,073	181,343	223,683	280,747	353,153
Savannah	East Coast S America	Agriculture	2,375	2,837	8,570	8,960	9,150	9,512	9,618	9,782	9,936	10,148	10,179
Savannah	East Coast S America	Extractive	27,328	15,181	17,568	17,527	18,062	20,781	23,254	26,289	34,225	45,391	59,618
Savannah	East Coast S America	Food	26,562	9,226	4,823	4,673	4,559	4,827	3,988	3,335	2,449	1,801	1,288
Savannah	East Coast S America	Materials	113,769	126,261	88,569	88,779	86,878	87,770	89,348	99,812	127,390	163,896	207,051
Savannah	East Coast S America	Consumer Goods	5,613	3,010	1,448	1,512	1,557	1,871	2,099	2,280	2,701	3,234	3,824
Savannah	East Coast S America	Chemicals	29,686	42,644	17,825	18,734	18,657	20,182	21,506	22,791	26,063	30,118	34,297
Savannah	East Coast S America	High Technology	5,537	7,624	4,144	4,450	4,630	6,118	7,611	8,917	11,734	15,802	25,392
Savannah	East Coast S America	Intermed. Manufact	8,537	10,954	2,133	2,230	2,245	2,521	2,781	3,000	3,516	4,162	4,880
Savannah	East Coast S America	Capital Equipment	12,219	13,671	2,804	2,966	3,017	3,546	3,905	4,116	4,546	5,004	5,413
Savannah	East Coast S America	Motor Vehicles	884	1,169	735	776	769	883	964	1,021	1,123	1,192	1,212

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Savannah	Eastern Europe	All Commodities	15,856	21,323	62,847	64,364	67,141	81,552	91,920	108,251	177,926	354,280	713,198
Savannah	Eastern Europe	Agriculture	108	466	462	541	745	849	918	1,000	1,113	1,245	1,378
Savannah	Eastern Europe	Extractive	58	71	1,422	1,494	1,591	2,036	2,315	2,483	2,874	3,359	3,741
Savannah	Eastern Europe	Food	6,027	9,190	25,609	27,253	29,791	39,504	45,411	53,483	77,717	111,567	151,866
Savannah	Eastern Europe	Materials	5,208	8,436	28,897	28,413	28,293	30,057	31,363	34,695	51,866	90,835	141,326
Savannah	Eastern Europe	Consumer Goods	212	95	144	150	160	220	302	431	1,036	2,487	5,031
Savannah	Eastern Europe	Chemicals	715	827	2,339	2,450	2,465	3,355	4,669	7,271	25,047	94,424	277,937
Savannah	Eastern Europe	High Technology	355	437	747	779	832	1,243	1,809	2,767	8,633	34,043	106,083
Savannah	Eastern Europe	Intermed. Manufact	1,729	774	1,290	1,323	1,246	1,409	1,500	1,608	2,169	3,438	5,112
Savannah	Eastern Europe	Capital Equipment	1,270	646	1,451	1,472	1,509	2,083	2,585	3,160	5,351	9,731	16,283
Savannah	Eastern Europe	Motor Vehicles	176	384	485	491	509	796	1,048	1,352	2,119	3,152	4,442
Savannah	India	All Commodities	39,454	42,756	78,372	80,239	76,981	81,272	88,885	101,876	160,353	339,148	776,051
Savannah	India	Agriculture	6,044	1,516	18,749	22,443	20,089	24,079	27,962	31,889	40,936	52,478	66,247
Savannah	India	Extractive	2,003	3,061	2,906	3,125	3,376	5,213	7,453	10,109	16,775	25,285	35,488
Savannah	India	Food	1,646	351	437	472	488	626	721	857	1,183	1,565	1,947
Savannah	India	Materials	22,065	29,293	46,910	44,847	43,483	39,501	37,010	36,397	36,281	37,165	36,293
Savannah	India	Consumer Goods	76	581	506	490	495	615	770	983	1,698	3,008	4,926
Savannah	India	Chemicals	3,969	2,342	3,931	3,853	3,875	4,102	4,512	5,251	8,901	17,387	29,201
Savannah	India	High Technology	265	387	716	772	863	1,702	3,501	7,640	40,186	176,232	553,267
Savannah	India	Intermed. Manufact	636	2,081	1,544	1,565	1,527	2,122	3,003	3,963	6,879	13,095	25,835
Savannah	India	Capital Equipment	2,745	3,118	2,158	2,156	2,268	2,727	3,222	3,837	5,943	10,494	19,195
Savannah	India	Motor Vehicles	6	26	515	514	518	585	731	950	1,571	2,440	3,652
Savannah	Middle East	All Commodities	95,964	73,738	72,278	71,461	70,734	74,769	78,296	85,340	105,558	136,037	175,799
Savannah	Middle East	Agriculture	726	2,118	466	499	527	691	778	855	1,024	1,222	1,428
Savannah	Middle East	Extractive	3,416	1,296	481	472	472	556	615	687	870	1,126	1,431
Savannah	Middle East	Food	5,341	7,790	10,331	10,784	11,463	16,127	20,425	25,412	39,295	60,560	89,466
Savannah	Middle East	Materials	72,723	46,402	50,170	49,182	47,669	46,005	44,292	45,396	49,263	55,174	62,134
Savannah	Middle East	Consumer Goods	1,442	1,409	1,125	1,124	1,164	1,435	1,714	1,995	2,739	3,853	5,356
Savannah	Middle East	Chemicals	5,206	6,672	4,964	4,663	4,598	4,126	3,741	3,504	3,199	2,952	2,685
Savannah	Middle East	High Technology	214	471	503	504	524	689	842	1,002	1,395	1,918	2,551
Savannah	Middle East	Intermed. Manufact	3,827	3,256	2,113	2,123	2,142	2,429	2,750	3,029	3,655	4,406	5,200
Savannah	Middle East	Capital Equipment	2,812	4,003	2,059	2,054	2,116	2,653	3,083	3,405	4,067	4,779	5,505
Savannah	Middle East	Motor Vehicles	256	321	65	56	58	58	55	54	51	48	44
Savannah	Mediterranean	All Commodities	117,888	138,886	163,243	165,774	165,773	160,153	169,541	191,422	255,090	353,861	487,676
Savannah	Mediterranean	Agriculture	1,552	7,267	14,418	14,882	14,819	16,988	18,587	20,333	24,732	30,548	36,908
Savannah	Mediterranean	Extractive	2,132	6,702	13,691	11,390	7,822	9,278	9,580	10,005	11,448	13,580	14,666
Savannah	Mediterranean	Food	15,113	7,662	16,591	18,276	19,262	23,486	30,193	37,961	59,060	90,406	132,385
Savannah	Mediterranean	Materials	91,377	104,791	101,075	103,425	105,636	87,002	82,389	88,045	106,882	137,589	179,421
Savannah	Mediterranean	Consumer Goods	743	1,633	1,731	1,796	1,876	2,413	2,954	3,589	5,335	8,014	11,450
Savannah	Mediterranean	Chemicals	2,495	4,082	5,209	5,273	5,373	7,185	9,490	12,500	21,719	37,883	64,128
Savannah	Mediterranean	High Technology	463	597	594	605	621	814	981	1,167	1,658	2,345	3,219
Savannah	Mediterranean	Intermed. Manufact	1,537	1,861	2,976	3,078	3,170	3,834	4,431	4,877	5,888	7,153	8,631
Savannah	Mediterranean	Capital Equipment	2,347	2,983	4,900	4,977	5,101	5,936	6,643	7,327	8,992	11,179	13,762
Savannah	Mediterranean	Motor Vehicles	128	1,309	2,058	2,072	2,094	3,216	4,293	5,618	9,375	15,164	23,107

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Savannah	North America	All Commodities	594	1,259	359	346	350	406	463	529	720	1,021	1,432
Savannah	North America	Agriculture	0	0	0	0	0	0	0	0	0	0	0
Savannah	North America	Extractive	560	850	307	295	301	336	365	392	462	555	647
Savannah	North America	Food	0	0	0	0	0	0	0	0	0	0	1
Savannah	North America	Materials	0	0	8	8	7	5	4	4	4	4	5
Savannah	North America	Consumer Goods	0	0	0	0	0	0	0	0	0	0	0
Savannah	North America	Chemicals	0	388	29	28	27	44	69	103	210	395	688
Savannah	North America	High Technology	34	20	14	13	14	19	21	25	33	45	58
Savannah	North America	Intermed. Manufact	0	0	1	1	1	2	3	4	11	22	33
Savannah	North America	Capital Equipment	0	0	0	0	0	0	0	0	0	0	0
Savannah	North America	Motor Vehicles	0	0	0	0	0	0	0	0	0	0	0
Savannah	NE Asia	All Commodities	982,947	1,102,116	1,930,910	1,989,338	1,976,538	2,007,433	2,027,614	2,160,904	2,612,216	3,423,674	4,815,105
Savannah	NE Asia	Agriculture	13,327	6,578	202,795	211,435	212,354	225,820	233,364	234,704	244,085	262,718	286,099
Savannah	NE Asia	Extractive	394,299	456,639	671,979	714,702	720,124	770,314	793,666	848,289	1,006,974	1,224,041	1,510,463
Savannah	NE Asia	Food	46,905	107,492	200,103	198,163	196,631	206,533	188,672	179,130	165,051	153,644	109,692
Savannah	NE Asia	Materials	392,143	404,488	587,912	588,629	563,278	472,726	418,532	426,446	468,463	547,306	641,686
Savannah	NE Asia	Consumer Goods	5,244	3,617	13,607	14,449	15,250	18,940	23,956	31,265	56,010	106,408	204,253
Savannah	NE Asia	Chemicals	82,276	76,093	179,874	183,591	186,857	209,702	239,719	281,318	414,421	680,616	1,237,010
Savannah	NE Asia	High Technology	10,457	9,696	10,678	11,843	12,630	17,226	22,706	30,291	57,408	116,536	241,032
Savannah	NE Asia	Intermed. Manufact	15,225	20,320	39,826	40,656	41,862	50,621	61,515	71,816	104,405	166,622	283,021
Savannah	NE Asia	Capital Equipment	20,272	14,462	19,215	20,517	22,479	29,745	38,848	50,066	84,986	151,607	283,289
Savannah	NE Asia	Motor Vehicles	2,799	2,729	4,921	5,353	5,073	5,805	6,636	7,579	10,411	14,176	18,559
Savannah	North Europe	All Commodities	578,740	510,412	783,347	808,557	823,289	744,581	706,564	716,474	766,558	873,327	1,024,968
Savannah	North Europe	Agriculture	12,493	32,534	13,168	13,928	14,453	15,051	15,801	15,879	15,267	15,563	16,586
Savannah	North Europe	Extractive	207,046	164,925	281,612	290,480	295,711	251,790	226,688	212,905	189,564	174,361	161,617
Savannah	North Europe	Food	9,717	9,611	13,178	13,595	13,522	13,382	14,108	15,086	17,202	20,193	23,855
Savannah	North Europe	Materials	288,508	232,653	367,348	385,311	394,840	340,038	307,648	313,199	344,331	410,919	511,125
Savannah	North Europe	Consumer Goods	2,335	3,772	3,986	3,979	4,007	4,332	4,583	4,890	5,663	6,655	7,707
Savannah	North Europe	Chemicals	31,536	27,359	65,980	63,287	61,570	72,448	82,989	92,804	116,437	146,824	181,555
Savannah	North Europe	High Technology	5,450	7,092	7,971	7,793	7,878	9,118	9,962	11,048	14,064	18,600	25,153
Savannah	North Europe	Intermed. Manufact	7,106	10,425	7,445	7,476	7,916	9,848	11,917	13,711	17,493	21,871	26,393
Savannah	North Europe	Capital Equipment	12,814	15,622	18,606	19,063	19,698	22,488	24,507	26,312	30,830	36,802	43,326
Savannah	North Europe	Motor Vehicles	1,735	6,420	4,052	3,646	3,694	6,086	8,361	10,641	15,708	21,539	27,653
Savannah	Oceania	All Commodities	124,427	136,646	166,171	174,377	166,892	175,514	195,679	222,890	293,828	393,225	514,949
Savannah	Oceania	Agriculture	3,141	670	843	876	748	465	343	271	171	132	120
Savannah	Oceania	Extractive	13,022	9,920	22,643	21,564	21,190	21,486	21,534	21,630	22,682	24,854	27,138
Savannah	Oceania	Food	6,683	10,556	16,046	16,608	15,405	14,598	15,086	15,728	16,992	18,472	19,523
Savannah	Oceania	Materials	30,828	54,412	50,038	53,845	51,007	49,176	53,172	61,980	83,244	109,584	135,291
Savannah	Oceania	Consumer Goods	1,846	2,706	11,605	11,490	11,488	14,444	16,985	19,886	27,499	37,917	50,204
Savannah	Oceania	Chemicals	20,028	19,810	22,080	23,166	21,502	19,554	19,628	19,966	21,785	24,985	29,268
Savannah	Oceania	High Technology	1,123	1,825	1,530	1,558	1,621	2,072	2,476	2,956	4,130	5,719	7,705
Savannah	Oceania	Intermed. Manufact	10,176	10,508	15,422	16,656	16,199	18,327	21,914	25,848	36,393	51,415	71,083
Savannah	Oceania	Capital Equipment	26,211	20,853	20,163	22,310	21,114	25,207	30,450	36,118	50,551	71,288	99,141
Savannah	Oceania	Motor Vehicles	11,369	5,386	5,800	6,302	6,619	10,186	14,089	18,509	30,381	48,858	75,475

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Savannah	Europe, Other	All Commodities	2,252	4,120	3,811	3,972	3,873	2,628	2,085	1,998	1,851	1,777	1,783
Savannah	Europe, Other	Agriculture	4	16	36	47	58	61	63	64	66	68	69
Savannah	Europe, Other	Extractive	260	742	88	91	92	86	85	85	88	93	94
Savannah	Europe, Other	Food	135	75	20	18	16	8	4	2	1	0	0
Savannah	Europe, Other	Materials	1,556	2,141	3,129	3,283	3,169	1,810	1,194	1,027	701	423	227
Savannah	Europe, Other	Consumer Goods	6	164	88	88	88	92	95	100	113	128	142
Savannah	Europe, Other	Chemicals	17	3	63	63	64	79	97	118	170	243	336
Savannah	Europe, Other	High Technology	111	110	179	171	169	194	210	232	284	349	419
Savannah	Europe, Other	Intermed. Manufact	41	20	21	20	20	20	20	21	23	25	27
Savannah	Europe, Other	Capital Equipment	61	68	100	98	100	105	110	117	134	156	179
Savannah	Europe, Other	Motor Vehicles	60	782	87	93	98	174	207	233	272	293	292
Savannah	SE Asia	All Commodities	106,910	129,246	185,139	240,685	244,511	283,241	320,704	376,458	580,745	1,023,547	2,039,183
Savannah	SE Asia	Agriculture	0	0	0	55,199	58,700	73,582	80,471	85,885	100,680	81,044	107,899
Savannah	SE Asia	Extractive	25,002	37,347	46,841	49,948	52,261	61,289	66,225	73,689	89,408	105,223	118,790
Savannah	SE Asia	Food	1,805	11,029	14,040	15,648	17,436	30,227	46,715	69,497	145,999	287,778	518,435
Savannah	SE Asia	Materials	68,235	51,218	71,690	69,477	67,834	63,253	61,200	62,330	66,323	72,791	79,688
Savannah	SE Asia	Consumer Goods	434	1,858	3,603	3,462	3,429	4,100	4,961	6,417	12,395	23,767	37,396
Savannah	SE Asia	Chemicals	1,822	12,542	28,374	28,035	27,878	28,041	29,454	32,616	49,247	97,003	196,463
Savannah	SE Asia	High Technology	3,331	3,025	3,378	3,613	3,894	5,878	9,194	15,382	52,666	203,684	616,300
Savannah	SE Asia	Intermed. Manufact	963	7,758	10,269	7,351	4,452	5,937	8,141	11,409	25,198	66,051	180,010
Savannah	SE Asia	Capital Equipment	4,401	3,859	5,417	6,127	6,526	8,431	11,190	14,811	26,561	48,568	87,757
Savannah	SE Asia	Motor Vehicles	916	608	1,528	1,823	2,102	2,503	3,153	4,423	12,268	37,637	96,445
Savannah	West Coast S America	All Commodities	68,429	49,080	70,483	71,177	71,369	76,513	84,629	97,602	153,961	322,792	732,292
Savannah	West Coast S America	Agriculture	1,869	6,925	9,651	9,996	10,370	12,003	13,180	14,541	17,386	20,722	24,061
Savannah	West Coast S America	Extractive	7,794	11,360	13,525	13,577	13,626	14,660	16,034	17,998	22,603	28,365	34,980
Savannah	West Coast S America	Food	6,920	807	2,427	2,571	2,831	3,842	4,663	5,634	8,009	11,100	14,663
Savannah	West Coast S America	Materials	33,144	18,367	27,665	27,117	26,337	24,039	23,202	23,278	25,791	30,271	35,403
Savannah	West Coast S America	Consumer Goods	1,668	779	461	471	485	600	725	855	1,200	1,721	2,410
Savannah	West Coast S America	Chemicals	5,381	4,762	8,051	8,233	8,362	10,079	12,566	16,060	28,777	56,925	106,004
Savannah	West Coast S America	High Technology	1,696	1,740	2,182	2,351	2,482	3,668	5,668	9,597	37,827	157,433	494,361
Savannah	West Coast S America	Intermed. Manufact	6,517	3,427	4,523	4,741	4,690	5,158	5,800	6,531	8,449	11,085	14,279
Savannah	West Coast S America	Capital Equipment	3,209	711	1,555	1,643	1,656	1,883	2,106	2,315	2,842	3,524	4,269
Savannah	West Coast S America	Motor Vehicles	233	203	445	475	472	583	683	794	1,076	1,447	1,861

tonnes from North East Asia will grow nearly two-thirds (2.556/1.546 = 1.65), while total import containerized tonnes from North Europe will grow nearly 55 percent (0.450/0.346 = 1.56) and total import containerized tonnes from South East Asia will grow 30 percent (0.568/0.456 = 1.30).

The predominant trade regions for Savannah Harbor total export containerized tonnes (Table 22) in 2003 (3.879 million tonnes) are North East Asia (1.903 million tonnes) and North Europe (0.783 million tonnes). The next largest trade region for export containerized tonnes is South East Asia (0.185 million tonnes). The leading commodity groups for Savannah Harbor export containerized tonnes in 2003 to North East Asia are Extractive (0.671 million tonnes)and Materials (0.587 million tonnes). The leading commodity groups for Savannah Harbor export containerized tonnes in 2003 to North Europe are Materials (0.367 million tonnes) and Extractive (0.281 million tonnes). The leading commodity groups for Savannah Harbor export containerized tonnes in 2003 to South East Asia are Materials (0.071 million tonnes) and Extractive (0.046 million tonnes).

Savannah Harbor export containerized tonnes (all commodities) are expected to grow 4.20 percent between 2003 and 2004, then at an average annual rate of 0.27 percent between 2005 and 2010, at 0.52 percent between 2010 and 2015, and at less than 2 percent between 2015 and 2020, then increasing to 2.38 percent between 2020 and 2030, 3.69 percent between 2030 and 2040, and 4.79 percent between 2040 and 2050. As a result of slower growth of containerized exports after 2004, the trade picture will be largely unchanged by 2010 and during ensuing periods. For example, by 2010 the largest trade will be North East Asia (2.007 million tonnes), followed by North Europe (0.744 million tonnes) and South East Asia (0.283 million tonnes). Between 2003 and 2010, total export containerized tonnes to North East Asia will grow only four percent (2.007/1.930 = 1.04), total export containerized tonnes to North Europe will decline five percent (0.744/0.783 = 0.95), and total export containerized tonnes to South East Asia will grow nearly 50 percent (0.283/0.185 = 1.53).

TEUs

Tables 23 and 24 depict the major world trade areas for each of the 10 commodity groups for Savannah Harbor total TEU imports and exports, respectively, and their historic growth from 1995 to 2003 and projected growth from 2003 to 2050. For example, the predominant trade regions for Savannah Harbor import TEUs (Table 23) in 2003 (0.602 million TEUs) are North East Asia (0.365 million TEUs), South East Asia (0.077 million TEUs), and North Europe (0.059 million TEUs). The leading commodity groups (TEUs) for North East Asia containerized imports in 2003 are Consumer Goods (0.162 million TEUs) and Intermediate Manufacturing (0.061 million TEUs). The leading commodity groups for TEU imports from South East Asia are Consumer Goods (0.034 million TEUs) and High Technology (0.014 million TEUs). The leading commodity groups for North Europe TEU imports in 2003 are Intermediate Manufacturing (0.010 million TEUs) and Chemicals (0.010 million TEUs).

Savannah Harbor total TEU imports (all commodities) are expected to grow 2.54 percent between 2003 and 2004 and 7.69 percent between 2004 and 2005, then at an average annual rate of 6.63 percent between 2005 and 2010, slowing to an average annual rate of growth of

Table 23. TEUs of Imports to Savannah Harbor by World Trade Route and Commodity Groups: 1995 - 2050 (selected years)

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	All Commodities	6,149,984	10,615,461	14,237,352	12,891,228	13,864,939	18,318,933	21,317,783	24,392,355	32,233,589	42,426,911	55,122,665
USA	Percent Change	All Commodities	NA	11.54%	10.28%	-9.45%	7.55%	5.73%	3.08%	2.73%	2.83%	2.79%	2.65%
Savannah	World	All Commodities	196,136	396,563	602,107	617,399	664,876	916,546	1,105,626	1,310,895	1,848,206	2,585,808	3,527,589
Savannah	Percent Change	All Commodities	NA	15.12%	14.94%	2.54%	7.69%	6.63%	3.82%	3.46%	3.49%	3.42%	3.15%
Savannah	Africa	All Commodities	517	495	447	456	482	620	725	813	961	1,075	1,161
Savannah	Africa	Agriculture	12	12	1	1	1	1	1	1	1	1	1
Savannah	Africa	Extractive	21	41	7	7	7	6	6	5	5	4	3
Savannah	Africa	Food	72	2	31	31	33	32	30	27	24	21	18
Savannah	Africa	Materials	2	80	87	82	85	100	120	137	172	212	258
Savannah	Africa	Consumer Goods	123	19	12	12	13	14	15	16	18	19	20
Savannah	Africa	Chemicals	2	182	25	24	25	30	34	41	51	58	60
Savannah	Africa	High Technology	1	11	2	2	2	4	6	8	13	21	32
Savannah	Africa	Intermed. Manufact.	23	96	41	45	50	68	85	100	127	143	144
Savannah	Africa	Capital Equipment	43	46	22	24	26	30	31	31	32	31	30
Savannah	Africa	Motor Vehicles	218	6	219	228	241	334	398	446	519	566	596
Savannah	Central America	All Commodities	2,783	1,188	2,594	2,677	2,840	3,577	4,250	4,990	6,863	9,311	12,402
Savannah	Central America	Agriculture	600	39	138	141	143	137	142	138	130	118	104
Savannah	Central America	Extractive	2	0	1	1	1	1	1	1	1	1	1
Savannah	Central America	Food	166	193	402	391	414	426	408	396	373	348	314
Savannah	Central America	Materials	12	1	125	112	106	81	62	57	44	30	17
Savannah	Central America	Consumer Goods	1,441	68	739	748	786	959	1,137	1,339	1,843	2,450	3,152
Savannah	Central America	Chemicals	17	232	24	24	25	28	31	32	36	41	48
Savannah	Central America	High Technology	108	195	517	565	616	964	1,355	1,806	3,001	4,653	6,800
Savannah	Central America	Intermed. Manufact.	6	45	7	7	8	12	15	19	29	44	65
Savannah	Central America	Capital Equipment	16	266	85	97	111	157	191	223	305	413	550
Savannah	Central America	Motor Vehicles	415	148	557	592	630	813	908	978	1,101	1,215	1,351
Savannah	East Coast S America	All Commodities	13,690	26,692	29,046	29,754	31,345	39,422	45,234	51,090	65,008	83,015	106,409
Savannah	East Coast S America	Agriculture	4,553	6,988	5,204	4,991	5,033	5,034	5,058	5,065	5,136	5,124	4,973
Savannah	East Coast S America	Extractive	37	213	155	156	161	175	177	175	167	155	140
Savannah	East Coast S America	Food	1,459	2,398	5,383	5,842	6,277	9,004	11,232	13,573	18,888	25,015	31,908
Savannah	East Coast S America	Materials	2,221	4,679	9,081	9,086	9,468	11,448	11,907	12,177	12,511	12,723	12,871
Savannah	East Coast S America	Consumer Goods	1,425	1,115	1,197	1,268	1,297	1,416	1,414	1,457	1,551	1,634	1,690
Savannah	East Coast S America	Chemicals	766	1,496	1,355	1,420	1,554	2,128	2,808	3,497	5,090	7,095	9,485
Savannah	East Coast S America	High Technology	96	410	1,313	1,502	1,752	3,005	4,654	6,728	12,787	22,294	36,311
Savannah	East Coast S America	Intermed. Manufact.	1,994	7,646	3,264	3,267	3,422	3,896	4,227	4,490	4,982	5,418	5,779
Savannah	East Coast S America	Capital Equipment	769	1,202	445	460	479	576	635	677	780	905	1,050
Savannah	East Coast S America	Motor Vehicles	370	545	1,649	1,762	1,902	2,740	3,121	3,252	3,115	2,653	2,202

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Savannah	Eastern Europe	All Commodities	5,958	2,346	5,736	5,589	5,646	6,788	7,616	8,418	10,012	11,718	13,770
Savannah	Eastern Europe	Agriculture	30	42	424	414	417	410	391	341	272	191	117
Savannah	Eastern Europe	Extractive	0	3	0	0	0	0	0	0	0	0	0
Savannah	Eastern Europe	Food	51	77	35	33	33	31	27	23	17	13	10
Savannah	Eastern Europe	Materials	517	968	849	771	758	936	1,068	1,137	1,250	1,329	1,348
Savannah	Eastern Europe	Consumer Goods	82	230	214	220	239	279	288	294	309	327	346
Savannah	Eastern Europe	Chemicals	537	117	214	214	229	306	385	465	659	943	1,355
Savannah	Eastern Europe	High Technology	22	80	52	56	64	98	128	161	250	376	547
Savannah	Eastern Europe	Intermed. Manufact.	2,589	521	2,159	2,159	2,213	2,475	2,524	2,551	2,364	1,947	1,483
Savannah	Eastern Europe	Capital Equipment	1,946	259	150	163	174	233	279	332	470	659	912
Savannah	Eastern Europe	Motor Vehicles	184	49	1,639	1,558	1,520	2,001	2,527	3,113	4,420	5,913	7,653
Savannah	India	All Commodities	3,293	19,932	18,788	19,036	19,758	24,231	27,346	29,988	35,812	42,182	47,686
Savannah	India	Agriculture	308	333	126	126	124	120	116	55	50	47	44
Savannah	India	Extractive	9	10	5	5	5	7	6	5	3	2	1
Savannah	India	Food	17	218	245	241	244	288	315	343	398	442	467
Savannah	India	Materials	1,288	7,406	7,576	7,616	8,016	9,800	10,960	12,052	14,619	17,593	19,708
Savannah	India	Consumer Goods	484	7,747	7,045	7,199	7,454	9,277	10,719	11,850	13,960	15,954	17,697
Savannah	India	Chemicals	203	726	513	533	550	606	623	616	597	571	538
Savannah	India	High Technology	50	101	180	200	231	376	458	553	785	1,088	1,478
Savannah	India	Intermed. Manufact.	765	2,879	2,001	2,057	2,138	2,603	2,890	3,172	3,859	4,732	5,786
Savannah	India	Capital Equipment	40	468	1,038	1,007	945	1,100	1,204	1,291	1,499	1,721	1,941
Savannah	India	Motor Vehicles	129	42	58	52	51	55	54	50	42	34	27
Savannah	Middle East	All Commodities	5,054	7,443	11,162	11,536	12,109	14,294	15,083	15,748	16,981	18,120	19,136
Savannah	Middle East	Agriculture	132	134	21	22	23	22	21	20	18	16	15
Savannah	Middle East	Extractive	18	42	4	4	3	3	3	2	1	1	0
Savannah	Middle East	Food	24	83	53	51	51	43	33	25	16	10	7
Savannah	Middle East	Materials	95	2,050	2,059	2,173	2,146	2,125	1,970	1,885	1,770	1,710	1,690
Savannah	Middle East	Consumer Goods	448	1,284	876	938	986	1,274	1,384	1,538	1,850	2,155	2,423
Savannah	Middle East	Chemicals	2,944	987	2,401	2,302	2,320	2,279	2,161	2,031	1,864	1,765	1,681
Savannah	Middle East	High Technology	24	42	43	46	51	75	92	111	155	214	288
Savannah	Middle East	Intermed. Manufact.	1,011	2,474	3,934	4,070	4,326	5,227	5,831	6,347	7,304	8,191	8,931
Savannah	Middle East	Capital Equipment	36	345	623	674	751	1,026	1,197	1,366	1,758	2,215	2,725
Savannah	Middle East	Motor Vehicles	322	0	1,148	1,276	1,452	2,221	2,390	2,424	2,245	1,844	1,396
Savannah	Mediterranean	All Commodities	4,501	7,893	15,414	16,070	17,465	21,689	24,887	28,032	36,154	46,437	58,404
Savannah	Mediterranean	Agriculture	2	110	105	112	125	170	190	166	190	213	235
Savannah	Mediterranean	Extractive	30	338	313	281	282	305	304	302	299	299	301
Savannah	Mediterranean	Food	786	1,379	1,239	1,314	1,423	2,087	2,740	3,441	5,077	7,001	9,186
Savannah	Mediterranean	Materials	859	1,579	5,313	5,559	6,116	7,260	7,879	8,387	9,767	11,376	12,519
Savannah	Mediterranean	Consumer Goods	365	1,045	1,929	2,091	2,308	2,598	3,122	3,635	4,933	6,675	9,073
Savannah	Mediterranean	Chemicals	1,370	338	1,626	1,422	1,287	1,042	704	457	203	96	46
Savannah	Mediterranean	High Technology	46	100	176	198	226	376	478	589	861	1,217	1,673
Savannah	Mediterranean	Intermed. Manufact.	770	1,982	3,355	3,702	4,230	5,830	7,115	8,426	11,631	15,742	20,847
Savannah	Mediterranean	Capital Equipment	183	463	982	988	1,038	1,374	1,569	1,758	2,198	2,732	3,365
Savannah	Mediterranean	Motor Vehicles	90	558	375	404	431	648	786	871	994	1,086	1,161

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Savannah	North America	All Commodities	1,268	286	384	409	436	541	618	698	888	1,107	1,341
Savannah	North America	Agriculture	343	0	85	93	102	118	123	130	140	148	152
Savannah	North America	Extractive	81	11	8	8	8	8	8	8	8	8	9
Savannah	North America	Food	0	0	17	19	22	36	47	59	76	85	86
Savannah	North America	Materials	6	0	0	0	0	0	0	0	0	0	0
Savannah	North America	Consumer Goods	0	8	0	0	0	0	0	0	0	0	0
Savannah	North America	Chemicals	815	0	191	197	203	227	256	281	351	423	469
Savannah	North America	High Technology	6	61	82	90	100	149	182	218	310	440	622
Savannah	North America	Intermed. Manufact.	17	0	0	0	0	0	0	0	0	0	0
Savannah	North America	Capital Equipment	0	3	1	1	1	1	1	1	1	1	1
Savannah	North America	Motor Vehicles	0	203	1	1	1	1	1	1	1	2	2
Savannah	NE Asia	All Commodities	105,028	207,498	365,781	376,948	410,597	594,678	738,304	899,142	1,330,929	1,938,178	2,726,954
Savannah	NE Asia	Agriculture	108	99	443	429	437	476	497	432	486	551	612
Savannah	NE Asia	Extractive	2	24	4	4	3	2	1	1	0	0	0
Savannah	NE Asia	Food	1,228	1,858	3,101	2,923	3,067	3,350	3,445	3,558	3,798	4,015	4,110
Savannah	NE Asia	Materials	8,869	9,354	24,184	24,528	26,234	33,607	38,341	41,518	49,770	60,836	74,893
Savannah	NE Asia	Consumer Goods	26,792	72,741	162,769	163,680	176,545	246,840	284,544	329,170	442,792	584,486	746,116
Savannah	NE Asia	Chemicals	9,646	17,035	18,038	17,883	18,419	20,347	21,641	22,564	24,921	27,826	30,636
Savannah	NE Asia	High Technology	23,721	39,088	43,160	45,731	50,628	83,659	114,101	147,085	229,137	334,701	463,035
Savannah	NE Asia	Intermed. Manufact.	19,182	34,051	61,404	63,900	70,510	103,954	141,524	184,636	310,084	507,646	790,950
Savannah	NE Asia	Capital Equipment	12,990	25,842	42,104	46,424	52,034	82,079	107,285	136,154	217,570	340,827	507,888
Savannah	NE Asia	Motor Vehicles	2,549	7,406	10,573	11,445	12,719	20,364	26,924	34,005	52,370	77,291	108,715
Savannah	North Europe	All Commodities	32,024	61,854	59,298	61,148	65,845	86,019	99,397	111,930	143,041	183,424	232,898
Savannah	North Europe	Agriculture	284	1,880	870	815	787	870	817	699	534	353	189
Savannah	North Europe	Extractive	457	221	64	57	51	56	39	26	14	10	9
Savannah	North Europe	Food	5,238	9,845	7,604	7,889	8,526	8,662	8,444	8,313	8,108	7,820	7,369
Savannah	North Europe	Materials	3,459	5,800	4,371	4,076	4,021	4,217	4,186	4,161	4,220	4,291	4,191
Savannah	North Europe	Consumer Goods	5,753	6,240	7,550	7,951	8,375	10,131	11,511	12,677	15,461	19,076	23,379
Savannah	North Europe	Chemicals	5,136	7,556	10,654	10,825	11,770	16,764	19,621	21,920	29,436	41,926	59,447
Savannah	North Europe	High Technology	1,205	1,455	2,298	2,353	2,582	3,837	4,854	5,953	8,698	12,335	17,049
Savannah	North Europe	Intermed. Manufact.	4,757	10,974	10,729	11,224	12,279	15,564	18,574	21,676	29,393	39,513	52,417
Savannah	North Europe	Capital Equipment	4,195	12,937	9,437	10,261	11,480	15,301	17,747	20,410	26,634	33,778	41,294
Savannah	North Europe	Motor Vehicles	1,541	4,947	5,721	5,698	5,972	10,617	13,694	16,096	20,543	24,323	27,554
Savannah	Oceania	All Commodities	79	3,475	9,848	9,209	10,026	15,636	20,457	25,638	38,899	57,824	82,857
Savannah	Oceania	Agriculture	1	135	333	314	328	346	352	334	276	177	91
Savannah	Oceania	Extractive	1	24	22	23	23	27	30	31	35	39	43
Savannah	Oceania	Food	2	2,289	5,283	4,774	5,205	8,811	11,972	15,496	24,381	37,268	54,799
Savannah	Oceania	Materials	1	254	1,509	1,379	1,420	1,803	2,137	2,452	3,172	4,074	5,197
Savannah	Oceania	Consumer Goods	0	10	87	98	107	170	214	263	388	553	749
Savannah	Oceania	Chemicals	2	278	545	576	635	706	717	726	743	759	771
Savannah	Oceania	High Technology	26	64	136	141	158	251	304	359	485	641	843
Savannah	Oceania	Intermed. Manufact.	0	110	480	433	480	642	799	834	815	763	714
Savannah	Oceania	Capital Equipment	4	306	1,170	1,208	1,418	2,420	3,260	4,205	6,904	10,762	15,571
Savannah	Oceania	Motor Vehicles	43	4	282	265	252	460	673	936	1,699	2,789	4,079

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Savannah	Europe, Other	All Commodities	664	5,075	3,520	3,275	3,260	3,932	4,379	4,822	5,943	7,265	8,668
Savannah	Europe, Other	Agriculture	0	3,724	772	720	757	852	948	1,037	1,209	1,318	1,310
Savannah	Europe, Other	Extractive	64	2	2	2	2	2	2	1	1	0	0
Savannah	Europe, Other	Food	4	14	8	10	11	14	19	25	40	58	76
Savannah	Europe, Other	Materials	223	557	1,764	1,565	1,435	1,669	1,739	1,818	2,060	2,314	2,469
Savannah	Europe, Other	Consumer Goods	72	99	12	12	12	13	14	13	10	8	8
Savannah	Europe, Other	Chemicals	144	37	64	62	61	56	47	38	26	18	13
Savannah	Europe, Other	High Technology	2	33	21	21	24	33	40	48	68	91	118
Savannah	Europe, Other	Intermed. Manufact.	135	380	328	313	330	356	372	370	367	363	357
Savannah	Europe, Other	Capital Equipment	18	226	476	491	541	829	1,080	1,344	2,020	2,935	4,144
Savannah	Europe, Other	Motor Vehicles	2	4	73	79	88	109	119	127	143	158	172
Savannah	SE Asia	All Commodities	18,720	51,096	77,345	78,517	82,238	101,932	113,932	125,975	152,648	181,613	210,897
Savannah	SE Asia	Agriculture	71	716	1,146	1,158	1,209	1,225	1,240	1,249	1,363	1,529	1,735
Savannah	SE Asia	Extractive	0	1	3	3	3	4	4	5	5	6	6
Savannah	SE Asia	Food	1,032	2,507	3,329	3,403	3,572	4,356	5,096	5,816	7,333	8,985	10,629
Savannah	SE Asia	Materials	1,441	6,280	7,056	6,892	7,025	7,317	7,525	7,828	8,142	8,018	7,319
Savannah	SE Asia	Consumer Goods	4,462	19,653	34,240	34,835	36,533	45,716	50,015	54,310	63,605	73,535	84,324
Savannah	SE Asia	Chemicals	1,117	1,551	6,023	6,376	6,874	8,391	10,101	11,438	14,521	18,168	22,064
Savannah	SE Asia	High Technology	8,972	14,039	14,150	14,176	14,528	18,300	20,545	23,280	29,739	37,376	45,803
Savannah	SE Asia	Intermed. Manufact.	1,030	3,914	6,518	6,519	6,980	9,054	10,215	11,224	13,031	14,183	14,075
Savannah	SE Asia	Capital Equipment	496	2,291	3,721	3,983	4,241	6,014	7,455	8,983	12,921	17,836	23,100
Savannah	SE Asia	Motor Vehicles	98	144	1,158	1,171	1,275	1,555	1,735	1,841	1,988	1,977	1,840
Savannah	West Coast S America	All Commodities	2,556	1,290	2,745	2,756	2,831	3,187	3,398	3,611	4,067	4,540	4,984
Savannah	West Coast S America	Agriculture	1,816	101	873	869	894	975	999	1,014	1,052	1,091	1,128
Savannah	West Coast S America	Extractive	2	6	39	40	41	47	52	56	64	73	81
Savannah	West Coast S America	Food	57	167	935	932	933	1,022	1,097	1,191	1,384	1,572	1,766
Savannah	West Coast S America	Materials	305	218	143	130	127	143	154	166	189	213	240
Savannah	West Coast S America	Consumer Goods	38	285	229	229	238	265	284	303	338	370	399
Savannah	West Coast S America	Chemicals	192	214	39	37	38	39	38	33	20	10	4
Savannah	West Coast S America	High Technology	6	7	27	29	33	49	61	73	103	140	188
Savannah	West Coast S America	Intermed. Manufact.	24	216	407	434	469	573	627	676	781	888	941
Savannah	West Coast S America	Capital Equipment	117	53	44	45	47	54	58	61	66	70	74
Savannah	West Coast S America	Motor Vehicles	0	24	9	10	11	20	29	40	70	112	163

Table 24. TEUs of Exports from Savannah Harbor by World Trade Route and Commodity Groups: 1995 - 2050 (selected years)

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	All Commodities	5,717,411	5,222,689	6,552,904	6,793,201	6,890,924	7,592,271	8,246,429	9,186,147	12,285,625	18,890,848	32,117,631
USA	Percent Change	All Commodities	NA	-1.79%	7.86%	3.67%	1.44%	1.96%	1.67%	2.18%	2.95%	4.40%	5.45%
Savannah	World	All Commodities	227,918	260,437	388,361	406,627	408,991	420,447	442,855	488,149	637,739	945,571	1,543,369
Savannah	Percent Change	All Commodities	NA	2.70%	14.25%	4.70%	0.58%	0.55%	1.04%	1.97%	2.71%	4.02%	5.02%
Savannah	Africa	All Commodities	2,210	2,479	1,725	1,714	1,706	1,765	1,785	1,853	2,205	3,227	5,610
Savannah	Africa	Agriculture	18	67	156	157	152	165	164	173	176	180	186
Savannah	Africa	Extractive	0	0	0	0	0	0	0	0	0	0	0
Savannah	Africa	Food	67	736	80	80	78	72	60	53	43	35	29
Savannah	Africa	Materials	365	230	105	100	93	89	87	86	95	104	124
Savannah	Africa	Consumer Goods	7	85	47	47	49	59	68	79	109	153	219
Savannah	Africa	Chemicals	121	595	532	515	500	433	370	315	231	193	170
Savannah	Africa	High Technology	59	87	85	88	92	120	152	194	412	1,181	3,228
Savannah	Africa	Intermed. Manufact.	26	69	256	259	261	232	202	176	133	99	73
Savannah	Africa	Capital Equipment	664	451	180	176	184	224	261	296	405	575	795
Savannah	Africa	Motor Vehicles	883	158	283	290	297	371	420	479	601	706	786
Savannah	Central America	All Commodities	10,493	3,047	14,284	15,206	15,648	17,665	19,683	22,286	32,946	60,967	121,000
Savannah	Central America	Agriculture	94	4	552	573	594	674	707	733	769	798	822
Savannah	Central America	Extractive	0	0	0	0	0	0	0	0	0	0	0
Savannah	Central America	Food	799	196	693	751	802	1,102	1,262	1,414	1,740	2,086	2,442
Savannah	Central America	Materials	4,773	1,335	9,942	10,703	10,990	12,132	13,211	14,321	16,823	19,769	23,213
Savannah	Central America	Consumer Goods	1,528	111	423	425	426	428	425	425	423	420	412
Savannah	Central America	Chemicals	1,150	233	770	770	760	714	670	622	551	482	414
Savannah	Central America	High Technology	696	644	803	853	909	1,293	1,914	3,058	10,194	33,740	88,425
Savannah	Central America	Intermed. Manufact.	990	454	820	843	868	998	1,169	1,382	2,097	3,296	4,867
Savannah	Central America	Capital Equipment	302	64	197	199	201	207	205	202	202	207	216
Savannah	Central America	Motor Vehicles	161	7	85	88	96	117	122	129	148	168	190
Savannah	East Coast S America	All Commodities	27,164	31,424	9,965	10,572	10,652	11,764	12,689	13,874	16,541	19,613	23,349
Savannah	East Coast S America	Agriculture	666	1,918	438	451	461	513	528	573	592	602	605
Savannah	East Coast S America	Extractive	0	0	0	0	0	0	0	0	0	0	0
Savannah	East Coast S America	Food	1,381	2,021	59	63	66	89	94	98	105	109	108
Savannah	East Coast S America	Materials	10,805	10,414	4,347	4,556	4,499	4,501	4,475	4,802	5,685	6,673	7,775
Savannah	East Coast S America	Consumer Goods	1,075	473	140	151	154	175	189	200	220	239	257
Savannah	East Coast S America	Chemicals	5,505	8,372	2,577	2,743	2,805	3,283	3,764	4,257	5,375	6,742	8,386
Savannah	East Coast S America	High Technology	1,663	1,661	889	981	1,021	1,322	1,601	1,810	2,269	2,841	3,716
Savannah	East Coast S America	Intermed. Manufact.	3,405	2,194	415	444	452	512	567	611	702	797	901
Savannah	East Coast S America	Capital Equipment	2,314	3,733	712	750	761	847	894	913	938	951	960
Savannah	East Coast S America	Motor Vehicles	349	637	388	435	435	521	577	611	655	660	640

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Savannah	Eastern Europe	All Commodities	1,354	2,165	4,648	4,710	4,823	5,369	5,787	6,593	10,223	18,820	34,646
Savannah	Eastern Europe	Agriculture	1	51	6	6	6	6	6	6	7	7	7
Savannah	Eastern Europe	Extractive	0	0	0	0	0	0	0	0	0	0	0
Savannah	Eastern Europe	Food	429	668	1,254	1,283	1,337	1,429	1,364	1,345	1,373	1,401	1,407
Savannah	Eastern Europe	Materials	247	746	2,303	2,281	2,287	2,355	2,417	2,630	3,621	5,686	8,461
Savannah	Eastern Europe	Consumer Goods	124	26	24	25	27	35	47	66	143	288	463
Savannah	Eastern Europe	Chemicals	46	163	307	323	327	422	550	768	1,912	5,373	13,312
Savannah	Eastern Europe	High Technology	144	140	162	169	182	242	306	389	718	1,533	3,252
Savannah	Eastern Europe	Intermed. Manufact.	189	101	211	218	223	258	293	349	644	1,449	2,861
Savannah	Eastern Europe	Capital Equipment	133	98	280	295	316	423	518	637	1,067	1,874	3,069
Savannah	Eastern Europe	Motor Vehicles	23	173	101	110	119	198	286	404	738	1,209	1,814
Savannah	India	All Commodities	2,882	5,302	10,415	10,549	10,639	11,872	13,401	15,424	23,740	45,280	92,145
Savannah	India	Agriculture	351	555	2,788	3,041	3,163	4,342	5,399	6,297	8,410	10,968	13,959
Savannah	India	Extractive	0	0	0	0	0	0	0	0	0	0	0
Savannah	India	Food	18	48	65	74	81	151	270	462	1,202	2,694	5,183
Savannah	India	Materials	1,450	3,007	3,719	5,582	5,459	5,006	4,672	4,492	4,212	4,062	3,937
Savannah	India	Consumer Goods	12	147	120	123	126	159	206	280	583	1,364	3,096
Savannah	India	Chemicals	835	486	770	784	824	1,000	1,235	1,591	3,001	5,778	9,653
Savannah	India	High Technology	76	97	138	128	140	242	443	869	3,932	15,786	47,131
Savannah	India	Intermed. Manufact.	73	262	193	201	212	285	386	509	990	2,178	4,634
Savannah	India	Capital Equipment	66	686	490	484	504	589	698	833	1,313	2,354	4,458
Savannah	India	Motor Vehicles	1	14	132	133	130	98	90	93	99	96	92
Savannah	Middle East	All Commodities	6,813	9,540	7,729	7,751	7,727	7,939	8,014	8,277	8,907	9,577	10,252
Savannah	Middle East	Agriculture	57	211	121	121	122	126	121	119	120	126	134
Savannah	Middle East	Extractive	0	0	0	0	0	0	0	0	0	0	0
Savannah	Middle East	Food	1,017	1,280	1,191	1,174	1,151	1,166	1,135	1,115	1,094	1,073	1,031
Savannah	Middle East	Materials	4,038	5,696	4,090	4,091	4,020	3,900	3,772	3,870	4,161	4,504	4,873
Savannah	Middle East	Consumer Goods	294	328	429	429	441	486	517	540	579	602	599
Savannah	Middle East	Chemicals	378	561	416	421	429	454	461	459	452	442	431
Savannah	Middle East	High Technology	53	107	112	115	122	163	201	239	327	438	572
Savannah	Middle East	Intermed. Manufact.	361	493	729	746	761	823	881	929	1,017	1,099	1,173
Savannah	Middle East	Capital Equipment	494	811	516	526	546	676	785	867	1,023	1,169	1,325
Savannah	Middle East	Motor Vehicles	121	51	125	128	135	145	141	139	133	125	115
Savannah	Mediterranean	All Commodities	11,319	16,606	22,422	23,212	23,477	25,991	28,472	31,885	39,772	48,792	58,602
Savannah	Mediterranean	Agriculture	801	2,358	6,130	6,275	6,182	6,805	7,274	7,772	9,021	10,542	12,227
Savannah	Mediterranean	Extractive	0	0	0	0	0	0	0	0	0	0	0
Savannah	Mediterranean	Food	563	2,494	3,586	3,780	3,951	6,185	7,807	9,637	13,388	17,025	20,366
Savannah	Mediterranean	Materials	8,246	8,521	8,195	8,430	8,486	7,051	6,535	6,674	7,332	8,493	10,154
Savannah	Mediterranean	Consumer Goods	374	615	763	805	823	1,018	1,184	1,368	1,782	2,233	2,607
Savannah	Mediterranean	Chemicals	435	930	714	720	726	775	825	880	996	1,128	1,274
Savannah	Mediterranean	High Technology	134	170	266	283	308	367	427	494	651	839	1,068
Savannah	Mediterranean	Intermed. Manufact.	175	466	370	386	393	520	654	777	1,056	1,383	1,770
Savannah	Mediterranean	Capital Equipment	562	486	1,035	1,092	1,126	1,286	1,438	1,574	1,882	2,254	2,706
Savannah	Mediterranean	Motor Vehicles	29	566	1,364	1,441	1,481	1,983	2,327	2,710	3,663	4,894	6,432

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Savannah	North America	All Commodities	2	2	1	1	1	2	2	2	3	4	5
Savannah	North America	Agriculture	0	0	0	0	0	0	0	0	0	0	0
Savannah	North America	Extractive	0	0	0	0	0	0	0	0	0	0	0
Savannah	North America	Food	0	0	0	0	0	0	0	0	0	0	0
Savannah	North America	Materials	0	0	0	0	0	0	0	0	0	0	0
Savannah	North America	Consumer Goods	0	0	0	0	0	0	0	0	0	0	0
Savannah	North America	Chemicals	0	0	0	0	0	0	0	0	0	0	0
Savannah	North America	High Technology	1	2	1	1	1	1	2	2	2	3	4
Savannah	North America	Intermed. Manufact.	0	0	0	0	0	0	0	0	0	0	0
Savannah	North America	Capital Equipment	0	0	0	0	0	0	0	0	0	0	0
Savannah	North America	Motor Vehicles	0	0	0	0	0	0	0	0	0	0	0
Savannah	NE Asia	All Commodities	84,816	91,920	204,634	212,565	213,429	214,163	219,054	237,166	295,356	401,199	588,497
Savannah	NE Asia	Agriculture	4,037	5,582	37,477	40,841	41,293	39,720	39,366	39,932	41,169	42,603	44,188
Savannah	NE Asia	Extractive	0	0	0	0	0	0	0	0	0	0	0
Savannah	NE Asia	Food	6,717	13,584	23,035	23,316	23,295	23,461	20,553	18,932	16,168	13,967	10,373
Savannah	NE Asia	Materials	50,433	45,944	83,801	86,234	83,727	73,055	66,644	68,282	73,821	82,300	91,304
Savannah	NE Asia	Consumer Goods	1,692	1,042	3,528	3,819	4,079	4,798	5,827	7,433	12,960	24,274	46,914
Savannah	NE Asia	Chemicals	11,764	10,957	25,443	25,463	26,343	30,763	35,553	41,797	59,535	88,628	135,667
Savannah	NE Asia	High Technology	3,006	2,602	2,937	3,180	3,423	4,636	6,059	8,008	14,638	28,018	54,913
Savannah	NE Asia	Intermed. Manufact.	3,521	8,629	17,166	17,898	18,819	23,468	29,171	34,654	51,983	83,612	142,235
Savannah	NE Asia	Capital Equipment	3,267	2,246	4,809	5,097	5,439	6,957	8,875	11,329	18,653	31,795	57,328
Savannah	NE Asia	Motor Vehicles	380	1,335	6,438	6,716	7,011	7,305	7,006	6,800	6,427	6,001	5,574
Savannah	North Europe	All Commodities	43,152	57,010	60,032	63,041	64,205	62,577	64,770	69,552	80,566	93,373	106,788
Savannah	North Europe	Agriculture	1,987	3,519	1,400	1,422	1,382	1,293	1,263	1,254	1,262	1,297	1,348
Savannah	North Europe	Extractive	0	0	0	0	0	0	0	0	0	0	0
Savannah	North Europe	Food	1,227	2,294	956	942	906	745	626	547	435	357	297
Savannah	North Europe	Materials	24,970	24,925	31,558	34,075	34,974	28,794	26,962	27,825	29,853	32,390	34,645
Savannah	North Europe	Consumer Goods	783	1,065	1,472	1,523	1,547	1,561	1,560	1,609	1,727	1,833	1,896
Savannah	North Europe	Chemicals	5,630	5,039	8,269	8,034	7,771	7,303	6,785	6,239	5,369	4,580	3,898
Savannah	North Europe	High Technology	2,123	2,564	2,569	2,572	2,634	2,977	3,216	3,519	4,328	5,454	7,085
Savannah	North Europe	Intermed. Manufact.	1,776	3,054	1,481	1,496	1,515	1,624	1,726	1,813	1,989	2,167	2,327
Savannah	North Europe	Capital Equipment	3,288	4,536	5,932	6,192	6,408	6,868	7,191	7,496	8,205	9,029	9,955
Savannah	North Europe	Motor Vehicles	1,369	10,014	6,395	6,787	7,067	11,412	15,442	19,250	27,399	36,265	45,337
Savannah	Oceania	All Commodities	18,734	21,510	23,988	26,211	25,084	26,429	29,978	34,857	46,963	62,478	79,456
Savannah	Oceania	Agriculture	16	31	10	11	10	8	7	6	5	4	4
Savannah	Oceania	Extractive	0	0	0	0	0	0	0	0	0	0	0
Savannah	Oceania	Food	586	742	1,293	1,321	1,317	1,259	1,146	1,058	952	891	836
Savannah	Oceania	Materials	4,640	8,569	8,923	9,989	9,198	8,618	9,779	12,363	19,000	27,747	36,968
Savannah	Oceania	Consumer Goods	274	343	1,156	1,173	1,183	1,224	1,192	1,151	1,072	980	869
Savannah	Oceania	Chemicals	2,125	2,694	2,512	2,652	2,532	2,468	2,504	2,544	2,654	2,783	2,891
Savannah	Oceania	High Technology	373	431	471	488	496	566	624	683	841	1,049	1,315
Savannah	Oceania	Intermed. Manufact.	1,275	2,063	2,557	2,768	2,646	2,944	3,492	4,074	5,576	7,601	10,263
Savannah	Oceania	Capital Equipment	6,096	4,631	5,427	5,961	5,730	6,272	6,881	7,375	8,269	8,995	9,444
Savannah	Oceania	Motor Vehicles	3,348	2,007	1,639	1,846	1,971	3,070	4,353	5,604	8,594	12,428	16,868

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Savannah	Europe, Other	All Commodities	68	483	48	48	49	54	58	62	70	80	90
Savannah	Europe, Other	Agriculture	0	0	0	0	0	0	0	0	0	0	0
Savannah	Europe, Other	Extractive	0	0	0	0	0	0	0	0	0	0	0
Savannah	Europe, Other	Food	0	13	0	0	0	0	0	0	1	1	1
Savannah	Europe, Other	Materials	1	0	1	1	1	1	1	1	1	1	1
Savannah	Europe, Other	Consumer Goods	9	16	0	0	0	0	0	0	0	0	0
Savannah	Europe, Other	Chemicals	4	2	0	0	0	0	0	0	0	0	0
Savannah	Europe, Other	High Technology	8	13	13	13	13	15	17	18	22	26	30
Savannah	Europe, Other	Intermed. Manufact	13	16	2	2	2	2	2	2	1	1	0
Savannah	Europe, Other	Capital Equipment	29	15	27	27	28	28	29	29	31	33	36
Savannah	Europe, Other	Motor Vehicles	2	408	5	5	5	8	10	11	14	18	23
Savannah	SE Asia	All Commodities	10,222	13,551	21,379	23,820	24,311	26,961	30,225	35,523	58,256	119,476	254,497
Savannah	SE Asia	Agriculture	0	0	0	1,892	1,948	2,237	2,432	2,601	3,087	3,876	4,616
Savannah	SE Asia	Extractive	0	0	0	0	0	0	0	0	0	0	0
Savannah	SE Asia	Food	164	1,098	3,917	4,209	4,482	5,803	6,628	7,534	9,645	12,105	14,693
Savannah	SE Asia	Materials	6,957	7,178	8,979	8,796	8,581	7,655	7,182	7,196	7,437	7,926	8,556
Savannah	SE Asia	Consumer Goods	148	579	668	696	718	843	1,002	1,303	2,515	4,551	6,336
Savannah	SE Asia	Chemicals	153	1,013	2,256	2,323	2,395	2,729	3,080	3,599	5,999	12,837	26,506
Savannah	SE Asia	High Technology	1,077	1,021	1,235	1,346	1,453	2,099	3,100	4,807	13,696	40,887	105,168
Savannah	SE Asia	Intermed. Manufact.	277	1,297	2,277	2,355	2,423	2,754	3,145	3,537	4,459	5,515	6,437
Savannah	SE Asia	Capital Equipment	1,352	1,250	1,357	1,442	1,514	1,887	2,400	3,044	5,021	8,477	14,671
Savannah	SE Asia	Motor Vehicles	93	115	690	761	798	954	1,256	1,901	6,398	23,301	67,495
Savannah	West Coast S. America	All Commodities	8,691	5,398	7,090	7,226	7,240	7,896	8,937	10,796	22,190	62,686	168,433
Savannah	West Coast S. America	Agriculture	114	178	1,077	1,078	1,108	1,233	1,312	1,408	1,584	1,759	1,922
Savannah	West Coast S. America	Extractive	0	0	0	0	0	0	0	0	0	0	0
Savannah	West Coast S. America	Food	198	66	691	725	754	937	1,061	1,195	1,469	1,743	1,998
Savannah	West Coast S. America	Materials	4,762	2,626	2,677	2,642	2,531	2,238	2,081	1,958	1,976	2,096	2,244
Savannah	West Coast S. America	Consumer Goods	456	123	76	79	81	92	102	112	133	156	177
Savannah	West Coast S. America	Chemicals	1,038	829	780	809	820	947	1,134	1,414	2,500	4,286	6,199
Savannah	West Coast S. America	High Technology	590	706	687	743	791	1,181	1,861	3,217	12,809	50,702	153,725
Savannah	West Coast S. America	Intermed. Manufact.	1,002	636	752	782	786	851	914	963	1,024	1,023	977
Savannah	West Coast S. America	Capital Equipment	470	152	254	263	264	290	316	342	406	481	560
Savannah	West Coast S. America	Motor Vehicles	62	83	96	105	106	129	155	188	289	441	631

3.82 percent between 2010 and 2015, and growing thereafter at an average annual rate of slightly more than 3 percent between 2015 and 2050. By 2010, the largest trade will be North East Asia (0.594 million TEUs), followed by South East Asia (0.101 million TEUs) and North Europe (0.086 million TEUs). Between 2003 and 2010, total import TEUs from North East Asia will grow nearly two-thirds (0.594/0.365 = 1.63), while total import TEUs from South East Asia will grow nearly one-third (0.101/0.077 = 1.31) and total import TEUs from North Europe will grow 50 percent (0.087/0.059 = 1.46).

The predominant trade regions for Savannah Harbor total export TEUs (Table 24) in 2003 (0.388 million TEUs) are North East Asia (0.204 million TEUs) and North Europe (0.060 million TEUs). The leading commodity groups for Savannah Harbor total export TEUs in 2003 to North East Asia are Materials (0.083 million TEUs) and Agriculture (0.037 million TEUs). The leading commodity group for Savannah Harbor total export TEUs in 2003 to North Europe is Materials (0.031 million TEUs).

Savannah Harbor total export TEUs (all commodities) are expected to grow 4.70 percent between 2003 and 2004 and 0.58 percent between 2004 and 2005, then at an average annual rate of 0.55 percent between 2005 and 2010 and 1.04 percent between 2010 and 2015, and growing thereafter at an average annual rate of 1.97 percent between 2015 and 2020, 2.71 percent between 2020 and 2030, 4.02 percent between 2030 and 2040, and 5.02 percent between 2040 and 2050. As a result of slow growth of export TEUs after 2004, the trade picture will be largely unchanged by 2010 and during ensuing periods. For example, by 2010 the largest trade measured in TEUs will be North East Asia (0.214 million TEUs), followed by North Europe (0.062 million TEUs). Between 2003 and 2010, total export TEUs to North East Asia will grow five percent (0.214/0.204 = 1.05), and total export TEUs to Europe will grow three percent (0.062/0.060 = 1.03).

VII. CONCLUSIONS

Trade in liner-type products through Savannah Harbor has grown strongly over the past three years as new trade lanes were established. The West Coast dock strike and the slower economic growth in the United States contributed to this resurgence. The West Coast strike prompted shippers to diversify cargo destinations.

The recession may have been another factor. In the period when trade grew strongly (late 1990s through mid-2001), demand for a rapid flow of goods from Asia was the greatest. As the economy slowed, the all-water route to the East Coast became a lower-cost and acceptable alternative. This benefited the East Coast ports, especially in the South.

As can be seen in Figure 4, Savannah Harbor is projected to lose export share to Charleston, primarily because of the slow growth forecast for exports of Materials (mainly textiles, but also wood and paper products). Towards the end of the period, the export gap between Savannah and Charleston is expected to be nearly closed. As can be seen in Figure 5, Savannah Harbor is expected to slightly reduce its market share import gap with Charleston. After 2010, growth in TEU imports for Savannah and Charleston is projected to be the same. The gap will persist over the forecast period because Charleston has a larger inflow.

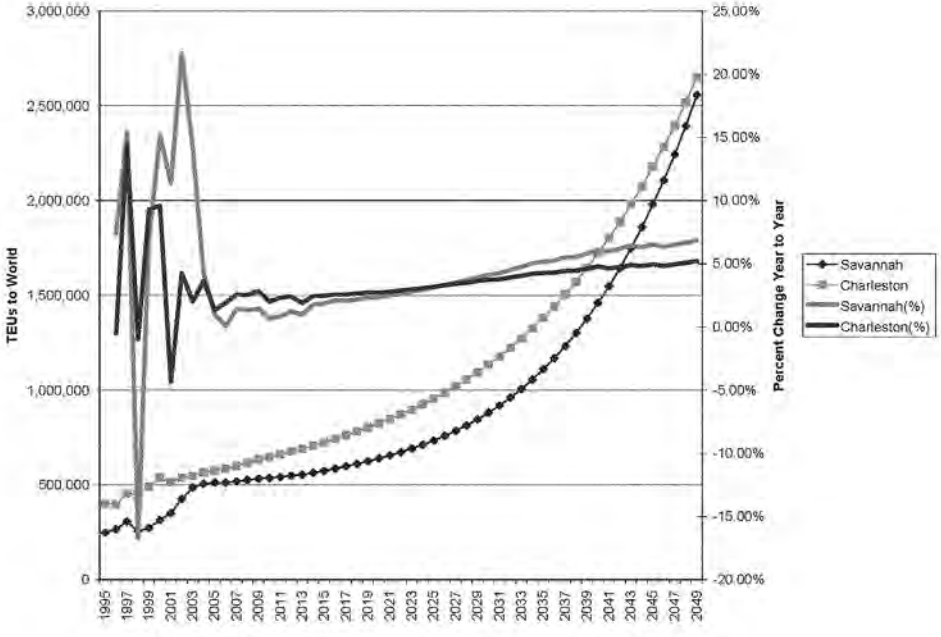

Figure 4. Exports -- Savannah Compared to Charleston

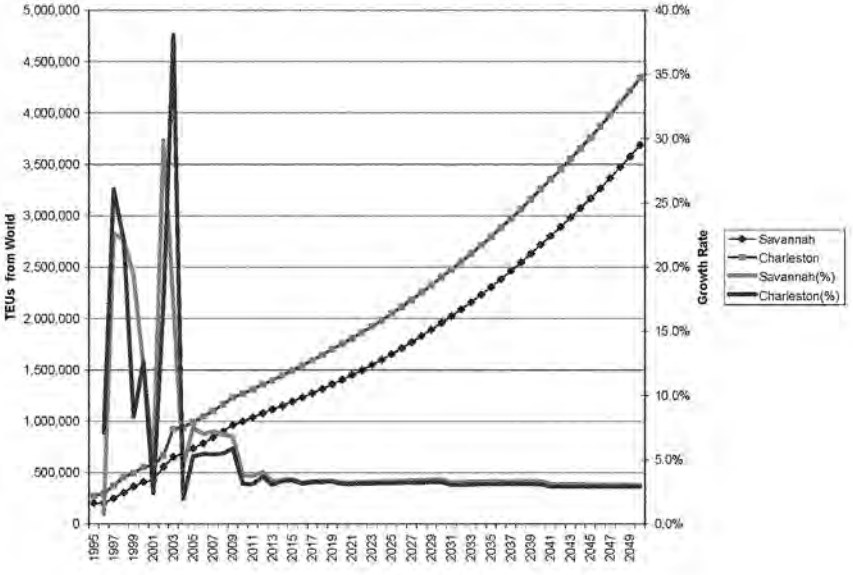

Figure 5. Imports -- Savannah Compared to Charleston

Appendix A

IMPORTS AND EXPORTS TO/FROM U.S. SOUTH ATLANTIC COAST PORTS, BY WORLD TRADE ROUTES

Table A-1. Metric Tonnes of Imports to US South Atlantic Coast Ports and Other Coasts, by World Trade Route, for All Commodities: 1995 - 2050 (selected years)

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	All Commodities	349,618,044	480,643,870	523,345,733	572,541,999	609,407,813	732,752,219	807,862,915	870,072,437	1,028,642,640	1,237,230,419	1,503,326,524
USA	Percent Change	All Commodities	NA	6.57%	2.88%	9.40%	6.44%	3.76%	1.97%	1.49%	1.69%	1.86%	1.97%
Savannah	World	All Commodities	5,584,624	8,605,861	11,107,024	11,896,397	12,662,126	15,399,479	17,335,371	19,362,813	24,908,258	32,474,072	41,380,610
Savannah	Percent Change	All Commodities	NA	9.03%	8.88%	7.11%	6.44%	3.99%	2.40%	2.24%	2.55%	2.69%	2.45%
Savannah	Africa	All Commodities	50,629	53,216	34,740	36,457	37,956	42,317	43,103	43,367	45,321	48,755	53,381
Savannah	Central America	All Commodities	623,681	592,215	1,668,524	1,800,077	1,871,933	2,142,177	2,302,367	2,430,646	2,711,773	3,032,082	3,371,231
Savannah	East Coast S America	All Commodities	1,543,543	2,451,715	2,957,043	3,243,541	3,448,048	3,634,015	3,666,660	3,660,397	3,787,047	4,059,661	4,433,359
Savannah	Eastern Europe	All Commodities	431,784	360,401	249,838	269,329	297,586	479,272	754,779	1,145,930	2,385,923	4,270,839	6,504,645
Savannah	India	All Commodities	38,573	140,771	153,994	163,743	174,548	230,900	274,203	315,670	417,559	543,630	674,498
Savannah	Middle East	All Commodities	9,601	25,607	31,473	34,529	36,807	48,255	57,835	70,297	103,936	152,293	217,628
Savannah	Mediterranean	All Commodities	234,311	382,364	392,276	410,045	450,682	532,561	572,071	619,018	744,713	917,857	1,148,693
Savannah	North America	All Commodities	771,668	712,083	745,632	770,536	760,732	730,113	691,503	659,821	649,153	712,774	863,130
Savannah	NE Asia	All Commodities	999,213	1,858,395	2,747,031	2,925,210	3,202,187	4,584,018	5,632,347	6,745,261	9,569,560	13,169,934	17,160,532
Savannah	North Europe	All Commodities	496,009	1,083,685	1,109,766	1,199,026	1,287,276	1,664,448	1,914,898	2,139,107	2,737,493	3,574,644	4,658,374
Savannah	Oceania	All Commodities	85,347	64,271	178,980	176,305	188,878	246,126	280,178	309,775	385,286	501,259	680,403
Savannah	Europe, Other	All Commodities	9,711	57,208	40,318	38,956	39,496	42,372	43,784	44,570	44,660	42,385	40,191
Savannah	SE Asia	All Commodities	248,912	722,583	639,328	666,594	698,683	823,911	875,821	925,296	1,012,402	1,071,159	1,129,297
Savannah	West Coast S America	All Commodities	41,642	101,347	158,081	162,047	167,315	198,991	225,820	253,658	313,431	376,803	445,248
Charleston	World	All Commodities	4,097,103	7,434,344	9,960,208	10,697,651	11,600,373	15,145,150	17,879,077	20,549,886	27,184,692	35,637,899	45,562,525
Charleston	Percent Change	All Commodities	NA	12.66%	10.24%	7.40%	8.44%	5.48%	3.37%	2.82%	2.84%	2.74%	2.49%
Charleston	Africa	All Commodities	44,346	69,857	139,757	148,828	155,931	181,810	202,183	223,211	277,052	342,400	412,213
Charleston	Central America	All Commodities	38,768	149,217	231,806	251,211	264,712	305,467	334,559	359,608	417,082	486,202	565,545
Charleston	East Coast S America	All Commodities	926,143	1,271,197	2,325,682	2,586,504	2,872,600	3,762,052	4,645,920	5,473,302	7,391,875	9,699,711	12,337,940
Charleston	Eastern Europe	All Commodities	77,151	387,749	578,100	611,610	651,498	875,436	1,105,527	1,386,947	2,242,633	3,486,794	4,933,587
Charleston	India	All Commodities	179,330	236,575	490,609	519,014	545,755	715,461	855,377	980,062	1,287,192	1,657,504	2,052,894
Charleston	Middle East	All Commodities	10,356	21,626	47,713	53,123	56,267	73,463	83,964	99,202	141,652	203,085	281,869
Charleston	Mediterranean	All Commodities	312,625	551,096	615,208	684,556	767,986	1,051,037	1,239,923	1,432,974	1,905,965	2,517,733	3,290,967
Charleston	North America	All Commodities	319,254	409,909	287,956	294,242	286,193	261,187	234,319	210,846	185,566	186,451	213,392
Charleston	NE Asia	All Commodities	484,284	942,972	1,177,619	1,248,655	1,359,378	1,939,860	2,391,375	2,871,599	4,112,131	5,749,637	7,691,269
Charleston	North Europe	All Commodities	1,085,060	1,949,477	2,262,347	2,408,307	2,592,197	3,277,009	3,730,334	4,163,245	5,323,561	6,979,599	9,201,662
Charleston	Oceania	All Commodities	290,230	171,046	498,321	483,504	501,561	632,687	724,924	788,773	925,951	1,087,938	1,286,671
Charleston	Europe, Other	All Commodities	33,707	89,253	146,284	146,285	151,337	177,810	199,227	220,184	268,883	321,444	371,479
Charleston	SE Asia	All Commodities	227,697	740,122	276,519	286,495	298,293	354,452	382,835	411,816	469,842	522,228	575,029
Charleston	West Coast S America	All Commodities	68,153	444,248	882,286	975,319	1,096,664	1,537,419	1,748,609	1,928,117	2,235,308	2,397,172	2,348,010

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Jacksonville	World	All Commodities	9,061,850	14,263,647	18,204,602	19,497,047	20,494,894	24,079,236	27,153,394	30,630,275	40,439,603	54,232,906	70,450,496
Jacksonville	Percent Change	All Commodities	NA	9.50%	8.47%	7.10%	5.12%	3.28%	2.43%	2.44%	2.82%	2.98%	2.65%
Jacksonville	Africa	All Commodities	25,292	81,508	92,174	102,796	107,347	105,763	109,135	115,034	133,165	161,332	199,183
Jacksonville	Central America	All Commodities	2,539,743	2,898,715	4,039,526	4,388,739	4,568,814	5,182,920	5,622,769	5,979,947	6,786,965	7,698,729	8,654,290
Jacksonville	East Coast S America	All Commodities	1,597,217	3,048,714	3,768,209	4,113,020	4,381,657	5,385,628	6,159,684	6,893,666	8,700,876	11,192,200	14,431,770
Jacksonville	Eastern Europe	All Commodities	784,809	839,880	1,105,694	1,204,662	1,340,680	2,173,088	3,497,107	5,449,423	11,606,722	20,941,315	31,987,532
Jacksonville	India	All Commodities	5,297	7,606	45,885	52,820	61,141	100,667	137,411	177,971	286,944	442,998	644,974
Jacksonville	Middle East	All Commodities	2,299	2,101	3,509	3,692	3,963	5,795	8,391	11,844	21,465	35,582	54,838
Jacksonville	Mediterranean	All Commodities	330,168	218,985	565,752	630,050	700,286	865,965	964,457	1,056,980	1,259,373	1,492,763	1,766,011
Jacksonville	North America	All Commodities	961,050	2,148,726	2,778,415	2,878,973	2,809,147	2,579,958	2,296,029	2,003,544	1,632,755	1,491,605	1,545,815
Jacksonville	NE Asia	All Commodities	451,961	799,965	723,941	772,383	836,977	1,186,682	1,458,956	1,740,898	2,418,572	3,250,043	4,180,473
Jacksonville	North Europe	All Commodities	714,520	885,531	1,307,199	1,355,225	1,394,275	1,506,002	1,545,594	1,555,573	1,574,304	1,599,366	1,638,546
Jacksonville	Oceania	All Commodities	36,087	25,071	36,939	34,861	34,748	38,781	41,769	44,827	50,222	56,623	64,263
Jacksonville	Europe, Other	All Commodities	862	8,257	53,896	54,403	59,084	80,504	104,666	127,169	180,055	243,309	317,460
Jacksonville	SE Asia	All Commodities	66,904	743,314	177,147	189,268	211,864	331,622	384,301	432,447	499,625	507,292	474,134
Jacksonville	West Coast S America	All Commodities	1,544,741	2,555,275	3,506,317	3,716,156	3,984,913	4,555,862	4,823,126	5,041,250	5,288,560	5,119,750	4,491,206
Miami	World	All Commodities	5,270,237	7,275,991	8,966,361	9,662,011	10,439,979	13,257,224	15,496,766	17,811,726	24,200,574	33,310,833	44,912,039
Miami	Percent Change	All Commodities	NA	6.66%	7.21%	7.76%	8.05%	4.89%	3.17%	2.82%	3.11%	3.25%	3.03%
Miami	Africa	All Commodities	2,515	16,262	33,651	36,689	38,587	41,694	45,901	50,330	59,261	70,009	83,815
Miami	Central America	All Commodities	832,674	1,001,291	1,156,259	1,209,140	1,254,480	1,403,495	1,542,416	1,669,493	1,982,267	2,370,156	2,860,244
Miami	East Coast S America	All Commodities	2,447,231	1,953,677	2,080,257	2,149,540	2,198,126	2,282,039	2,348,938	2,408,935	2,529,584	2,652,188	2,762,303
Miami	Eastern Europe	All Commodities	7,269	106,878	317,477	348,742	394,792	699,969	1,170,686	1,828,000	3,961,822	7,270,939	11,210,943
Miami	India	All Commodities	16,519	31,223	45,542	48,834	52,239	70,212	84,516	97,894	133,435	179,464	229,167
Miami	Middle East	All Commodities	7,809	6,279	12,143	12,983	13,833	16,954	20,136	24,442	36,683	55,157	81,070
Miami	Mediterranean	All Commodities	494,473	1,175,247	1,639,416	1,853,749	2,116,269	2,912,114	3,354,847	3,797,179	4,862,464	6,234,882	8,000,562
Miami	North America	All Commodities	34,000	62,450	135,135	141,489	142,089	148,287	150,310	153,938	154,616	152,215	143,354
Miami	NE Asia	All Commodities	269,852	470,200	715,012	756,794	826,601	1,195,572	1,522,268	1,868,216	2,751,271	3,898,307	5,260,880
Miami	North Europe	All Commodities	639,877	1,665,034	1,964,503	2,198,323	2,458,632	3,370,567	4,023,399	4,574,946	6,201,234	8,766,979	12,525,333
Miami	Oceania	All Commodities	605	4,779	28,688	29,101	30,632	39,409	51,160	64,323	97,890	142,972	200,055
Miami	Europe, Other	All Commodities	4,955	19,486	32,682	35,692	39,635	35,528	35,417	35,975	37,714	39,229	40,572
Miami	SE Asia	All Commodities	101,556	240,224	201,691	210,408	218,728	255,309	271,844	290,830	328,694	362,772	396,979
Miami	West Coast S America	All Commodities	411,093	522,961	603,906	630,527	655,339	786,073	874,929	947,226	1,063,638	1,113,563	1,116,761
Wilmington	World	All Commodities	2,448,975	2,437,581	2,854,866	3,121,860	3,347,959	4,506,198	5,842,877	7,516,245	12,963,526	22,585,840	37,475,137
Wilmington	Percent Change	All Commodities	NA	-0.09%	5.41%	9.35%	7.24%	6.12%	5.33%	5.17%	5.60%	5.71%	5.19%
Wilmington	Africa	All Commodities	28,601	24,335	28,852	30,834	31,717	31,550	30,014	30,956	38,311	52,491	74,152
Wilmington	Central America	All Commodities	380,484	238,121	138,826	157,329	168,634	217,262	275,815	345,046	548,618	894,645	1,509,668
Wilmington	East Coast S America	All Commodities	605,888	240,126	899,526	1,001,891	1,070,253	1,342,087	1,646,759	2,007,195	3,016,770	4,602,478	7,105,474
Wilmington	Eastern Europe	All Commodities	164,241	250,333	289,704	312,809	336,798	447,806	560,256	666,537	870,156	969,800	979,208
Wilmington	India	All Commodities	13,557	48,869	4,335	4,703	5,170	7,478	9,797	11,212	19,001	33,819	62,714
Wilmington	Middle East	All Commodities	4,089	10,090	10,228	11,525	12,821	20,231	29,741	42,224	77,117	128,456	198,596
Wilmington	Mediterranean	All Commodities	96,595	174,962	68,789	67,828	69,884	71,174	74,247	83,420	126,430	222,423	417,278
Wilmington	North America	All Commodities	516,426	347,643	270,304	287,149	290,682	317,731	335,048	349,430	386,186	430,929	484,086
Wilmington	NE Asia	All Commodities	252,357	477,745	449,931	480,442	525,857	785,635	1,023,641	1,378,091	1,929,904	2,796,034	3,892,758
Wilmington	North Europe	All Commodities	244,235	316,567	323,385	348,379	367,790	495,908	624,603	737,238	990,011	1,228,507	1,426,945
Wilmington	Oceania	All Commodities	10,855	566	508	539	610	1,008	1,342	1,750	3,015	5,279	9,324
Wilmington	Europe, Other	All Commodities	4,857	213	10,756	11,466	13,092	22,860	38,249	61,771	146,131	298,946	566,416
Wilmington	SE Asia	All Commodities	74,474	198,467	154,501	165,828	178,173	237,941	300,800	375,370	608,155	963,366	1,471,220
Wilmington	West Coast S America	All Commodities	52,316	109,543	205,221	241,077	276,471	507,526	892,567	1,526,005	4,203,722	9,958,666	19,277,296

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Norfolk	World	All Commodities	6,994,318	8,322,228	9,433,485	10,131,565	10,780,474	13,627,474	15,536,302	17,292,126	21,422,507	26,272,184	31,878,838
Norfolk	Percent Change	All Commodities	NA	3.54%	4.27%	7.40%	6.40%	4.80%	2.66%	2.16%	2.17%	2.06%	1.95%
Norfolk	Africa	All Commodities	99,800	72,888	83,974	86,880	90,776	105,438	112,564	119,400	137,579	160,771	187,574
Norfolk	Central America	All Commodities	350,015	173,886	102,863	111,829	116,437	129,048	135,445	138,625	147,150	158,985	175,384
Norfolk	East Coast S America	All Commodities	2,160,946	1,205,440	2,146,842	2,370,197	2,508,878	3,065,412	3,405,866	3,678,272	4,187,982	4,573,793	4,860,650
Norfolk	Eastern Europe	All Commodities	217,077	765,335	726,490	761,833	802,113	988,958	1,129,057	1,232,285	1,423,467	1,611,533	1,917,888
Norfolk	India	All Commodities	84,361	171,711	315,088	328,333	341,144	427,991	495,671	545,564	708,125	910,585	1,129,265
Norfolk	Middle East	All Commodities	6,262	15,499	23,128	25,421	26,747	33,676	36,027	39,892	49,419	61,307	74,690
Norfolk	Mediterranean	All Commodities	870,389	792,620	422,672	451,173	482,944	565,361	615,268	660,590	758,942	859,107	956,596
Norfolk	North America	All Commodities	524,235	1,335,219	1,476,153	1,648,882	1,759,909	2,392,232	2,877,566	3,340,790	4,531,116	6,190,357	8,435,852
Norfolk	NE Asia	All Commodities	320,325	699,201	1,283,559	1,357,248	1,496,083	2,205,526	2,649,452	3,120,563	4,284,839	5,651,261	7,034,729
Norfolk	North Europe	All Commodities	1,405,009	2,070,001	1,867,633	1,964,191	2,073,303	2,384,108	2,577,689	2,737,528	3,088,186	3,480,671	3,919,956
Norfolk	Oceania	All Commodities	37,125	87,903	85,253	83,357	89,357	121,371	137,679	152,078	185,398	222,051	259,392
Norfolk	Europe, Other	All Commodities	23,326	41,474	60,823	61,182	63,011	66,730	71,550	76,790	89,278	102,402	115,037
Norfolk	SE Asia	All Commodities	287,150	433,543	439,407	460,931	488,395	607,076	678,771	760,125	964,617	1,226,387	1,527,611
Norfolk	West Coast S America	All Commodities	698,298	457,507	399,601	420,109	441,377	534,546	613,757	689,623	866,408	1,062,974	1,283,414
Other N Atlantic	World	All Commodities	70,489,654	97,532,863	116,408,329	128,349,493	136,058,556	162,839,330	179,056,054	192,105,162	223,766,727	263,367,006	313,969,208
Other N Atlantic	Percent Change	All Commodities	NA	6.71%	6.07%	10.26%	6.01%	3.66%	1.92%	1.42%	1.54%	1.64%	1.77%
Other N Atlantic	Africa	All Commodities	8,254,710	7,286,306	8,517,286	9,795,179	10,681,673	13,516,639	14,258,748	14,622,853	15,381,210	16,828,537	18,326,914
Other N Atlantic	Central America	All Commodities	4,396,868	6,926,136	10,789,997	12,563,052	13,176,138	15,036,782	15,348,263	15,210,090	15,064,888	15,146,905	15,717,244
Other N Atlantic	East Coast S America	All Commodities	19,533,066	24,582,522	20,298,181	22,635,865	24,342,050	29,822,259	34,107,482	37,981,170	47,741,624	61,021,054	79,027,366
Other N Atlantic	Eastern Europe	All Commodities	1,418,390	5,772,634	8,821,535	9,859,611	10,414,524	12,467,183	13,892,917	14,789,066	15,792,158	15,920,834	16,889,006
Other N Atlantic	India	All Commodities	461,364	1,164,090	2,037,054	2,239,948	2,396,703	3,223,311	3,881,132	4,468,929	6,014,427	7,970,894	10,222,148
Other N Atlantic	Middle East	All Commodities	120,627	155,636	200,848	217,114	229,353	279,124	295,654	314,535	353,461	397,070	449,653
Other N Atlantic	Mediterranean	All Commodities	2,674,018	3,611,941	3,733,817	4,074,731	4,408,509	5,171,282	5,553,004	5,865,303	6,632,938	7,602,161	8,840,487
Other N Atlantic	North America	All Commodities	11,287,328	15,883,865	21,127,065	23,773,694	25,024,205	30,030,052	33,620,180	36,494,332	42,945,883	51,075,773	61,968,402
Other N Atlantic	NE Asia	All Commodities	4,089,421	4,500,008	5,923,700	6,261,758	6,866,681	9,598,083	11,389,342	13,063,480	16,951,602	21,075,832	24,546,670
Other N Atlantic	North Europe	All Commodities	8,045,170	15,005,898	17,520,521	19,067,090	20,124,260	23,540,380	25,765,044	27,721,529	33,594,511	41,862,678	52,458,546
Other N Atlantic	Oceania	All Commodities	1,485,281	1,105,142	1,240,692	1,237,897	1,352,942	1,931,754	2,196,597	2,451,238	3,064,161	3,768,583	4,497,186
Other N Atlantic	Europe, Other	All Commodities	72,829	185,367	282,709	292,039	309,701	349,384	375,594	401,784	473,717	568,734	683,700
Other N Atlantic	SE Asia	All Commodities	2,348,233	2,940,116	3,776,008	3,892,791	4,108,307	4,381,117	4,345,501	4,341,516	4,533,682	4,874,724	5,306,777
Other N Atlantic	West Coast S America	All Commodities	5,702,349	8,413,201	12,138,914	12,438,743	12,623,507	13,491,979	14,026,597	14,379,338	15,022,464	15,253,228	15,026,106
Gulf Coast	World	All Commodities	169,360,761	219,075,383	227,760,201	251,742,121	268,687,425	315,463,494	338,211,664	351,341,992	382,280,584	417,884,012	457,682,219
Gulf Coast	Percent Change	All Commodities	NA	5.28%	1.30%	10.53%	6.73%	3.26%	1.40%	0.76%	0.85%	0.89%	0.91%
Gulf Coast	Africa	All Commodities	9,213,839	10,928,539	12,568,896	14,518,852	15,860,678	19,977,089	21,114,919	21,616,052	23,159,278	25,179,472	27,658,032
Gulf Coast	Central America	All Commodities	52,917,087	68,997,294	79,872,280	89,099,515	94,214,187	108,783,930	115,637,196	119,052,899	127,908,838	138,580,650	150,180,002
Gulf Coast	East Coast S America	All Commodities	67,998,161	72,169,500	72,191,582	80,181,487	85,798,263	99,159,011	104,668,115	106,804,332	112,378,015	119,480,398	127,473,875
Gulf Coast	Eastern Europe	All Commodities	5,275,897	10,199,769	14,832,819	16,084,572	17,002,549	20,182,465	21,925,310	22,823,920	23,479,791	22,983,898	22,403,583
Gulf Coast	India	All Commodities	649,833	1,485,554	709,643	766,983	818,338	1,114,771	1,307,017	1,468,447	1,886,477	2,414,931	3,028,773
Gulf Coast	Middle East	All Commodities	174,248	220,375	184,595	194,029	204,818	246,958	270,055	287,898	323,138	354,935	385,430
Gulf Coast	Mediterranean	All Commodities	2,922,647	4,277,478	3,156,208	3,431,183	3,768,119	4,832,101	5,835,981	6,862,296	9,535,054	13,226,349	18,123,771
Gulf Coast	North America	All Commodities	2,751,938	2,647,087	3,122,938	3,484,569	3,630,699	4,085,714	4,126,847	4,085,284	4,117,865	4,327,449	4,762,309
Gulf Coast	NE Asia	All Commodities	5,038,945	8,778,445	6,873,904	7,215,996	7,797,304	10,016,878	11,651,827	13,114,980	16,508,872	20,383,699	24,507,301
Gulf Coast	North Europe	All Commodities	5,621,711	11,178,980	10,993,012	11,650,685	12,080,403	13,697,671	14,719,117	15,613,891	18,425,568	22,700,399	28,664,401
Gulf Coast	Oceania	All Commodities	999,627	1,831,242	1,100,776	1,217,566	1,353,417	1,858,824	2,091,007	2,258,619	2,566,822	2,790,514	2,922,599
Gulf Coast	Europe, Other	All Commodities	60,989	133,170	207,323	224,045	246,176	319,861	393,331	462,128	644,473	897,812	1,212,671
Gulf Coast	SE Asia	All Commodities	2,782,362	5,389,275	2,996,066	3,254,429	3,578,488	4,875,772	5,237,416	5,429,493	5,516,617	5,090,474	4,507,691
Gulf Coast	West Coast S America	All Commodities	12,953,476	20,388,676	18,950,158	20,418,209	22,333,986	26,312,470	29,233,528	31,461,754	35,829,777	39,473,034	41,851,780

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
South Pacific	World	All Commodities	30,906,458	59,455,989	63,563,274	68,291,377	73,216,821	93,092,955	105,363,653	116,376,480	142,655,692	173,630,179	207,249,181
South Pacific	Percent Change	All Commodities	NA	13.98%	2.25%	7.44%	7.21%	4.92%	2.51%	2.01%	2.06%	1.98%	1.79%
South Pacific	Africa	All Commodities	47,474	68,144	413,530	472,966	515,633	645,127	694,197	710,219	756,610	814,532	874,269
South Pacific	Central America	All Commodities	1,845,982	4,184,783	4,541,156	5,207,444	5,535,445	6,998,933	8,177,294	9,265,980	12,139,108	16,204,380	21,947,177
South Pacific	East Coast S America	All Commodities	3,480,712	3,717,821	3,275,388	3,593,339	3,837,565	4,525,262	4,954,928	5,160,340	5,641,705	6,222,243	6,980,725
South Pacific	Eastern Europe	All Commodities	160,191	287,191	506,096	534,764	566,688	714,304	816,937	914,521	1,154,072	1,470,380	1,945,111
South Pacific	India	All Commodities	546,626	877,934	973,349	1,026,190	1,077,951	1,339,926	1,529,749	1,688,102	2,136,330	2,719,171	3,423,462
South Pacific	Middle East	All Commodities	43,866	186,252	139,461	149,543	161,354	213,616	254,888	298,836	401,341	530,615	690,621
South Pacific	Mediterranean	All Commodities	202,621	453,175	536,907	596,651	666,737	894,443	1,063,520	1,242,784	1,713,694	2,393,782	3,363,123
South Pacific	North America	All Commodities	1,586,481	1,944,365	3,078,254	3,349,321	3,406,577	3,745,993	4,043,814	4,380,999	5,379,830	6,914,841	9,179,686
South Pacific	NE Asia	All Commodities	14,185,233	28,163,616	30,201,156	31,907,189	34,578,511	46,722,209	55,057,500	63,167,822	82,286,652	103,877,282	124,198,797
South Pacific	North Europe	All Commodities	1,545,702	2,681,421	2,347,220	2,513,098	2,699,349	3,379,848	3,887,445	4,390,486	5,678,140	7,369,408	9,342,508
South Pacific	Oceania	All Commodities	817,036	2,486,638	2,398,074	2,513,230	2,704,653	3,240,062	3,227,768	3,079,686	2,818,473	2,621,097	2,532,544
South Pacific	Europe, Other	All Commodities	21,175	46,156	87,519	96,065	107,629	112,861	124,356	136,987	167,246	199,766	227,455
South Pacific	SE Asia	All Commodities	3,420,345	8,175,876	7,612,456	8,080,914	8,679,155	10,906,077	11,748,908	12,337,655	13,151,711	13,593,791	14,261,315
South Pacific	West Coast S America	All Commodities	3,003,013	6,182,616	7,452,707	8,250,664	8,679,574	9,653,305	9,782,350	9,602,562	9,235,782	8,698,891	8,082,389
North Pacific	World	All Commodities	13,841,574	18,430,292	17,645,139	19,162,480	20,695,134	27,302,737	32,825,493	38,466,398	52,944,216	71,063,242	91,314,456
North Pacific	Percent Change	All Commodities	NA	5.89%	-1.44%	8.60%	8.00%	5.70%	3.75%	3.22%	3.25%	2.99%	2.54%
North Pacific	Africa	All Commodities	1,073	11,303	22,632	24,706	26,823	30,144	29,920	29,708	32,483	36,063	36,524
North Pacific	East Coast S America	All Commodities	395,004	1,339,253	1,942,712	2,162,797	2,319,664	2,738,519	2,903,080	2,958,044	3,184,704	3,550,181	4,024,083
North Pacific	Eastern Europe	All Commodities	21,756	153,184	152,766	156,363	165,441	206,480	231,986	247,048	265,679	265,808	269,747
North Pacific	India	All Commodities	228,626	257,901	154,834	168,781	178,990	233,388	282,560	334,340	485,227	689,722	909,948
North Pacific	Middle East	All Commodities	815	12,154	9,349	10,121	10,834	13,757	15,300	16,794	19,459	22,631	26,709
North Pacific	Mediterranean	All Commodities	10,923	11,987	17,447	18,856	20,718	28,848	35,974	43,382	63,153	90,874	128,042
North Pacific	North America	All Commodities	3,188,164	4,154,008	4,519,527	4,928,702	5,192,362	5,890,247	6,532,623	7,173,233	8,706,455	10,665,303	13,132,858
North Pacific	NE Asia	All Commodities	4,738,333	6,329,380	7,896,675	8,510,617	9,335,432	13,483,816	16,868,137	20,424,795	29,574,651	40,747,509	52,003,747
North Pacific	North Europe	All Commodities	93,786	162,468	174,507	188,245	204,395	262,555	308,499	358,231	497,587	701,200	989,983
North Pacific	Oceania	All Commodities	2,654,944	3,234,950	767,501	836,893	935,941	1,419,647	2,019,779	2,685,444	4,474,270	6,831,296	9,913,109
North Pacific	Europe, Other	All Commodities	723	5,350	1,211	1,281	1,406	1,826	2,226	2,599	3,577	4,851	6,365
North Pacific	SE Asia	All Commodities	929,971	1,178,182	831,213	873,718	940,195	1,233,187	1,371,686	1,493,134	1,680,330	1,702,192	1,613,492
North Pacific	West Coast S America	All Commodities	365,954	193,254	104,537	107,886	111,842	135,567	150,543	162,841	185,683	203,854	218,984
Alaska	World	All Commodities	603,667	1,253,731	1,013,847	1,118,397	1,218,720	1,809,025	2,554,086	3,623,504	7,830,756	17,626,301	38,574,272
Alaska	Percent Change	All Commodities	NA	15.74%	-6.83%	10.31%	8.97%	8.22%	7.14%	7.25%	8.01%	8.45%	8.15%
Alaska	Africa	All Commodities	14	15	45	52	59	98	126	157	238	348	495
Alaska	Central America	All Commodities	32,604	5,385	12,773	15,227	17,466	31,209	51,625	83,272	219,186	582,887	1,549,805
Alaska	East Coast S America	All Commodities	240	642	1,353	1,518	1,703	2,664	3,616	4,746	7,866	12,588	19,501
Alaska	Eastern Europe	All Commodities	1,796	70,098	132,921	143,179	146,767	142,452	123,500	103,102	75,274	54,664	38,668
Alaska	India	All Commodities	241	502	755	852	974	1,630	2,254	3,167	7,033	18,803	57,253
Alaska	Middle East	All Commodities	129	268	257	286	319	486	595	712	998	1,370	1,850
Alaska	Mediterranean	All Commodities	160	437	546	621	706	1,149	1,466	1,811	2,683	3,868	5,453
Alaska	North America	All Commodities	198,595	156,406	289,116	323,813	342,666	430,019	524,990	633,147	924,418	1,378,969	2,111,499
Alaska	NE Asia	All Commodities	212,552	391,222	471,422	525,258	597,486	1,068,821	1,705,741	2,641,156	6,406,345	15,338,507	34,495,681
Alaska	North Europe	All Commodities	6,227	5,970	8,471	8,885	9,833	14,930	19,041	23,699	35,832	52,001	72,629
Alaska	Oceania	All Commodities	118	346,291	35,421	36,492	37,610	35,105	29,989	24,555	16,233	10,850	8,171
Alaska	Europe, Other	All Commodities	30	210	61	63	71	110	142	177	263	377	524
Alaska	SE Asia	All Commodities	150,954	270,976	60,658	62,095	63,594	80,249	90,866	105,632	134,119	170,636	212,143
Alaska	West Coast S America	All Commodities	7	5,311	49	56	64	104	135	171	266	404	600

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Hawaii	World	All Commodities	5,370,606	6,389,349	6,003,571	6,465,710	6,913,556	8,734,781	10,413,272	12,367,443	18,625,637	29,067,376	44,313,899
Hawaii	Percent Change	All Commodities	NA	3.53%	-2.05%	7.70%	6.93%	4.79%	3.58%	3.50%	4.18%	4.55%	4.31%
Hawaii	Africa	All Commodities	10,022	49	38,945	45,078	49,355	63,516	67,452	69,541	74,990	82,479	92,773
Hawaii	Central America	All Commodities	2,879	2,646	4,039	4,274	4,615	6,129	7,687	9,516	14,719	23,064	36,556
Hawaii	East Coast S America	All Commodities	28,775	111,460	214,036	237,686	253,737	305,439	355,951	409,403	542,177	718,892	957,455
Hawaii	Eastern Europe	All Commodities	135	772	98,476	117,121	131,714	199,449	259,413	312,066	435,094	582,999	767,295
Hawaii	India	All Commodities	637	866	2,569	3,008	3,500	6,976	12,588	22,520	76,529	267,160	922,047
Hawaii	Middle East	All Commodities	343	268	363	406	454	690	868	1,069	1,602	2,399	3,618
Hawaii	Mediterranean	All Commodities	211	557	1,438	1,642	1,874	2,938	4,027	5,433	9,901	18,173	33,641
Hawaii	North America	All Commodities	47,746	80,238	25,377	27,129	28,156	24,867	18,780	13,771	7,348	4,121	2,718
Hawaii	NE Asia	All Commodities	330,751	2,293,452	1,058,916	1,069,823	1,102,229	1,289,047	1,451,604	1,635,304	2,160,967	3,004,505	4,434,137
Hawaii	North Europe	All Commodities	6,346	12,113	16,690	17,527	18,881	26,552	31,988	38,282	56,746	86,978	136,960
Hawaii	Oceania	All Commodities	1,187,056	1,009,067	677,810	699,655	711,967	688,957	603,729	509,503	372,826	315,748	369,178
Hawaii	Europe, Other	All Commodities	30	210	63	65	73	113	146	181	271	391	551
Hawaii	SE Asia	All Commodities	3,755,645	2,877,592	3,777,242	4,144,608	4,499,546	5,949,647	7,338,055	8,949,043	13,996,348	22,035,638	32,438,695
Hawaii	West Coast S America	All Commodities	30	59	87,606	97,688	107,455	170,461	260,983	391,810	876,117	1,924,829	4,118,274

Table A-2. Metric Tonnes of Imports to US South Atlantic Coast Ports and Other Coasts, by World Trade Route, for Commodity Groups: 1995 - 2050 (selected years)

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	Agriculture	5,999,299	7,778,296	9,429,127	9,899,717	10,437,875	11,681,153	12,744,425	13,250,701	15,424,517	17,933,671	20,676,856
Savannah	World	Agriculture	176,904	274,038	268,727	274,602	284,521	296,984	294,686	275,594	251,963	221,236	185,373
Charleston	World	Agriculture	147,297	342,436	280,576	281,585	288,810	303,308	300,022	276,485	255,184	226,977	194,638
Jacksonville	World	Agriculture	211,679	297,776	452,977	457,233	465,898	468,278	460,652	428,591	382,196	331,674	275,429
Miami	World	Agriculture	197,522	285,040	312,376	320,946	329,989	331,416	332,774	317,648	297,880	272,556	243,096
Wilmington	World	Agriculture	45,999	76,957	274,965	307,227	337,777	518,817	722,464	919,890	1,461,103	2,159,064	3,022,789
Norfolk	World	Agriculture	177,805	295,741	290,975	291,213	297,077	304,593	306,965	279,358	280,842	278,375	265,947
Other N Atlantic	World	Agriculture	1,179,184	1,739,280	2,106,602	2,144,090	2,217,053	2,364,219	2,480,500	2,431,023	2,655,871	2,903,410	3,113,548
Gulf Coast	World	Agriculture	750,093	1,152,408	1,669,583	1,682,008	1,700,145	1,677,860	1,595,079	1,432,374	1,229,460	1,060,100	890,723
South Pacific	World	Agriculture	916,591	1,427,205	1,352,713	1,399,581	1,473,342	1,612,799	1,730,013	1,718,503	1,978,180	2,296,190	2,684,005
North Pacific	World	Agriculture	533,080	1,097,935	1,728,496	1,988,679	2,246,790	2,874,545	3,501,101	4,067,674	5,273,674	6,540,619	7,872,219
Alaska	World	Agriculture	44,784	2,680	11,802	13,941	15,987	23,251	28,872	34,695	48,684	66,807	90,618
Hawaii	World	Agriculture	18,645	31,562	31,743	33,852	35,542	35,509	34,051	34,289	50,661	93,634	178,518
USA	World	Extractive	209,154,448	255,099,784	289,104,040	318,547,504	336,399,477	386,913,966	405,396,057	413,282,149	435,193,646	464,041,603	498,904,389
Savannah	World	Extractive	2,161,641	3,206,572	3,889,549	4,174,183	4,353,165	4,398,714	4,226,690	4,015,650	3,774,166	3,700,227	3,712,024
Charleston	World	Extractive	1,064,998	761,366	859,333	891,063	908,977	887,014	834,717	784,186	730,857	721,221	734,330
Jacksonville	World	Extractive	3,820,992	5,595,928	7,975,970	8,354,643	8,483,574	8,581,962	8,476,118	8,297,174	8,177,787	8,285,059	8,466,951
Miami	World	Extractive	348,169	198,187	355,457	373,552	396,389	383,084	345,773	308,895	262,153	237,916	223,821
Wilmington	World	Extractive	754,629	646,816	796,612	863,163	903,662	1,041,472	1,160,982	1,283,790	1,589,606	1,981,443	2,474,297
Norfolk	World	Extractive	2,541,679	2,232,857	2,708,062	2,985,727	3,164,598	3,930,992	4,440,187	4,894,809	6,064,013	7,684,117	9,831,834
Other N Atlantic	World	Extractive	32,561,555	37,058,317	46,402,430	51,296,946	53,904,879	62,990,742	66,308,879	68,425,230	74,173,095	81,972,801	91,755,266
Gulf Coast	World	Extractive	135,531,522	162,297,513	178,730,502	198,268,228	211,236,695	244,461,571	255,878,197	259,426,997	268,882,337	280,055,968	290,848,494
South Pacific	World	Extractive	6,088,941	12,324,409	14,642,823	16,387,231	17,185,298	19,530,068	20,003,984	19,850,336	20,220,421	21,327,331	23,357,103
North Pacific	World	Extractive	4,049,466	5,597,184	4,838,834	5,148,627	5,238,875	5,554,086	5,543,711	5,462,700	5,591,283	6,087,539	6,965,083
Alaska	World	Extractive	88,096	510,228	227,372	247,085	256,609	291,766	322,268	372,552	614,121	1,201,050	2,570,389
Hawaii	World	Extractive	4,774,735	5,152,384	4,963,830	5,328,635	5,640,664	6,578,035	7,219,205	7,677,686	8,689,492	10,224,810	12,996,688
USA	World	Food	9,958,964	12,810,495	15,739,953	16,241,100	17,365,077	20,224,264	21,378,370	22,571,247	25,007,051	27,425,506	29,792,182
Savannah	World	Food	319,981	446,358	773,677	792,643	829,193	992,831	1,115,003	1,250,988	1,557,770	1,922,017	2,364,436
Charleston	World	Food	202,590	323,589	366,232	385,934	417,682	462,700	488,059	519,154	589,811	667,172	751,141
Jacksonville	World	Food	176,342	159,819	202,397	215,089	228,960	295,681	347,736	400,908	513,380	635,489	767,304
Miami	World	Food	352,300	597,903	847,260	903,952	979,644	1,110,169	1,199,170	1,306,329	1,545,420	1,802,306	2,075,450
Wilmington	World	Food	44,007	117,983	85,401	88,458	93,170	112,813	128,132	147,289	204,299	302,167	473,529
Norfolk	World	Food	563,686	698,943	827,978	853,831	896,538	995,746	1,031,446	1,066,467	1,133,311	1,190,230	1,229,130
Other N Atlantic	World	Food	4,139,025	5,312,158	6,176,318	6,460,116	7,022,363	8,271,066	8,679,063	9,081,426	9,845,698	10,460,112	10,814,864
Gulf Coast	World	Food	1,508,346	1,247,940	1,846,736	1,929,224	2,043,895	2,396,375	2,551,681	2,690,557	2,946,169	3,168,856	3,348,342
South Pacific	World	Food	2,188,219	3,470,032	4,182,592	4,183,982	4,400,052	5,046,829	5,252,816	5,467,462	5,866,082	6,157,408	6,250,347
North Pacific	World	Food	368,478	368,451	363,128	359,453	381,718	452,453	480,854	510,191	566,655	613,619	637,936
Alaska	World	Food	2,579	4,016	7,321	7,729	8,759	15,287	25,470	42,921	121,079	323,548	757,705
Hawaii	World	Food	37,536	41,562	40,876	39,825	40,869	45,626	47,861	50,119	56,649	71,169	109,972

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	Materials	6,906,875	10,307,703	13,508,101	13,724,815	14,296,813	16,941,884	18,318,847	19,530,165	22,631,833	26,554,170	31,057,545
Savannah	World	Materials	364,010	437,259	578,419	586,074	609,494	714,431	757,223	785,835	845,940	886,315	854,613
Charleston	World	Materials	445,117	732,802	987,534	983,589	1,006,990	1,122,561	1,154,839	1,167,148	1,192,681	1,212,832	1,199,311
Jacksonville	World	Materials	226,837	615,123	783,352	818,880	875,642	1,131,360	1,186,561	1,187,918	1,150,232	1,077,018	988,104
Miami	World	Materials	134,598	234,329	331,491	324,432	327,565	374,481	397,023	412,706	443,807	469,109	472,057
Wilmington	World	Materials	48,224	45,918	40,720	43,207	47,027	67,948	92,778	126,603	242,989	464,672	882,238
Norfolk	World	Materials	409,414	626,450	783,510	798,619	829,884	951,253	1,003,566	1,044,336	1,119,843	1,185,287	1,217,929
Other N Atlantic	World	Materials	2,208,946	3,056,718	4,027,984	4,045,606	4,174,024	4,744,967	4,948,907	5,137,442	5,524,147	5,912,322	6,192,370
Gulf Coast	World	Materials	727,279	946,697	1,469,787	1,465,228	1,486,376	1,623,345	1,654,374	1,664,008	1,720,311	1,818,242	1,961,809
South Pacific	World	Materials	1,593,164	2,897,047	3,552,179	3,663,638	3,874,112	4,762,880	5,273,502	5,650,609	6,461,491	7,069,541	6,992,851
North Pacific	World	Materials	671,712	628,995	635,169	644,620	670,628	810,619	884,755	932,235	1,038,456	1,110,260	1,062,130
Alaska	World	Materials	6,550	11,318	24,051	26,878	29,100	38,828	48,456	61,634	115,574	250,835	544,568
Hawaii	World	Materials	18,636	25,402	14,189	14,886	15,969	21,436	26,660	32,723	51,427	83,662	138,100
USA	World	Consumer Goods	6,948,735	12,536,247	16,909,105	17,496,693	18,750,481	25,123,693	28,934,783	33,303,348	44,411,462	58,702,556	76,189,372
Savannah	World	Consumer Goods	168,633	437,674	867,868	893,882	973,283	1,381,402	1,582,568	1,813,934	2,361,663	2,928,335	3,293,363
Charleston	World	Consumer Goods	176,997	388,129	552,228	580,541	627,664	864,587	1,017,723	1,176,505	1,552,208	1,988,856	2,401,920
Jacksonville	World	Consumer Goods	21,623	28,886	45,549	49,389	51,576	78,283	92,098	114,421	183,074	289,571	408,001
Miami	World	Consumer Goods	267,297	622,074	742,490	762,898	799,035	942,338	1,048,418	1,157,765	1,409,250	1,672,216	1,899,047
Wilmington	World	Consumer Goods	42,856	67,024	74,888	77,884	83,655	112,077	135,151	163,081	238,393	341,692	469,448
Norfolk	World	Consumer Goods	112,325	353,419	677,583	707,797	778,269	1,152,989	1,333,523	1,559,856	2,143,909	2,820,127	3,437,084
Other N Atlantic	World	Consumer Goods	1,031,479	1,557,624	2,277,540	2,401,697	2,599,434	3,558,750	4,122,808	4,746,308	6,284,806	8,119,603	9,859,158
Gulf Coast	World	Consumer Goods	75,758	265,952	412,956	435,812	470,614	624,407	748,700	879,761	1,208,837	1,615,052	2,068,455
South Pacific	World	Consumer Goods	4,031,995	7,299,209	9,469,382	9,742,187	10,392,236	13,787,156	15,758,267	17,987,908	23,338,343	29,007,077	32,711,793
North Pacific	World	Consumer Goods	992,500	1,465,736	1,729,768	1,779,350	1,900,209	2,483,174	2,856,515	3,281,153	4,302,611	5,391,121	6,108,698
Alaska	World	Consumer Goods	208	59	426	477	553	1,081	1,942	3,519	11,852	39,108	117,637
Hawaii	World	Consumer Goods	6,859	10,894	14,368	15,417	17,045	26,573	37,445	52,905	106,524	208,341	372,282
USA	World	Chemicals	57,322,816	87,059,192	96,336,048	105,896,738	110,894,452	127,679,451	142,303,289	154,789,123	185,852,872	227,075,465	281,630,273
Savannah	World	Chemicals	995,041	1,210,847	2,132,969	2,340,528	2,476,396	3,045,318	3,647,112	4,328,593	6,226,034	8,894,668	12,028,027
Charleston	World	Chemicals	951,164	1,059,841	2,200,302	2,321,816	2,431,443	2,966,272	3,487,098	4,032,788	5,463,833	7,399,167	9,664,619
Jacksonville	World	Chemicals	2,152,328	3,421,450	4,870,021	5,367,505	5,732,911	7,473,297	9,671,250	12,450,229	20,442,803	31,915,211	45,506,228
Miami	World	Chemicals	2,254,734	2,251,786	2,734,642	2,918,045	3,048,222	3,714,198	4,464,216	5,345,011	8,046,024	12,167,264	17,271,379
Wilmington	World	Chemicals	998,362	874,906	1,027,843	1,143,689	1,226,163	1,656,035	2,257,819	3,108,851	6,187,988	12,087,437	21,061,170
Norfolk	World	Chemicals	1,210,652	1,606,375	1,504,530	1,611,712	1,674,895	1,910,839	2,085,050	2,199,203	2,385,245	2,508,850	2,685,842
Other N Atlantic	World	Chemicals	22,444,506	33,971,538	43,247,602	48,411,907	50,804,877	58,119,338	63,647,290	67,272,561	74,715,311	82,645,334	93,913,603
Gulf Coast	World	Chemicals	16,157,039	25,838,424	26,900,546	29,220,532	30,454,784	34,018,447	36,617,519	38,031,718	40,034,348	40,673,944	41,319,056
South Pacific	World	Chemicals	4,778,693	10,664,541	7,343,785	7,938,135	8,349,767	9,898,950	11,273,682	12,474,517	15,080,053	17,783,761	20,753,458
North Pacific	World	Chemicals	3,203,295	3,591,811	1,972,818	2,123,681	2,228,839	2,612,152	2,922,017	3,167,404	3,643,096	4,011,192	4,209,901
Alaska	World	Chemicals	225,426	345,782	303,312	341,425	369,673	531,177	771,209	1,130,691	2,596,860	5,941,149	11,963,275
Hawaii	World	Chemicals	189,753	540,711	277,539	291,528	305,209	355,324	390,873	415,725	462,127	488,303	496,987

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	High Technology	2,075,874	3,522,964	3,796,589	4,005,944	4,370,518	6,832,523	9,051,053	11,464,088	17,420,356	25,028,506	34,263,534
Savannah	World	High Technology	159,683	270,997	292,045	308,408	337,368	534,119	713,247	909,313	1,397,848	2,028,982	2,802,615
Charleston	World	High Technology	159,683	270,997	292,045	308,191	336,601	528,663	702,430	891,732	1,360,016	1,959,548	2,688,188
Jacksonville	World	High Technology	159,683	270,997	292,045	307,521	334,110	512,435	669,675	838,475	1,247,257	1,757,177	2,361,832
Miami	World	High Technology	159,683	270,997	292,045	308,097	336,254	526,496	698,000	884,474	1,344,512	1,931,542	2,642,713
Wilmington	World	High Technology	159,683	270,997	292,045	308,394	336,479	526,035	697,360	884,021	1,346,011	1,938,431	2,660,970
Norfolk	World	High Technology	159,683	270,997	292,045	308,414	337,505	534,907	715,347	913,553	1,409,529	2,053,585	2,847,011
Other N Atlantic	World	High Technology	159,683	270,997	292,045	307,968	335,971	524,733	695,173	880,540	1,338,070	1,922,304	2,630,790
Gulf Coast	World	High Technology	159,683	270,997	292,045	307,939	335,598	521,993	689,019	869,895	1,313,651	1,876,128	2,553,528
South Pacific	World	High Technology	159,683	270,997	292,045	308,087	336,142	526,249	696,618	881,559	1,336,231	1,913,822	2,611,921
North Pacific	World	High Technology	159,683	270,997	292,045	307,742	335,051	518,789	682,101	858,465	1,289,197	1,831,695	2,481,053
Alaska	World	High Technology	159,683	270,997	292,045	308,394	336,479	526,035	697,360	884,021	1,346,011	1,938,431	2,660,970
Hawaii	World	High Technology	159,683	270,997	292,045	308,394	336,479	526,035	697,360	884,021	1,346,011	1,938,431	2,660,970
USA	World	Intermed. Manufact.	40,541,639	76,285,987	60,392,309	66,616,865	74,561,357	103,700,553	128,538,116	153,048,755	215,379,809	299,959,199	412,498,002
Savannah	World	Intermed. Manufact.	917,706	1,623,146	1,358,524	1,470,576	1,617,043	2,172,878	2,593,041	2,976,646	3,875,123	4,972,516	6,263,188
Charleston	World	Intermed. Manufact.	574,133	2,801,344	3,472,505	3,897,605	4,416,292	6,198,403	7,567,233	8,803,147	11,645,157	15,009,403	18,883,137
Jacksonville	World	Intermed. Manufact.	1,871,333	3,230,211	2,948,343	3,234,044	3,568,324	4,447,741	4,856,297	5,173,813	5,705,325	6,049,603	6,207,037
Miami	World	Intermed. Manufact.	1,394,462	2,672,403	3,146,164	3,528,480	3,984,784	5,563,612	6,648,489	7,664,184	10,310,434	14,057,740	19,197,159
Wilmington	World	Intermed. Manufact.	313,904	294,234	219,860	243,521	270,557	406,352	569,904	789,386	1,554,493	3,090,146	6,053,408
Norfolk	World	Intermed. Manufact.	1,166,083	1,393,250	1,267,673	1,384,777	1,531,799	2,076,293	2,501,880	2,895,736	3,804,982	4,897,058	6,209,622
Other N Atlantic	World	Intermed. Manufact.	4,828,723	11,812,241	8,441,585	9,422,773	10,659,293	15,470,849	19,940,464	24,515,335	36,353,671	52,689,539	74,713,194
Gulf Coast	World	Intermed. Manufact.	14,030,044	26,396,430	15,705,560	17,617,623	20,044,120	28,814,877	36,844,163	44,381,411	62,115,145	83,598,765	109,138,803
South Pacific	World	Intermed. Manufact.	6,827,418	14,776,994	15,123,811	16,306,860	17,967,525	24,445,745	29,394,042	33,973,201	44,654,937	58,314,104	75,283,103
North Pacific	World	Intermed. Manufact.	2,145,261	3,350,297	3,738,712	4,153,418	4,693,394	7,086,345	9,572,782	12,251,341	19,364,877	28,496,144	38,983,721
Alaska	World	Intermed. Manufact.	76,104	106,424	145,000	169,728	198,642	377,931	654,245	1,088,651	2,970,375	7,857,295	19,858,423
Hawaii	World	Intermed. Manufact.	146,573	294,425	342,095	402,806	487,598	1,090,347	1,877,975	3,100,791	7,601,020	15,356,869	25,931,099
USA	World	Capital Equipment	4,692,456	7,426,161	9,252,267	10,199,326	11,254,845	16,199,536	19,556,012	23,011,114	31,591,521	42,762,742	56,647,525
Savannah	World	Capital Equipment	196,957	417,496	560,871	627,164	700,663	1,055,845	1,359,320	1,706,749	2,676,966	4,125,232	6,026,458
Charleston	World	Capital Equipment	227,511	447,456	526,236	582,986	649,885	946,441	1,185,322	1,455,782	2,188,264	3,260,998	4,708,795
Jacksonville	World	Capital Equipment	58,826	44,928	20,568	22,249	24,072	32,965	40,926	50,610	81,272	134,800	217,813
Miami	World	Capital Equipment	80,976	98,977	138,104	150,757	162,779	214,602	254,327	293,877	389,502	509,313	650,318
Wilmington	World	Capital Equipment	34,554	40,307	38,766	42,027	44,590	56,216	65,519	74,206	95,774	125,519	168,891
Norfolk	World	Capital Equipment	295,298	365,606	526,898	571,369	620,198	833,851	990,356	1,150,722	1,555,643	2,085,119	2,722,650
Other N Atlantic	World	Capital Equipment	841,589	1,161,026	1,349,199	1,499,943	1,668,038	2,414,335	2,976,388	3,578,444	5,101,080	7,079,217	9,443,138
Gulf Coast	World	Capital Equipment	337,964	487,600	562,601	623,837	698,542	974,875	1,197,284	1,439,578	2,069,184	2,927,760	4,027,074
South Pacific	World	Capital Equipment	1,867,682	3,411,758	4,458,030	4,890,437	5,374,785	7,732,700	9,116,832	10,442,004	13,448,381	16,901,389	20,867,005
North Pacific	World	Capital Equipment	606,429	826,778	967,767	1,076,848	1,191,731	1,783,364	2,177,600	2,575,883	3,548,689	4,737,819	5,963,765
Alaska	World	Capital Equipment	236	2,202	2,470	2,686	2,858	3,585	4,148	4,655	5,855	7,335	9,078
Hawaii	World	Capital Equipment	2,342	3,837	6,436	7,484	8,634	16,013	27,652	46,757	134,010	380,818	1,053,108

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	Motor Vehicles	6,016,939	7,817,042	8,878,194	9,913,299	11,076,918	17,455,196	21,641,963	25,821,749	35,729,573	47,747,001	61,666,844
Savannah	World	Motor Vehicles	124,069	281,473	384,375	428,337	481,000	806,956	1,046,482	1,299,512	1,940,786	2,794,543	3,850,513
Charleston	World	Motor Vehicles	147,612	306,384	423,215	464,339	516,028	865,200	1,141,633	1,442,960	2,206,682	3,191,725	4,336,446
Jacksonville	World	Motor Vehicles	362,207	598,528	613,380	670,494	729,827	1,057,235	1,352,081	1,688,137	2,556,277	3,757,504	5,251,797
Miami	World	Motor Vehicles	80,487	44,296	66,333	70,852	75,318	96,827	108,577	120,838	151,592	190,870	237,000
Wilmington	World	Motor Vehicles	6,759	2,438	3,766	4,291	4,878	8,432	12,769	19,128	42,870	95,269	208,396
Norfolk	World	Motor Vehicles	357,692	478,592	554,230	618,105	649,710	936,012	1,127,980	1,288,087	1,525,188	1,569,436	1,431,788
Other N Atlantic	World	Motor Vehicles	1,094,963	1,592,964	2,087,024	2,358,446	2,672,623	4,380,330	5,256,582	6,036,854	7,774,978	9,662,365	11,524,276
Gulf Coast	World	Motor Vehicles	83,035	171,422	169,883	191,690	216,655	349,344	435,648	525,694	761,142	1,089,199	1,525,935
South Pacific	World	Motor Vehicles	2,454,072	2,913,797	3,145,914	3,471,239	3,863,564	5,749,589	6,863,896	7,930,380	10,271,572	12,859,557	15,737,594
North Pacific	World	Motor Vehicles	1,111,670	1,232,107	1,378,403	1,580,064	1,807,899	3,127,211	4,204,056	5,359,353	8,325,678	12,243,234	17,031,950
Alaska	World	Motor Vehicles	0	26	47	54	60	85	116	165	346	744	1,609
Hawaii	World	Motor Vehicles	15,845	17,576	20,450	22,884	25,546	39,884	54,190	72,428	127,715	221,341	376,175

Table A-3. Metric Tonnes of Exports from US South Atlantic Coast Ports and Other Coasts, by World Trade Route, for All Commodities: 1995 - 2050 (selected years)

Origin	Destination	Produmt Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	All Commodities	251,370,211	212,856,887	206,987,701	214,095,492	217,671,381	232,098,313	243,272,392	258,521,722	303,739,049	379,462,039	531,306,089
USA	Percent Change	All Commodities	NA	-3.27%	-0.93%	3.43%	1.67%	1.29%	0.94%	1.22%	1.62%	2.25%	3.42%
Savannah	World	All Commodities	5,838,559	5,527,534	7,244,210	7,576,866	7,633,734	7,670,422	7,817,503	8,344,201	10,062,735	13,254,459	19,254,265
Savannah	Percent Change	All Commodities	NA	-1.09%	9.43%	4.59%	0.75%	0.10%	0.38%	1.31%	1.89%	2.79%	3.80%
Savannah	Africa	All Commodities	55,844	37,964	32,476	32,679	32,555	35,260	38,759	45,843	92,027	255,753	660,035
Savannah	Central America	All Commodities	116,887	127,332	282,906	299,062	306,626	338,453	362,220	387,594	465,031	632,906	976,824
Savannah	East Coast S America	All Commodities	427,259	397,006	247,045	254,718	255,543	269,526	279,370	300,348	351,901	415,213	493,628
Savannah	Eastern Europe	All Commodities	30,357	41,744	109,859	115,682	122,770	151,058	169,607	197,840	311,334	575,502	1,095,196
Savannah	India	All Commodities	68,195	70,117	120,498	121,195	121,781	131,057	143,567	162,280	234,738	424,086	847,328
Savannah	Middle East	All Commodities	160,731	115,066	100,381	101,015	100,773	104,852	109,153	118,297	142,851	176,318	219,763
Savannah	Mediterranean	All Commodities	259,127	223,764	254,933	267,683	276,478	263,279	271,566	300,196	379,743	496,049	657,091
Savannah	North America	All Commodities	54,596	83,963	26,842	26,270	27,024	29,983	32,280	34,365	39,352	45,419	51,748
Savannah	NE Asia	All Commodities	2,222,822	2,340,863	3,532,113	3,734,699	3,758,319	3,843,614	3,874,712	4,090,831	4,768,222	5,876,663	7,818,874
Savannah	North Europe	All Commodities	1,866,619	1,433,913	1,668,097	1,708,483	1,707,908	1,470,661	1,378,859	1,374,088	1,395,627	1,477,292	1,619,477
Savannah	Oceania	All Commodities	236,223	267,747	312,376	334,429	325,719	353,463	398,666	452,837	587,349	765,115	991,050
Savannah	Europe, Other	All Commodities	5,255	12,831	8,962	9,507	9,365	6,823	5,715	5,595	5,333	5,153	5,160
Savannah	SE Asia	All Commodities	206,246	265,435	418,187	440,731	457,649	533,981	602,982	704,536	1,044,476	1,671,480	2,957,945
Savannah	West Coast S America	All Commodities	128,397	109,787	129,534	130,711	131,232	138,411	150,045	169,552	244,951	437,511	860,144
Charleston	World	All Commodities	4,471,085	4,943,363	4,311,335	4,468,451	4,525,876	4,796,518	5,178,853	5,808,573	7,936,065	12,518,670	21,669,619
Charleston	Percent Change	All Commodities	NA	2.03%	-4.46%	3.64%	1.29%	1.17%	1.55%	2.32%	3.17%	4.66%	5.64%
Charleston	Africa	All Commodities	60,449	78,441	76,697	76,670	76,853	83,010	90,006	104,276	204,324	590,128	1,600,469
Charleston	Central America	All Commodities	42,713	99,765	122,474	128,407	131,130	146,366	160,769	175,827	232,268	376,563	692,404
Charleston	East Coast S America	All Commodities	139,728	386,768	296,929	313,647	314,979	336,842	352,267	369,284	408,744	452,734	504,447
Charleston	Eastern Europe	All Commodities	144,136	162,741	284,354	301,431	316,269	391,075	438,050	522,388	944,617	2,173,572	4,934,041
Charleston	India	All Commodities	103,015	65,429	186,994	190,244	194,429	225,402	265,843	321,623	516,797	968,016	1,900,266
Charleston	Middle East	All Commodities	86,011	66,868	62,446	62,892	63,294	67,653	72,386	79,858	99,233	124,716	156,991
Charleston	Mediterranean	All Commodities	231,251	336,575	309,947	327,690	339,276	363,182	403,497	464,539	620,055	839,472	1,143,751
Charleston	North America	All Commodities	42,362	31	79	79	75	66	64	69	82	102	126
Charleston	NE Asia	All Commodities	1,217,102	1,527,726	943,708	984,757	985,870	999,956	1,018,132	1,100,989	1,362,016	1,839,099	2,707,706
Charleston	North Europe	All Commodities	1,627,905	1,548,010	1,461,284	1,497,619	1,508,468	1,508,898	1,601,459	1,742,663	2,068,922	2,475,359	2,962,139
Charleston	Oceania	All Commodities	42,476	32,122	24,662	26,196	25,597	26,209	27,666	29,387	33,645	39,096	45,986
Charleston	Europe, Other	All Commodities	8,324	44,451	7,325	7,720	8,012	11,129	13,002	14,807	17,969	20,459	22,325
Charleston	SE Asia	All Commodities	488,029	282,327	250,355	259,254	266,007	303,110	352,898	429,562	731,473	1,415,742	2,923,927
Charleston	West Coast S America	All Commodities	237,582	312,108	284,081	291,845	295,615	333,621	382,813	453,301	695,920	1,203,612	2,075,038

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Jacksonville	World	All Commodities	2,910,767	2,482,693	2,247,770	2,338,066	2,384,639	2,613,269	2,806,613	3,073,434	3,872,342	5,222,280	7,457,401
Jacksonville	Percent Change	All Commodities	NA	-3.13%	-3.26%	4.02%	1.99%	1.85%	1.44%	1.83%	2.34%	3.04%	3.63%
Jacksonville	Africa	All Commodities	19,731	5,644	9,573	9,681	9,690	10,335	10,756	11,554	18,059	25,305	49,973
Jacksonville	Central America	All Commodities	422,815	456,710	594,085	618,986	639,151	720,102	769,603	827,559	991,645	1,249,634	1,660,643
Jacksonville	East Coast S America	All Commodities	610,665	295,748	353,741	365,807	364,639	377,015	381,064	386,398	404,318	427,954	458,841
Jacksonville	Eastern Europe	All Commodities	109,533	281,352	117,108	127,930	139,920	184,166	195,381	222,250	316,207	448,228	621,389
Jacksonville	India	All Commodities	881	1,864	1,495	1,559	1,646	2,436	4,129	7,947	35,392	136,255	388,061
Jacksonville	Middle East	All Commodities	13,360	12,333	11,304	11,417	11,376	11,327	10,850	11,004	11,571	12,367	13,461
Jacksonville	Mediterranean	All Commodities	108,153	208,612	168,396	185,086	194,424	215,050	240,628	276,909	366,115	484,225	634,281
Jacksonville	North America	All Commodities	2,795	35	4,781	4,838	4,787	5,651	6,817	8,146	11,068	14,560	18,504
Jacksonville	NE Asia	All Commodities	220,317	120,926	222,732	228,039	231,926	247,625	259,117	270,979	316,869	413,216	622,661
Jacksonville	North Europe	All Commodities	869,487	782,912	454,511	453,542	452,961	472,868	512,803	559,083	660,167	788,609	943,056
Jacksonville	Oceania	All Commodities	46,081	3,018	2,345	2,448	2,506	2,933	3,324	3,775	4,847	6,173	7,787
Jacksonville	Europe, Other	All Commodities	902	343	244	239	238	266	279	298	338	382	429
Jacksonville	SE Asia	All Commodities	61,603	56,043	99,062	105,345	110,638	141,688	174,567	215,918	340,634	572,362	989,014
Jacksonville	West Coast S America	All Commodities	424,443	257,154	228,393	224,079	220,737	221,798	237,295	271,613	398,111	641,009	1,049,301
Miami	World	All Commodities	2,417,867	2,775,307	2,685,518	2,802,643	2,859,691	3,127,980	3,359,693	3,632,336	4,549,295	6,448,638	9,948,136
Miami	Percent Change	All Commodities	NA	2.80%	-1.09%	4.36%	2.01%	1.81%	1.42%	1.60%	2.28%	3.55%	4.43%
Miami	Africa	All Commodities	2,291	5,151	3,276	3,294	3,311	3,343	3,746	4,057	5,916	11,016	21,186
Miami	Central America	All Commodities	1,039,162	1,620,212	1,574,050	1,639,623	1,684,319	1,876,751	2,013,661	2,159,969	2,651,109	3,654,603	5,400,047
Miami	East Coast S America	All Commodities	527,401	401,144	234,626	248,030	250,488	279,535	293,343	306,150	335,436	368,396	408,493
Miami	Eastern Europe	All Commodities	3,542	5,195	12,673	13,331	13,799	17,694	22,142	29,471	68,450	197,161	510,200
Miami	India	All Commodities	34,492	18,716	31,653	31,156	30,742	29,477	29,590	32,989	61,643	169,052	436,726
Miami	Middle East	All Commodities	3,636	5,666	6,596	6,760	6,996	8,376	9,884	11,600	15,939	21,665	28,895
Miami	Mediterranean	All Commodities	88,240	12,228	40,855	44,833	46,752	50,432	56,822	65,217	85,553	112,544	148,301
Miami	North America	All Commodities	41	3,334	119	119	127	166	167	187	242	329	436
Miami	NE Asia	All Commodities	127,658	143,476	207,158	215,035	213,942	208,239	205,407	215,310	253,014	324,907	458,817
Miami	North Europe	All Commodities	208,779	268,712	308,692	323,093	326,862	323,112	335,091	350,707	380,305	418,218	468,144
Miami	Oceania	All Commodities	2,468	15,818	7,976	8,235	8,200	8,890	9,698	10,566	12,629	15,251	18,436
Miami	Europe, Other	All Commodities	360	890	665	675	682	733	757	789	852	912	967
Miami	SE Asia	All Commodities	26,040	34,106	23,532	24,534	25,458	31,198	38,554	49,055	99,365	232,267	526,031
Miami	West Coast S America	All Commodities	351,757	240,659	233,647	243,025	247,322	289,834	330,830	395,369	578,543	922,318	1,521,456
Wilmington	World	All Commodities	1,118,155	1,142,204	650,285	682,372	683,424	640,118	645,631	706,696	987,658	1,790,944	3,739,136
Wilmington	Percent Change	All Commodities	NA	0.43%	-17.12%	4.93%	0.15%	-1.30%	0.17%	1.82%	3.40%	6.13%	7.64%
Wilmington	Africa	All Commodities	5,101	5,586	4,717	4,926	5,165	5,915	6,496	7,294	10,800	20,466	41,772
Wilmington	Central America	All Commodities	9,219	12,974	5,967	6,277	6,546	8,257	10,912	16,228	52,762	183,658	506,659
Wilmington	East Coast S America	All Commodities	14,784	34,780	4,129	4,511	4,720	6,126	7,473	8,593	11,406	15,944	23,999
Wilmington	Eastern Europe	All Commodities	56,239	5,925	2,623	2,801	3,028	4,350	5,666	7,770	18,990	55,357	143,554
Wilmington	India	All Commodities	1,568	10,893	8,180	8,389	8,569	10,513	13,404	18,966	58,229	213,531	633,372
Wilmington	Middle East	All Commodities	7,955	5,282	4,338	4,343	4,418	4,885	5,286	5,765	6,634	7,679	8,790
Wilmington	Mediterranean	All Commodities	39,742	26,292	21,206	22,114	22,168	20,514	20,130	20,917	23,495	27,400	32,251
Wilmington	North America	All Commodities	41	133,660	15	15	16	20	23	26	32	40	49
Wilmington	NE Asia	All Commodities	586,011	434,031	257,332	268,359	270,898	286,689	298,776	322,586	393,044	522,409	756,852
Wilmington	North Europe	All Commodities	288,885	316,548	277,403	292,379	286,317	291,166	165,732	150,435	150,835	149,241	153,779
Wilmington	Oceania	All Commodities	2,497	1,956	3,553	3,743	3,743	4,304	4,938	5,643	7,370	9,652	12,657
Wilmington	Europe, Other	All Commodities	2,977	3,395	2,008	2,045	2,074	1,785	1,597	1,630	1,698	1,724	1,706
Wilmington	SE Asia	All Commodities	58,472	114,306	56,393	59,868	63,076	81,684	99,363	122,355	217,291	460,278	1,074,062
Wilmington	West Coast S America	All Commodities	34,664	36,576	2,421	2,602	2,746	3,009	5,833	9,550	34,172	123,565	349,632

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Norfolk	World	All Commodities	37,366,365	20,704,378	13,453,664	13,662,523	13,834,626	13,328,551	13,119,746	13,246,731	14,255,089	17,425,599	24,880,576
Norfolk	Percent Change	All Commodities	NA	-11.14%	-13.39%	1.55%	1.26%	-0.74%	-0.32%	0.19%	0.74%	2.03%	3.63%
Norfolk	Africa	All Commodities	500,919	198,419	79,023	79,062	78,093	82,842	86,327	93,711	128,540	227,208	442,088
Norfolk	Central America	All Commodities	43,881	69,622	136,461	142,476	147,758	171,327	186,671	207,307	279,555	447,834	805,722
Norfolk	East Coast S America	All Commodities	3,703,011	3,249,477	1,822,142	1,836,807	1,916,628	2,081,412	2,137,999	2,171,610	2,275,842	2,381,149	2,488,270
Norfolk	Eastern Europe	All Commodities	1,437,813	1,090,049	407,043	434,793	467,543	583,264	648,756	728,849	1,150,007	2,547,980	6,079,323
Norfolk	India	All Commodities	87,151	153,331	216,445	220,286	224,612	238,142	294,905	355,525	601,616	1,243,376	2,626,398
Norfolk	Middle East	All Commodities	169,527	84,583	71,968	73,485	76,003	87,748	94,790	101,878	115,602	128,481	140,159
Norfolk	Mediterranean	All Commodities	3,951,546	2,349,985	1,817,624	1,844,320	1,893,963	1,806,234	1,783,302	1,804,490	1,878,212	1,992,758	2,156,263
Norfolk	North America	All Commodities	7,257	24,880	10,396	11,554	10,443	6,689	5,088	4,317	3,299	2,857	2,752
Norfolk	NE Asia	All Commodities	7,807,707	3,041,520	1,201,290	1,242,944	1,255,864	1,305,940	1,351,541	1,436,823	1,695,249	2,155,884	2,994,989
Norfolk	North Europe	All Commodities	18,953,051	9,968,362	7,235,957	7,305,328	7,290,766	6,442,828	5,984,730	5,729,918	5,291,472	5,027,139	4,911,719
Norfolk	Oceania	All Commodities	136,984	92,146	86,798	94,414	99,420	98,022	111,952	128,538	169,152	223,129	292,585
Norfolk	Europe, Other	All Commodities	72,766	17,267	6,718	6,915	7,056	9,286	11,425	14,145	21,234	30,217	40,434
Norfolk	SE Asia	All Commodities	425,269	330,976	309,887	316,419	321,110	338,968	355,336	393,651	527,612	777,025	1,374,023
Norfolk	West Coast S America	All Commodities	69,482	33,762	51,908	53,719	54,367	60,850	66,925	75,966	117,699	240,583	525,850
Other N Atlantic	World	All Commodities	20,978,097	11,951,303	14,924,707	15,412,614	15,501,700	15,759,479	16,108,345	16,976,977	20,046,958	26,428,802	39,299,488
Other N Atlantic	Percent Change	All Commodities	NA	-10.64%	7.69%	3.27%	0.58%	0.33%	0.44%	1.06%	1.68%	2.80%	4.05%
Other N Atlantic	Africa	All Commodities	214,446	230,781	110,549	111,466	113,117	121,225	126,813	137,111	196,777	361,469	665,932
Other N Atlantic	Central America	All Commodities	330,312	724,192	924,223	957,919	988,563	1,118,596	1,194,332	1,287,273	1,532,858	1,873,001	2,352,584
Other N Atlantic	East Coast S America	All Commodities	1,634,481	813,999	575,932	605,118	616,181	698,373	749,712	799,867	901,608	1,015,630	1,136,408
Other N Atlantic	Eastern Europe	All Commodities	955,762	119,629	216,804	227,480	237,868	294,669	348,979	440,017	947,123	2,566,514	6,570,895
Other N Atlantic	India	All Commodities	636,494	286,359	535,560	539,359	543,844	575,058	614,789	670,783	900,870	1,497,342	2,695,464
Other N Atlantic	Middle East	All Commodities	691,315	183,733	137,422	139,679	143,549	158,933	169,273	181,146	206,395	233,197	260,616
Other N Atlantic	Mediterranean	All Commodities	2,728,047	715,128	1,080,983	1,102,656	1,133,426	1,097,186	1,101,792	1,135,243	1,227,359	1,357,341	1,534,294
Other N Atlantic	North America	All Commodities	425,869	964,811	596,429	611,756	585,875	572,198	576,078	589,903	638,364	695,322	733,241
Other N Atlantic	NE Asia	All Commodities	4,348,793	2,180,700	5,258,293	5,497,231	5,481,836	5,431,643	5,411,196	5,663,344	6,534,422	8,074,842	10,888,581
Other N Atlantic	North Europe	All Commodities	7,407,570	4,581,269	3,589,764	3,644,379	3,668,710	3,658,111	3,758,498	3,900,800	4,268,266	4,801,769	5,526,720
Other N Atlantic	Oceania	All Commodities	103,076	121,433	150,789	164,486	160,458	175,076	195,093	217,189	268,336	330,781	403,508
Other N Atlantic	Europe, Other	All Commodities	25,470	18,019	21,171	22,398	23,399	34,064	45,643	60,042	97,822	147,587	207,121
Other N Atlantic	SE Asia	All Commodities	929,252	724,363	1,289,745	1,336,517	1,348,748	1,324,821	1,281,295	1,320,070	1,668,785	2,528,076	4,763,093
Other N Atlantic	West Coast S America	All Commodities	547,215	286,887	437,044	451,571	456,126	499,532	534,851	574,189	714,913	1,015,930	1,561,030
Gulf Coast	World	All Commodities	86,020,093	78,724,188	75,185,608	78,428,620	79,934,223	85,696,672	90,288,739	95,881,482	111,653,896	137,546,076	185,563,105
Gulf Coast	Percent Change	All Commodities	NA	-1.76%	-1.52%	4.31%	1.92%	1.40%	1.05%	1.21%	1.53%	2.11%	3.04%
Gulf Coast	Africa	All Commodities	1,844,543	972,887	1,202,076	1,194,449	1,186,153	1,252,786	1,326,220	1,460,469	2,222,471	4,879,361	11,647,680
Gulf Coast	Central America	All Commodities	9,044,243	19,769,107	20,408,942	21,132,509	21,785,220	23,952,900	25,525,387	27,287,885	30,851,350	34,650,061	38,582,141
Gulf Coast	East Coast S America	All Commodities	6,796,912	5,613,499	6,218,637	6,589,751	6,678,280	7,282,569	7,663,238	7,993,874	8,700,286	9,415,929	10,148,741
Gulf Coast	Eastern Europe	All Commodities	3,488,680	2,350,367	1,522,593	1,636,226	1,769,327	2,271,823	2,346,657	2,525,482	3,510,190	6,236,381	12,410,194
Gulf Coast	India	All Commodities	1,036,459	1,043,647	734,185	759,116	781,509	834,125	946,413	1,179,406	2,226,761	4,939,598	10,655,302
Gulf Coast	Middle East	All Commodities	1,096,921	1,156,310	823,118	840,516	877,181	1,017,336	1,103,815	1,206,149	1,407,872	1,610,033	1,808,581
Gulf Coast	Mediterranean	All Commodities	6,655,268	5,857,800	4,542,745	4,904,352	5,111,836	5,532,429	5,848,915	6,320,204	7,420,188	8,717,974	10,146,988
Gulf Coast	North America	All Commodities	1,026,014	1,176,447	1,377,449	1,442,912	1,385,628	1,628,350	1,862,138	2,082,036	2,584,184	3,173,402	3,826,983
Gulf Coast	NE Asia	All Commodities	21,721,979	14,998,437	16,496,583	17,292,102	17,441,035	17,835,681	17,932,188	17,908,865	18,607,852	20,561,017	24,704,540
Gulf Coast	North Europe	All Commodities	20,891,981	13,556,591	9,994,214	10,296,411	10,307,632	9,865,254	10,042,825	10,372,945	11,902,088	12,042,866	13,442,567
Gulf Coast	Oceania	All Commodities	1,494,252	973,972	918,391	1,007,293	964,077	953,196	1,016,381	1,096,924	1,266,716	1,484,018	1,753,175
Gulf Coast	Europe, Other	All Commodities	16,511	9,204	6,819	6,845	6,856	7,680	8,372	8,944	10,148	11,313	12,311
Gulf Coast	SE Asia	All Commodities	4,448,938	5,074,072	4,503,239	4,749,112	4,945,594	5,856,755	6,486,388	7,337,030	9,739,905	12,105,119	19,479,258
Gulf Coast	West Coast S America	All Commodities	6,457,392	6,171,841	6,434,316	6,577,026	6,693,864	7,405,588	8,177,799	9,101,469	12,103,586	17,719,904	26,944,644

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
South Pacific	World	All Commodities	30,662,388	28,000,650	25,421,259	26,484,350	26,785,336	28,618,058	30,195,529	32,823,878	40,965,466	56,223,087	86,114,270
South Pacific	Percent Change	All Commodities	NA	-1.80%	-3.17%	4.18%	1.14%	1.33%	1.08%	1.68%	2.24%	3.22%	4.36%
South Pacific	Africa	All Commodities	69,366	87,314	16,698	16,539	16,367	18,701	21,058	24,705	45,216	109,791	255,022
South Pacific	Central America	All Commodities	976,944	1,912,705	768,189	783,577	789,378	812,814	808,944	791,422	795,502	912,640	1,250,153
South Pacific	East Coast S America	All Commodities	402,030	458,610	390,163	422,665	429,875	509,630	572,992	633,541	774,890	947,712	1,153,469
South Pacific	Eastern Europe	All Commodities	66,850	43,329	48,496	51,983	56,070	72,547	77,688	88,253	149,697	340,761	779,024
South Pacific	India	All Commodities	690,907	463,463	557,607	570,590	581,930	672,240	779,974	922,753	1,410,127	2,505,901	4,720,186
South Pacific	Middle East	All Commodities	26,273	30,662	43,155	43,724	45,021	53,074	58,417	64,239	77,127	91,799	106,704
South Pacific	Mediterranean	All Commodities	176,158	135,987	73,349	76,336	76,519	78,737	81,646	86,626	99,740	117,859	141,424
South Pacific	North America	All Commodities	20,118	14,111	42,918	45,942	44,380	50,434	52,682	55,629	62,323	69,918	84,005
South Pacific	NE Asia	All Commodities	21,399,484	18,879,877	17,666,911	18,430,728	18,628,814	19,671,231	20,501,307	22,086,593	26,631,477	34,390,758	48,270,273
South Pacific	North Europe	All Commodities	975,419	827,819	627,116	653,182	650,933	649,164	677,632	712,124	781,444	865,385	967,734
South Pacific	Oceania	All Commodities	707,371	918,240	814,724	870,451	835,140	895,915	1,017,870	1,157,071	1,505,578	1,984,483	2,619,185
South Pacific	Europe, Other	All Commodities	4,377	11,833	10,394	10,567	10,607	9,960	9,569	9,480	9,477	9,580	9,783
South Pacific	SE Asia	All Commodities	4,649,670	3,875,891	3,955,892	4,092,443	4,198,365	4,655,332	5,012,198	5,595,729	7,786,213	12,563,433	23,685,779
South Pacific	West Coast S America	All Commodities	497,420	340,810	406,547	415,623	421,937	468,281	523,545	595,719	836,654	1,315,068	2,071,528
North Pacific	World	All Commodities	29,276,605	21,164,204	14,233,070	23,465,413	25,991,101	29,187,856	30,977,414	33,116,500	38,966,288	44,793,450	61,231,824
North Pacific	Percent Change	All Commodities	NA	-6.28%	4.62%	5.09%	2.06%	2.35%	1.20%	1.34%	1.64%	1.40%	3.17%
North Pacific	Africa	All Commodities	47,826	84,985	73,449	72,196	71,012	70,768	70,587	71,411	75,667	90,004	120,516
North Pacific	East Coast S America	All Commodities	177,736	97,303	151,147	168,515	170,098	198,326	217,906	235,382	273,181	314,836	362,437
North Pacific	Eastern Europe	All Commodities	295,751	155,831	81,178	87,363	95,299	124,628	122,370	130,991	191,709	363,113	776,369
North Pacific	India	All Commodities	1,848,830	430,441	268,201	274,301	278,467	319,666	356,932	399,702	527,644	789,895	1,298,681
North Pacific	Middle East	All Commodities	146,245	192,288	178,312	184,134	190,928	217,152	232,024	245,782	274,716	301,658	327,695
North Pacific	Mediterranean	All Commodities	119,107	68,782	191,080	199,131	200,918	208,111	222,071	237,321	265,827	294,894	324,423
North Pacific	North America	All Commodities	1,479,874	721,820	1,151,134	1,239,536	1,202,359	1,375,847	1,407,866	1,455,178	1,584,182	1,601,304	1,914,129
North Pacific	NE Asia	All Commodities	18,085,290	14,696,978	15,879,073	16,555,843	16,767,723	17,679,617	18,056,062	18,637,298	20,269,618	22,691,551	25,875,973
North Pacific	North Europe	All Commodities	183,016	311,028	459,966	472,165	478,686	498,378	530,361	561,586	629,106	709,746	804,775
North Pacific	Oceania	All Commodities	632,249	415,316	491,403	526,998	502,608	492,629	520,137	556,336	638,775	745,865	874,088
North Pacific	Europe, Other	All Commodities	909	994	1,559	1,562	1,549	1,404	1,323	1,320	1,350	1,379	1,405
North Pacific	SE Asia	All Commodities	5,501,426	3,565,372	4,284,603	4,632,062	4,962,644	6,823,672	7,959,671	9,193,236	12,453,951	14,297,316	24,619,418
North Pacific	West Coast S America	All Commodities	647,907	314,563	634,602	656,818	672,322	770,876	876,810	998,424	1,382,139	2,102,740	3,174,860
Alaska	World	All Commodities	4,637,202	5,827,467	4,410,057	4,680,003	4,763,719	5,092,229	5,304,817	5,679,937	6,813,025	8,821,873	12,841,114
Alaska	Percent Change	All Commodities	NA	4.68%	-8.87%	6.12%	1.79%	1.34%	0.82%	1.38%	1.84%	2.62%	3.83%
Alaska	Africa	All Commodities	1,486	273	277	287	295	382	487	654	1,661	5,338	14,886
Alaska	Central America	All Commodities	18,965	2,043	2,342	2,534	2,747	4,272	6,922	12,284	48,830	179,544	502,046
Alaska	East Coast S America	All Commodities	5,676	12,341	45,277	46,498	48,372	58,585	68,557	79,109	105,669	141,656	187,765
Alaska	Eastern Europe	All Commodities	47,958	1,373	7,295	7,899	8,685	11,273	10,940	11,674	17,784	37,203	84,651
Alaska	India	All Commodities	39,238	15,617	1,208	1,290	1,400	2,364	4,431	9,211	46,580	199,004	614,356
Alaska	Middle East	All Commodities	255	510	467	479	503	665	811	958	1,295	1,693	2,161
Alaska	Mediterranean	All Commodities	1,222	5,730	82,734	84,917	86,703	78,793	74,190	73,595	75,281	79,283	84,384
Alaska	North America	All Commodities	300,284	448,725	55,523	56,816	57,797	70,580	77,433	83,525	94,725	39,064	50,658
Alaska	NE Asia	All Commodities	3,824,726	4,712,265	3,614,684	3,872,727	3,950,794	4,306,959	4,522,548	4,869,790	5,826,412	7,294,532	9,808,722
Alaska	North Europe	All Commodities	249,397	354,506	526,706	533,295	531,331	470,994	440,926	425,809	399,709	387,009	386,974
Alaska	Oceania	All Commodities	18,232	98,818	45,787	43,993	44,249	47,664	49,327	51,023	56,920	66,263	78,632
Alaska	Europe, Other	All Commodities	135	379	239	231	228	247	255	271	308	350	397
Alaska	SE Asia	All Commodities	127,891	151,637	22,532	23,763	25,109	32,269	38,262	47,860	96,740	256,148	658,727
Alaska	West Coast S America	All Commodities	1,738	23,251	4,984	5,274	5,566	7,183	9,728	14,173	41,111	134,796	366,755

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Hawaii	World	All Commodities	911,137	716,264	511,475	536,052	550,018	609,247	672,659	776,097	1,162,245	2,134,520	4,393,352
Hawaii	Percent Change	All Commodities	NA	-4.70%	-10.62%	4.81%	2.61%	2.07%	2.00%	2.90%	4.12%	6.27%	7.49%
Hawaii	Africa	All Commodities	267	273	253	263	271	357	462	627	1,631	5,303	14,845
Hawaii	Central America	All Commodities	1,861	2,032	2,440	2,638	2,851	4,381	7,034	12,402	48,959	179,686	502,205
Hawaii	East Coast S America	All Commodities	33,724	7,721	3,790	4,150	4,354	5,691	6,983	8,050	10,749	15,155	23,058
Hawaii	Eastern Europe	All Commodities	364	509	811	862	929	1,367	1,955	2,926	8,541	27,663	75,432
Hawaii	India	All Commodities	52,552	2,881	6,575	6,653	6,783	8,052	10,604	16,091	55,369	210,570	629,907
Hawaii	Middle East	All Commodities	239	475	557	570	597	779	942	1,104	1,468	1,894	2,387
Hawaii	Mediterranean	All Commodities	486	603	614	625	645	824	972	1,138	1,561	2,115	2,828
Hawaii	North America	All Commodities	56	719	1,317	1,357	1,377	1,704	1,883	2,045	2,342	776	1,088
Hawaii	NE Asia	All Commodities	673,860	656,818	368,832	386,716	396,084	437,804	484,393	553,210	763,575	1,155,954	1,951,713
Hawaii	North Europe	All Commodities	6,089	7,331	8,273	8,271	8,469	9,783	10,665	11,697	14,271	17,714	22,644
Hawaii	Oceania	All Commodities	41,891	2,243	1,837	1,901	1,977	2,430	2,821	3,257	4,315	5,665	7,386
Hawaii	Europe, Other	All Commodities	135	146	254	250	249	269	280	295	330	369	411
Hawaii	SE Asia	All Commodities	97,864	32,735	113,889	119,602	123,104	132,384	138,384	154,328	215,760	389,151	811,212
Hawaii	West Coast S America	All Commodities	1,751	1,777	2,032	2,195	2,327	3,420	5,282	8,930	33,374	122,505	348,235

Table A-4. Metric Tonnes of Exports from US South Atlantic Coast Ports and Other Coasts, by World Trade Route, for Commodity Groups: 1995 - 2050 (selected years)

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	Agriculture	44,916,562	39,147,291	40,036,341	42,195,560	43,244,086	48,984,029	52,354,564	54,745,293	60,043,081	58,706,180	66,699,831
Savannah	World	Agriculture	195,882	201,824	500,687	530,736	542,798	600,012	629,381	646,355	689,070	684,439	762,612
Charleston	World	Agriculture	130,717	122,047	192,486	202,139	208,150	235,899	253,744	267,590	296,930	312,620	354,473
Jacksonville	World	Agriculture	109,348	41,499	28,026	29,793	31,017	34,144	36,301	37,447	39,411	41,229	43,168
Miami	World	Agriculture	122,729	117,848	114,549	121,700	127,038	142,649	152,848	158,857	167,486	174,337	181,191
Wilmington	World	Agriculture	199,894	329,097	44,754	48,424	50,271	61,682	68,113	73,368	86,827	87,580	111,031
Norfolk	World	Agriculture	350,179	411,515	411,822	443,501	459,587	502,648	528,356	546,306	584,629	582,812	641,909
Other N Atlantic	World	Agriculture	621,656	596,803	388,786	413,950	429,312	486,071	519,826	551,663	615,530	554,121	630,046
Gulf Coast	World	Agriculture	23,846,325	23,505,433	23,601,501	24,760,185	25,377,780	28,297,764	30,098,680	31,248,152	33,640,265	34,588,025	37,843,846
South Pacific	World	Agriculture	1,494,191	1,448,566	1,793,234	1,931,034	1,982,441	2,358,881	2,581,017	2,762,728	3,222,591	3,311,058	4,106,903
North Pacific	World	Agriculture	15,003,829	9,482,563	10,301,250	10,905,775	11,222,428	13,064,975	14,006,068	14,740,733	16,514,953	14,978,994	18,058,280
Alaska	World	Agriculture	769,645	830,937	365,380	393,775	400,526	453,439	478,721	491,910	525,518	507,407	575,385
Hawaii	World	Agriculture	781	2,079	1,780	1,859	1,883	2,265	2,481	2,665	3,021	1,508	1,927
USA	World	Extractive	100,915,131	69,382,908	60,032,352	60,865,978	62,176,733	63,892,394	64,689,578	66,237,438	70,524,916	76,225,546	83,574,687
Savannah	World	Extractive	2,399,403	2,310,114	2,805,901	2,963,008	3,000,705	3,034,923	3,030,711	3,133,192	3,429,741	3,814,156	4,351,768
Charleston	World	Extractive	787,981	868,390	385,596	404,163	410,781	422,213	435,166	462,230	527,236	601,079	690,006
Jacksonville	World	Extractive	301,178	90,873	401,978	416,918	430,296	479,837	501,660	531,153	607,746	692,183	785,151
Miami	World	Extractive	167,254	184,746	200,228	208,552	214,218	234,825	244,005	257,469	292,409	332,924	381,768
Wilmington	World	Extractive	14,098	28,888	39,732	43,078	43,764	46,387	47,215	49,765	56,726	65,230	76,929
Norfolk	World	Extractive	33,897,782	17,326,708	9,949,256	10,033,227	10,158,471	9,426,510	8,990,679	8,751,633	8,402,857	8,245,364	8,242,341
Other N Atlantic	World	Extractive	13,768,119	5,368,089	6,332,493	6,603,518	6,684,804	6,616,419	6,484,073	6,530,159	6,792,828	7,219,503	7,916,006
Gulf Coast	World	Extractive	16,341,496	7,206,923	5,815,008	5,923,446	6,072,429	6,075,534	6,041,002	6,085,452	6,212,368	6,515,413	6,906,718
South Pacific	World	Extractive	8,273,614	6,739,235	4,470,417	4,833,825	4,940,688	5,323,952	5,488,910	5,849,577	6,752,189	7,799,180	9,154,774
North Pacific	World	Extractive	2,183,306	1,031,498	1,722,723	1,850,946	1,881,668	2,005,552	2,051,129	2,164,792	2,467,242	2,831,881	3,319,785
Alaska	World	Extractive	2,762,991	3,988,332	2,748,054	2,932,158	2,971,835	3,058,471	3,074,277	3,200,731	3,567,373	4,039,259	4,702,184
Hawaii	World	Extractive	101,464	102,061	130,616	142,153	147,415	163,983	170,808	183,993	211,847	238,754	269,338
USA	World	Food	27,421,927	26,318,131	23,254,208	24,697,345	25,759,788	30,141,196	32,462,427	35,458,845	42,173,473	50,006,774	57,604,012
Savannah	World	Food	271,630	338,017	538,569	561,030	576,261	656,714	690,137	756,926	976,915	1,338,898	1,841,429
Charleston	World	Food	349,496	638,308	434,926	464,186	488,837	597,427	661,707	767,481	1,088,940	1,581,963	2,259,736
Jacksonville	World	Food	1,144,264	1,323,315	819,882	868,027	895,233	996,484	1,075,400	1,198,041	1,535,627	1,995,516	2,572,596
Miami	World	Food	533,608	640,406	625,834	653,783	667,666	720,178	741,386	768,049	836,611	936,149	1,068,038
Wilmington	World	Food	148,612	108,157	74,343	77,865	80,638	95,895	103,914	112,958	130,828	150,123	164,177
Norfolk	World	Food	963,185	758,327	672,969	710,774	733,639	815,750	839,445	889,600	1,020,894	1,177,003	1,312,452
Other N Atlantic	World	Food	623,784	543,820	597,381	628,030	646,604	757,217	817,077	880,545	1,014,625	1,160,240	1,309,764
Gulf Coast	World	Food	14,578,033	12,128,779	9,505,351	10,282,020	10,793,832	12,516,099	13,451,053	14,706,081	17,477,704	20,572,834	23,685,222
South Pacific	World	Food	4,451,378	4,853,437	4,628,333	4,849,436	4,996,197	5,859,396	6,341,270	6,897,389	8,014,439	9,266,254	10,241,896
North Pacific	World	Food	3,637,768	4,146,270	4,379,484	4,570,735	4,829,969	5,979,180	6,539,811	7,203,857	8,640,235	10,206,768	11,378,075
Alaska	World	Food	519,816	444,371	597,993	626,421	643,667	740,175	795,071	860,750	992,637	1,143,910	1,257,952
Hawaii	World	Food	4,768	5,360	15,490	16,183	16,696	19,637	21,281	23,182	26,975	31,324	34,464

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	Materials	19,449,772	17,880,499	20,275,036	20,613,798	20,101,679	17,320,517	15,786,394	15,758,387	16,382,136	18,463,731	22,623,351
Savannah	World	Materials	2,178,134	1,786,014	2,185,209	2,259,003	2,229,349	1,901,279	1,760,529	1,820,802	2,047,068	2,482,761	3,208,300
Charleston	World	Materials	1,510,409	1,655,808	1,412,706	1,457,352	1,442,224	1,193,819	1,088,283	1,116,865	1,256,430	1,576,830	2,171,603
Jacksonville	World	Materials	821,382	680,764	538,646	546,822	544,752	546,807	564,356	593,323	679,596	808,401	990,326
Miami	World	Materials	472,872	556,696	697,238	724,240	728,333	742,790	766,360	808,408	898,268	996,668	1,100,311
Wilmington	World	Materials	586,518	439,667	382,642	398,631	389,347	288,192	241,419	231,273	217,445	215,269	223,502
Norfolk	World	Materials	961,275	853,769	1,018,246	1,026,963	1,009,119	901,791	845,545	849,550	918,821	1,225,592	2,066,204
Other N Atlantic	World	Materials	2,327,591	2,371,383	3,409,137	3,424,398	3,312,992	2,796,747	2,478,533	2,400,097	2,309,729	2,417,498	2,780,877
Gulf Coast	World	Materials	3,054,150	2,006,214	1,988,071	2,046,665	2,019,976	1,753,219	1,669,928	1,729,893	1,968,952	2,469,744	3,409,091
South Pacific	World	Materials	4,024,908	4,764,180	5,940,737	5,951,712	5,769,884	5,006,621	4,446,541	4,272,604	4,033,396	4,020,199	4,212,873
North Pacific	World	Materials	3,319,820	2,567,990	2,427,004	2,496,640	2,381,615	1,975,053	1,741,213	1,759,218	1,883,471	2,081,043	2,273,775
Alaska	World	Materials	126,798	836	464	457	445	396	354	329	288	276	292
Hawaii	World	Materials	33,309	50,482	49,993	49,038	47,552	40,661	36,099	35,012	33,194	32,690	33,643
USA	World	Consumer Goods	1,041,702	1,308,662	1,182,537	1,239,796	1,291,609	1,542,364	1,836,988	2,247,252	3,891,876	7,995,170	16,780,077
Savannah	World	Consumer Goods	28,185	25,015	46,700	48,891	51,211	62,264	73,813	88,786	134,198	211,429	337,027
Charleston	World	Consumer Goods	50,442	61,200	47,917	50,326	52,616	64,341	76,735	94,297	165,420	358,674	840,835
Jacksonville	World	Consumer Goods	24,533	15,452	10,037	10,427	10,679	11,704	12,530	13,227	14,942	17,237	20,040
Miami	World	Consumer Goods	180,780	351,216	226,328	230,593	233,499	244,993	253,998	262,023	280,606	304,273	331,339
Wilmington	World	Consumer Goods	3,416	2,304	1,227	1,309	1,385	1,738	2,204	2,862	5,529	11,955	25,077
Norfolk	World	Consumer Goods	57,339	57,311	55,676	58,338	61,264	75,910	92,958	119,454	257,854	719,578	1,875,527
Other N Atlantic	World	Consumer Goods	175,942	196,423	208,825	217,927	226,658	272,516	322,595	389,950	645,861	1,233,655	2,373,020
Gulf Coast	World	Consumer Goods	67,018	137,097	139,862	145,268	150,326	178,662	205,648	239,269	357,556	645,964	1,265,313
South Pacific	World	Consumer Goods	356,560	362,312	349,505	373,867	395,392	495,715	625,579	810,734	1,575,206	3,457,347	7,339,049
North Pacific	World	Consumer Goods	69,333	59,350	60,854	66,116	70,801	92,608	125,048	174,781	379,082	899,267	2,119,073
Alaska	World	Consumer Goods	157	20	18	20	21	25	31	38	63	112	207
Hawaii	World	Consumer Goods	86	131	146	155	163	203	254	328	636	1,404	2,993
USA	World	Chemicals	45,999,506	51,269,580	53,368,603	55,208,002	55,433,898	58,291,358	61,734,948	66,987,489	84,726,884	122,318,572	197,189,249
Savannah	World	Chemicals	459,276	512,635	791,594	812,872	819,072	897,405	997,361	1,127,012	1,551,078	2,423,500	4,183,444
Charleston	World	Chemicals	1,179,361	1,012,606	1,107,484	1,129,896	1,136,215	1,293,814	1,470,729	1,695,031	2,522,915	4,570,847	8,998,006
Jacksonville	World	Chemicals	262,997	113,069	214,422	223,442	225,162	240,569	257,139	277,373	343,558	468,148	691,452
Miami	World	Chemicals	235,438	317,612	299,575	307,319	309,416	325,799	342,710	359,998	439,607	650,990	1,097,211
Wilmington	World	Chemicals	61,483	168,832	35,684	36,980	37,722	41,406	46,218	53,253	77,323	130,793	247,059
Norfolk	World	Chemicals	551,462	747,187	836,275	857,413	861,091	940,023	1,033,369	1,165,586	1,658,881	2,858,610	5,432,790
Other N Atlantic	World	Chemicals	1,618,150	1,722,985	2,160,808	2,210,570	2,261,139	2,387,335	2,579,898	2,850,792	3,858,427	6,105,768	10,681,029
Gulf Coast	World	Chemicals	25,564,191	32,633,891	32,759,933	33,827,204	34,019,661	35,051,012	36,643,230	39,334,634	48,354,368	67,008,335	102,872,083
South Pacific	World	Chemicals	9,746,732	8,151,391	6,747,155	6,963,092	7,052,530	7,540,891	8,204,284	9,178,223	12,439,624	19,158,650	32,553,184
North Pacific	World	Chemicals	4,074,382	3,378,883	4,841,207	5,047,627	5,050,473	5,393,713	5,692,426	6,087,248	7,528,887	10,991,280	18,646,016
Alaska	World	Chemicals	424,892	527,036	663,576	690,400	708,176	786,313	883,767	1,021,259	1,441,134	2,234,276	3,870,590
Hawaii	World	Chemicals	737,066	517,785	276,869	287,801	295,049	326,387	365,877	422,143	595,087	923,948	1,603,147

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	High Technology	420,976	465,430	448,635	476,454	504,974	684,233	921,087	1,314,288	3,446,833	10,365,122	27,268,274
Savannah	World	High Technology	32,383	35,802	34,510	36,704	38,953	53,131	72,000	103,390	278,178	858,102	2,301,141
Charleston	World	High Technology	32,383	35,802	34,510	36,645	38,815	52,479	70,487	100,249	260,688	776,664	2,025,321
Jacksonville	World	High Technology	32,383	35,802	34,510	36,571	38,677	51,808	68,886	96,668	240,083	676,751	1,689,156
Miami	World	High Technology	32,383	35,802	34,510	36,607	38,744	52,134	69,660	98,382	249,638	722,935	1,845,866
Wilmington	World	High Technology	32,383	35,802	34,510	36,709	38,982	53,330	72,499	104,812	285,861	896,409	2,434,145
Norfolk	World	High Technology	32,383	35,802	34,510	36,668	38,872	52,735	71,069	101,478	265,778	796,074	2,085,617
Other N Atlantic	World	High Technology	32,383	35,802	34,510	36,547	38,622	51,482	68,126	95,002	231,896	640,756	1,572,302
Gulf Coast	World	High Technology	32,383	35,802	34,510	36,556	38,627	51,575	68,377	95,559	234,657	653,729	1,617,596
South Pacific	World	High Technology	32,383	35,802	34,510	36,709	38,982	53,330	72,499	104,812	285,861	896,409	2,434,145
North Pacific	World	High Technology	32,383	35,802	34,510	36,612	38,755	52,239	69,986	99,300	256,610	758,069	1,960,551
Alaska	World	High Technology	32,383	35,802	34,510	36,709	38,982	53,330	72,499	104,812	285,861	896,409	2,434,145
Hawaii	World	High Technology	32,383	35,802	34,510	36,709	38,982	53,330	72,499	104,812	285,861	896,409	2,434,145
USA	World	Intermed. Manufact.	6,721,346	3,438,961	4,674,500	4,876,482	5,084,764	6,248,033	7,630,942	8,989,222	12,948,860	20,335,168	34,122,793
Savannah	World	Intermed. Manufact.	89,153	110,978	121,859	128,208	131,581	155,895	186,435	216,235	304,156	464,426	763,491
Charleston	World	Intermed. Manufact.	212,899	259,046	374,770	391,583	404,900	490,652	585,721	682,467	990,649	1,644,215	2,884,534
Jacksonville	World	Intermed. Manufact.	79,418	62,917	48,172	49,525	49,644	51,641	52,925	53,628	56,335	60,392	64,905
Miami	World	Intermed. Manufact.	226,989	236,647	208,973	224,732	236,505	303,314	383,988	483,684	860,654	1,691,850	3,165,293
Wilmington	World	Intermed. Manufact.	43,789	5,364	26,241	27,572	28,750	35,749	45,261	56,095	94,715	184,498	380,193
Norfolk	World	Intermed. Manufact.	164,963	250,892	258,377	270,060	280,953	341,815	414,801	490,311	730,009	1,264,378	2,431,384
Other N Atlantic	World	Intermed. Manufact.	924,418	546,893	1,081,826	1,130,423	1,187,661	1,477,962	1,818,028	2,150,058	3,105,501	4,964,475	8,725,608
Gulf Coast	World	Intermed. Manufact.	1,831,224	493,279	808,179	843,219	878,430	1,073,310	1,303,711	1,519,569	2,098,561	3,030,288	4,566,135
South Pacific	World	Intermed. Manufact.	1,192,860	824,388	689,201	722,392	744,573	892,174	1,083,733	1,272,672	1,863,490	3,006,394	5,220,826
North Pacific	World	Intermed. Manufact.	648,599	235,066	228,281	236,903	245,640	293,968	351,880	406,652	586,290	943,506	1,668,998
Alaska	World	Intermed. Manufact.	270	30	53	55	57	68	82	94	132	199	322
Hawaii	World	Intermed. Manufact.	271	1,671	1,075	1,104	1,166	1,401	1,656	1,867	2,335	2,976	4,001
USA	World	Capital Equipment	2,819,986	2,451,718	2,396,955	2,536,061	2,632,882	3,166,483	3,708,108	4,290,262	5,968,851	8,728,216	13,241,906
Savannah	World	Capital Equipment	141,050	132,531	125,000	135,231	136,802	164,399	195,158	227,494	314,166	445,778	653,982
Charleston	World	Capital Equipment	188,864	188,151	170,055	177,481	184,523	215,301	242,241	268,821	343,142	462,532	651,184
Jacksonville	World	Capital Equipment	57,623	31,752	35,692	36,685	37,137	40,091	42,054	43,706	50,097	65,291	99,310
Miami	World	Capital Equipment	272,259	221,384	183,684	193,084	198,002	230,763	255,860	276,055	329,276	400,798	489,865
Wilmington	World	Capital Equipment	25,064	23,218	8,308	8,711	9,193	11,792	14,630	17,820	27,222	43,295	70,352
Norfolk	World	Capital Equipment	245,370	189,196	171,469	179,249	184,642	216,363	245,429	273,147	348,407	468,145	658,545
Other N Atlantic	World	Capital Equipment	431,240	352,481	446,101	473,354	494,191	598,414	694,982	793,289	1,061,712	1,479,583	2,137,085
Gulf Coast	World	Capital Equipment	631,371	519,031	467,334	493,407	510,390	610,632	706,156	807,702	1,136,281	1,713,390	2,597,472
South Pacific	World	Capital Equipment	602,725	530,875	508,878	541,835	566,150	700,463	863,179	1,059,331	1,615,861	2,539,889	4,147,239
North Pacific	World	Capital Equipment	159,948	160,712	148,692	158,773	166,917	209,958	260,418	318,508	483,991	755,908	1,224,089
Alaska	World	Capital Equipment	222	89	9	10	10	12	13	14	18	23	31
Hawaii	World	Capital Equipment	769	576	835	879	929	1,166	1,459	1,812	2,861	4,696	7,979

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	Motor Vehicles	1,663,302	1,193,706	1,318,534	1,386,017	1,440,968	1,827,707	2,147,354	2,493,247	3,632,140	6,317,531	12,201,909
Savannah	World	Motor Vehicles	43,462	74,604	94,180	101,184	107,002	144,400	181,976	223,809	338,165	530,970	851,071
Charleston	World	Motor Vehicles	28,534	102,005	150,887	154,689	158,814	230,573	294,039	353,542	483,715	633,245	793,921
Jacksonville	World	Motor Vehicles	77,640	87,250	116,403	119,856	122,043	160,175	195,362	228,868	304,947	397,131	501,296
Miami	World	Motor Vehicles	171,556	112,750	94,599	102,030	105,579	130,534	144,878	159,420	194,740	237,715	287,254
Wilmington	World	Motor Vehicles	2,898	875	2,845	3,093	3,372	3,947	4,158	4,489	5,183	5,882	6,671
Norfolk	World	Motor Vehicles	142,427	73,672	45,064	46,329	46,988	55,006	58,094	59,667	66,962	88,042	133,808
Other N Atlantic	World	Motor Vehicles	454,814	216,622	264,841	273,297	279,717	316,216	325,206	335,423	411,251	653,204	1,173,750
Gulf Coast	World	Motor Vehicles	73,902	57,737	65,859	70,649	72,773	88,867	100,954	115,170	173,243	348,355	799,629
South Pacific	World	Motor Vehicles	487,036	290,463	259,288	280,449	298,498	386,635	486,509	615,806	1,160,789	2,769,707	6,703,379
North Pacific	World	Motor Vehicles	147,238	66,070	89,063	95,288	102,835	120,611	139,435	161,412	225,526	348,733	583,182
Alaska	World	Motor Vehicles	28	14	0	0	0	0	0	0	1	2	5
Hawaii	World	Motor Vehicles	240	316	160	171	184	213	244	284	429	812	1,715

Table A-5. Containerized Tonnes of Imports to US South Atlantic Coast Ports and Other Coasts, by World Trade Route, for All Commodities: 1995 - 2050 (selected years)

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	All Commodities	43,668,120	70,432,286	83,924,683	87,715,698	94,183,075	121,619,709	140,610,872	159,479,498	208,004,390	271,444,015	351,291,751
USA	Percent Change	All Commodities	NA	10.03%	6.02%	4.52%	7.37%	5.25%	2.94%	2.55%	2.69%	2.70%	2.61%
Savannah	World	All Commodities	1,307,526	2,106,325	3,154,499	3,287,391	3,554,627	4,753,187	5,586,015	6,473,756	8,808,387	11,895,628	15,548,339
Savannah	Percent Change	All Commodities	NA	10.01%	14.41%	4.21%	8.13%	5.98%	3.28%	2.99%	3.13%	3.05%	2.71%
Savannah	Africa	All Commodities	10,724	10,636	11,203	10,025	10,048	11,703	12,911	14,134	17,064	20,586	24,429
Savannah	Central America	All Commodities	39,516	50,030	152,333	146,419	153,645	177,948	189,687	201,271	229,631	263,664	308,956
Savannah	East Coast S America	All Commodities	228,841	234,303	309,058	325,509	343,740	401,423	438,834	474,941	558,515	654,438	762,215
Savannah	Eastern Europe	All Commodities	69,252	33,856	44,104	45,272	49,133	75,734	113,888	167,442	337,999	599,989	919,166
Savannah	India	All Commodities	18,845	75,547	90,099	90,220	95,110	123,611	142,601	160,914	207,438	266,213	329,040
Savannah	Middle East	All Commodities	5,566	15,291	18,260	19,379	20,487	26,334	30,085	34,645	46,611	64,131	89,076
Savannah	Mediterranean	All Commodities	34,845	58,828	81,774	88,452	99,706	126,041	139,319	152,544	183,232	222,790	275,543
Savannah	North America	All Commodities	26,962	8,511	24,162	26,167	27,558	32,583	37,356	42,536	55,891	75,487	104,798
Savannah	NE Asia	All Commodities	524,914	876,766	1,546,205	1,628,253	1,788,766	2,556,181	3,109,187	3,708,564	5,278,444	7,336,021	9,681,474
Savannah	North Europe	All Commodities	176,612	364,035	367,166	404,129	433,877	573,892	662,379	743,190	972,477	1,303,299	1,748,675
Savannah	Oceania	All Commodities	22,739	27,406	72,612	67,368	69,661	96,878	117,936	137,347	185,596	258,502	370,814
Savannah	Europe, Other	All Commodities	2,949	30,541	21,317	13,268	13,212	14,312	14,716	15,123	15,954	16,422	16,731
Savannah	SE Asia	All Commodities	126,602	304,707	346,835	353,757	378,700	450,313	477,552	506,272	569,841	626,062	684,825
Savannah	West Coast S America	All Commodities	19,160	15,868	69,373	69,172	70,984	86,232	99,563	114,835	149,693	188,025	232,598
Charleston	World	All Commodities	1,261,537	2,437,615	3,363,179	3,502,757	3,787,706	5,035,660	5,924,561	6,823,126	9,112,316	12,093,056	15,727,325
Charleston	Percent Change	All Commodities	NA	14.08%	11.33%	4.15%	8.13%	5.86%	3.30%	2.86%	2.94%	2.87%	2.66%
Charleston	Africa	All Commodities	18,764	25,520	55,783	58,007	61,673	82,354	97,885	113,701	149,896	192,064	234,835
Charleston	Central America	All Commodities	7,672	26,580	40,844	40,447	43,866	51,309	56,648	61,353	72,982	87,169	104,462
Charleston	East Coast S America	All Commodities	87,206	266,001	505,279	540,424	594,010	773,031	935,957	1,089,428	1,452,887	1,890,056	2,384,763
Charleston	Eastern Europe	All Commodities	24,055	96,831	107,852	108,699	114,915	158,013	198,316	244,167	375,649	561,457	781,146
Charleston	India	All Commodities	96,147	124,838	291,973	294,034	306,181	402,085	475,595	540,906	706,400	910,656	1,139,111
Charleston	Middle East	All Commodities	6,105	13,032	30,114	32,603	34,490	45,794	52,079	61,440	88,007	127,286	178,925
Charleston	Mediterranean	All Commodities	49,997	148,357	183,270	194,637	215,504	288,711	337,651	388,520	514,991	677,542	881,708
Charleston	North America	All Commodities	12,189	8,682	6,310	6,672	6,865	7,792	8,824	10,079	13,568	18,837	26,646
Charleston	NE Asia	All Commodities	280,597	510,264	681,299	711,650	777,788	1,124,025	1,379,152	1,654,360	2,385,573	3,381,944	4,608,093
Charleston	North Europe	All Commodities	455,836	791,270	939,191	1,003,383	1,088,091	1,396,494	1,594,875	1,797,641	2,336,638	3,089,429	4,112,837
Charleston	Oceania	All Commodities	49,315	28,349	77,442	72,718	75,171	96,230	110,470	120,917	144,935	176,041	218,066
Charleston	Europe, Other	All Commodities	10,983	46,594	80,727	64,491	66,061	76,438	84,334	92,402	110,435	128,950	145,259
Charleston	SE Asia	All Commodities	131,649	245,861	165,044	167,554	175,845	208,310	224,050	242,104	284,754	328,351	374,447
Charleston	West Coast S America	All Commodities	31,022	105,434	198,050	207,438	227,247	325,072	368,726	406,107	475,602	523,275	537,027

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Jacksonville	World	All Commodities	1,280,854	2,059,019	2,696,401	2,823,007	3,042,724	3,902,856	4,547,446	5,245,877	7,159,019	9,845,401	13,154,390
Jacksonville	Percent Change	All Commodities	NA	9.96%	9.41%	4.70%	7.78%	5.11%	3.10%	2.90%	3.16%	3.24%	2.94%
Jacksonville	Africa	All Commodities	3,563	11,660	13,894	15,720	17,564	22,093	27,035	32,880	47,253	66,795	89,781
Jacksonville	Central America	All Commodities	177,211	240,384	352,548	347,722	376,788	419,764	454,517	478,938	542,867	622,777	726,863
Jacksonville	East Coast S America	All Commodities	329,053	595,605	809,481	859,378	921,930	1,179,201	1,340,471	1,500,420	1,925,717	2,560,187	3,426,988
Jacksonville	Eastern Europe	All Commodities	105,813	122,379	138,867	167,963	186,154	302,173	481,683	746,069	1,584,109	2,869,973	4,433,044
Jacksonville	India	All Commodities	2,757	3,312	23,873	24,736	28,270	44,488	57,391	72,180	113,299	174,217	257,891
Jacksonville	Middle East	All Commodities	863	1,291	1,484	1,523	1,633	2,397	3,329	4,423	7,375	11,841	18,341
Jacksonville	Mediterranean	All Commodities	57,984	41,884	98,698	108,689	122,433	154,995	178,000	199,346	227,820	270,975	320,928
Jacksonville	North America	All Commodities	56,835	104,011	109,200	116,784	122,178	141,032	151,069	157,583	176,607	204,822	245,494
Jacksonville	NE Asia	All Commodities	155,803	274,536	285,902	296,997	324,111	485,977	619,076	760,451	1,122,223	1,606,031	2,193,685
Jacksonville	North Europe	All Commodities	209,443	234,164	411,269	431,746	440,910	488,597	496,971	489,990	483,557	483,993	497,347
Jacksonville	Oceania	All Commodities	13,756	9,361	12,440	11,719	10,128	12,755	15,007	16,099	17,797	19,798	22,349
Jacksonville	Europe, Other	All Commodities	232	4,532	29,329	21,614	23,600	34,314	46,404	57,771	80,622	100,680	114,004
Jacksonville	SE Asia	All Commodities	47,013	176,462	76,604	82,128	96,380	132,311	149,707	168,385	205,173	232,491	253,453
Jacksonville	West Coast S America	All Commodities	120,529	239,437	312,810	336,086	370,644	482,759	531,785	570,342	624,602	621,721	554,223
Miami	World	All Commodities	1,364,825	2,237,289	3,023,402	3,171,822	3,444,352	4,499,856	5,292,710	6,121,626	8,351,668	11,460,791	15,562,895
Miami	Percent Change	All Commodities	NA	10.39%	10.56%	4.91%	8.59%	5.49%	3.30%	2.95%	3.16%	3.22%	3.11%
Miami	Africa	All Commodities	899	5,040	8,631	9,399	10,431	13,110	15,536	18,177	23,653	30,275	38,075
Miami	Central America	All Commodities	271,206	525,560	631,902	644,221	671,315	756,610	831,260	904,593	1,093,728	1,333,035	1,643,538
Miami	East Coast S America	All Commodities	407,524	351,901	390,079	391,960	401,018	425,338	440,814	455,462	487,897	521,597	555,459
Miami	Eastern Europe	All Commodities	2,235	20,321	49,084	52,077	58,433	101,986	166,656	256,334	548,225	1,005,555	1,564,543
Miami	India	All Commodities	8,869	15,603	25,451	25,464	26,952	35,491	41,351	46,796	62,408	83,347	106,773
Miami	Middle East	All Commodities	4,787	3,724	6,976	7,195	7,595	8,995	10,035	11,339	15,079	21,126	30,435
Miami	Mediterranean	All Commodities	98,839	227,525	323,391	357,495	407,383	567,382	650,212	732,206	931,823	1,193,369	1,538,801
Miami	North America	All Commodities	843	6,113	17,071	17,456	17,586	18,575	18,931	19,579	20,116	20,362	19,858
Miami	NE Asia	All Commodities	180,368	267,390	448,904	468,029	512,744	749,772	954,293	1,174,218	1,748,370	2,509,833	3,440,684
Miami	North Europe	All Commodities	213,204	526,213	721,106	819,348	936,853	1,351,331	1,642,320	1,928,875	2,727,209	3,923,334	5,664,204
Miami	Oceania	All Commodities	380	2,754	17,742	17,497	18,221	23,623	30,504	38,172	57,979	85,079	120,408
Miami	Europe, Other	All Commodities	1,707	11,304	20,199	21,358	23,633	21,213	20,987	21,182	21,849	22,190	22,217
Miami	SE Asia	All Commodities	67,918	120,409	119,435	120,034	126,693	153,936	166,225	180,603	215,247	251,105	288,606
Miami	West Coast S America	All Commodities	106,047	153,431	223,428	220,270	225,497	272,513	303,586	334,092	398,085	461,583	529,293
Wilmington	World	All Commodities	500,971	636,237	733,502	772,656	839,625	1,209,221	1,581,015	2,015,153	3,362,706	5,615,288	9,110,141
Wilmington	Percent Change	All Commodities	NA	4.90%	4.86%	5.34%	8.67%	7.57%	5.51%	4.97%	5.25%	5.26%	4.96%
Wilmington	Africa	All Commodities	2,318	581	2,775	3,384	4,425	6,348	7,991	10,040	15,413	23,416	35,335
Wilmington	Central America	All Commodities	16,540	13,965	46,534	46,187	53,624	72,804	93,736	118,811	193,319	321,568	553,810
Wilmington	East Coast S America	All Commodities	80,832	24,068	80,855	87,601	94,008	126,744	165,648	216,454	380,409	685,772	1,246,079
Wilmington	Eastern Europe	All Commodities	25,989	55,773	54,263	55,640	59,176	76,211	91,941	106,621	136,927	155,011	162,862
Wilmington	India	All Commodities	7,523	18,852	2,572	2,658	2,864	4,104	5,270	5,835	9,848	17,900	34,656
Wilmington	Middle East	All Commodities	1,566	4,048	4,118	4,497	4,978	7,820	11,118	14,932	25,296	41,106	64,247
Wilmington	Mediterranean	All Commodities	6,468	15,245	7,253	8,350	9,731	12,214	13,856	16,141	24,581	42,789	80,128
Wilmington	North America	All Commodities	46,093	24,777	10,586	10,799	10,689	9,891	9,187	8,795	9,070	10,569	13,295
Wilmington	NE Asia	All Commodities	165,412	274,084	297,222	312,466	343,075	518,964	674,295	841,290	1,272,979	1,847,123	2,569,341
Wilmington	North Europe	All Commodities	77,216	91,851	88,958	97,210	100,174	139,867	173,952	196,199	254,873	317,814	382,842
Wilmington	Oceania	All Commodities	5,696	347	380	392	441	736	974	1,267	2,184	3,849	6,880
Wilmington	Europe, Other	All Commodities	1,163	165	5,456	2,639	3,019	5,392	9,159	15,064	37,098	79,554	152,423
Wilmington	SE Asia	All Commodities	52,922	103,860	104,300	108,066	115,595	154,941	194,161	241,025	389,999	615,393	942,360
Wilmington	West Coast S America	All Commodities	11,234	8,621	28,230	32,768	38,024	73,084	129,728	222,079	610,708	1,453,485	2,865,883

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Norfolk	World	All Commodities	1,654,417	2,412,844	3,230,294	3,333,337	3,541,441	4,605,270	5,282,095	5,960,689	7,609,389	9,541,578	11,711,690
Norfolk	Percent Change	All Commodities	NA	7.84%	10.21%	3.19%	6.24%	5.39%	2.78%	2.45%	2.47%	2.29%	2.07%
Norfolk	Africa	All Commodities	14,323	27,955	35,392	36,979	39,868	47,624	51,309	54,925	64,079	76,375	91,807
Norfolk	Central America	All Commodities	15,947	12,217	17,155	17,482	18,199	20,457	22,171	23,728	28,037	33,849	40,707
Norfolk	East Coast S America	All Commodities	254,861	345,574	486,799	525,101	548,574	728,239	839,672	938,639	1,117,889	1,322,930	1,565,911
Norfolk	Eastern Europe	All Commodities	48,326	149,126	149,690	151,460	158,769	196,176	221,770	240,045	281,624	328,162	399,154
Norfolk	India	All Commodities	46,446	98,033	184,728	186,240	192,453	243,041	279,606	307,133	399,310	517,470	650,584
Norfolk	Middle East	All Commodities	3,409	9,143	14,529	15,553	16,370	21,076	22,430	24,903	31,125	38,966	47,846
Norfolk	Mediterranean	All Commodities	204,750	204,032	162,669	170,052	183,419	213,899	232,334	249,652	289,087	328,302	363,760
Norfolk	North America	All Commodities	51,362	51,884	56,928	62,327	67,078	86,445	98,986	109,428	134,889	169,677	219,074
Norfolk	NE Asia	All Commodities	176,996	423,387	829,377	851,305	935,147	1,398,787	1,685,498	1,999,427	2,798,771	3,779,313	4,840,816
Norfolk	North Europe	All Commodities	653,682	803,158	894,659	914,569	962,672	1,113,912	1,213,401	1,305,427	1,498,941	1,708,504	1,954,993
Norfolk	Oceania	All Commodities	12,970	32,769	35,210	32,406	34,646	47,547	52,150	54,755	64,138	74,674	85,560
Norfolk	Europe, Other	All Commodities	11,092	23,166	34,474	33,250	33,814	35,976	38,281	40,316	45,965	52,515	59,867
Norfolk	SE Asia	All Commodities	148,550	219,142	256,104	262,654	275,100	350,237	394,650	450,210	600,099	803,320	1,049,968
Norfolk	West Coast S America	All Commodities	9,734	13,255	72,581	73,959	75,334	101,855	129,837	162,102	235,436	407,520	641,641
Other N Atlantic	World	All Commodities	10,549,036	16,187,158	20,439,880	21,534,362	23,001,096	28,498,222	32,106,756	35,452,847	43,862,675	54,418,313	67,491,475
Other N Atlantic	Percent Change	All Commodities	NA	8.94%	8.09%	5.35%	6.81%	4.38%	2.41%	2.00%	2.15%	2.18%	2.18%
Other N Atlantic	Africa	All Commodities	192,969	305,511	356,137	404,043	432,855	541,683	575,525	596,079	642,069	708,424	791,058
Other N Atlantic	Central America	All Commodities	330,539	494,128	504,040	524,383	542,870	590,397	602,437	599,104	607,938	642,976	715,212
Other N Atlantic	East Coast S America	All Commodities	1,916,370	2,970,412	2,917,028	3,165,815	3,436,342	4,302,625	4,974,341	5,649,399	7,458,600	9,983,563	13,464,366
Other N Atlantic	Eastern Europe	All Commodities	268,512	967,504	1,383,047	1,465,088	1,530,366	1,809,911	1,977,093	2,074,439	2,177,083	2,171,357	2,291,631
Other N Atlantic	India	All Commodities	262,508	619,505	836,366	870,730	923,431	1,282,683	1,529,189	1,741,195	2,339,635	3,118,515	4,025,653
Other N Atlantic	Middle East	All Commodities	58,737	79,547	106,981	113,130	119,635	149,808	158,838	170,086	197,341	229,013	267,622
Other N Atlantic	Mediterranean	All Commodities	541,178	794,499	898,567	980,834	1,082,520	1,312,086	1,430,458	1,524,885	1,762,274	2,026,954	2,317,097
Other N Atlantic	North America	All Commodities	870,152	1,078,177	1,908,427	2,096,107	2,208,208	2,564,394	2,811,671	2,982,200	3,358,188	3,852,745	4,628,620
Other N Atlantic	NE Asia	All Commodities	1,277,813	2,032,612	3,120,006	3,184,202	3,473,318	4,825,871	5,701,394	6,534,918	8,547,172	10,831,582	12,930,597
Other N Atlantic	North Europe	All Commodities	3,189,858	4,691,783	5,540,049	5,826,917	6,224,875	7,447,296	8,365,899	9,301,226	11,682,324	14,739,899	18,663,265
Other N Atlantic	Oceania	All Commodities	273,778	331,380	487,062	444,959	483,805	692,784	737,034	757,833	862,725	985,079	1,102,844
Other N Atlantic	Europe, Other	All Commodities	34,138	100,185	140,856	137,672	143,526	157,782	169,071	179,701	213,079	260,210	320,562
Other N Atlantic	SE Asia	All Commodities	731,753	969,836	1,185,885	1,264,162	1,304,048	1,567,777	1,691,168	1,825,877	2,152,083	2,539,367	2,970,350
Other N Atlantic	West Coast S America	All Commodities	600,731	752,047	1,055,420	1,056,230	1,075,298	1,253,125	1,384,737	1,515,306	1,862,163	2,328,719	3,000,597
Gulf Coast	World	All Commodities	7,986,500	12,154,252	12,045,686	12,747,086	13,665,612	16,948,769	19,287,537	21,300,566	26,156,375	32,055,260	39,366,497
Gulf Coast	Percent Change	All Commodities	NA	9.88%	-0.30%	5.82%	7.21%	4.40%	2.62%	2.01%	2.07%	2.05%	2.08%
Gulf Coast	Africa	All Commodities	309,446	358,708	312,579	346,788	371,146	469,212	406,807	408,715	444,708	507,110	598,194
Gulf Coast	Central America	All Commodities	1,074,696	1,349,791	1,744,027	1,816,102	1,941,821	2,242,810	2,468,439	2,641,133	3,106,628	3,719,503	4,509,119
Gulf Coast	East Coast S America	All Commodities	2,034,102	2,570,725	2,962,987	3,154,113	3,386,199	4,093,979	4,695,628	5,186,940	6,393,834	7,907,993	9,765,581
Gulf Coast	Eastern Europe	All Commodities	761,149	1,548,293	1,441,883	1,479,003	1,555,507	1,937,745	2,194,108	2,353,502	2,572,287	2,655,291	2,762,939
Gulf Coast	India	All Commodities	105,323	351,451	183,180	191,699	208,244	286,340	333,403	369,559	484,709	637,379	824,440
Gulf Coast	Middle East	All Commodities	71,757	70,015	85,054	87,916	87,490	109,257	119,909	128,222	147,549	170,290	198,044
Gulf Coast	Mediterranean	All Commodities	427,768	670,193	499,251	535,065	586,906	799,496	992,407	1,183,225	1,677,375	2,357,876	3,276,732
Gulf Coast	North America	All Commodities	153,563	128,344	78,575	85,744	90,157	109,413	126,140	144,068	191,795	260,132	360,489
Gulf Coast	NE Asia	All Commodities	605,694	1,132,978	978,563	1,043,967	1,164,117	1,682,915	2,094,914	2,503,568	3,506,994	4,747,890	6,165,458
Gulf Coast	North Europe	All Commodities	1,181,404	2,007,510	2,213,330	2,367,684	2,547,865	3,017,534	3,319,321	3,623,066	4,485,107	5,722,002	7,448,459
Gulf Coast	Oceania	All Commodities	114,599	189,812	163,358	96,307	100,456	139,633	153,548	164,492	187,673	213,391	239,126
Gulf Coast	Europe, Other	All Commodities	15,206	39,684	68,448	64,614	57,927	70,016	83,162	96,423	133,526	186,564	255,010
Gulf Coast	SE Asia	All Commodities	449,695	1,067,753	641,169	672,684	724,979	973,940	1,051,380	1,100,635	1,149,204	1,103,644	1,024,703
Gulf Coast	West Coast S America	All Commodities	282,187	668,695	733,274	776,301	842,797	1,085,479	1,252,372	1,397,110	1,674,088	1,866,196	1,938,204

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
South Pacific	World	All Commodities	12,068,591	22,341,303	26,809,877	27,701,290	29,790,735	39,246,872	45,194,238	51,003,213	65,092,670	81,682,207	98,965,594
South Pacific	Percent Change	All Commodities	NA	13.11%	6.27%	3.32%	7.54%	5.67%	2.86%	2.45%	2.47%	2.30%	1.94%
South Pacific	Africa	All Commodities	9,595	24,973	45,775	50,265	47,485	62,845	77,277	91,778	118,764	151,234	195,463
South Pacific	Central America	All Commodities	169,050	262,092	441,992	464,570	491,379	595,568	714,416	838,223	1,179,627	1,679,047	2,396,110
South Pacific	East Coast S America	All Commodities	359,451	412,860	362,058	383,051	410,009	482,402	529,643	564,814	642,898	734,787	858,206
South Pacific	Eastern Europe	All Commodities	29,839	82,269	135,662	136,546	148,178	205,567	246,776	289,793	398,770	546,492	757,189
South Pacific	India	All Commodities	321,944	529,524	616,455	601,510	612,699	728,206	787,667	826,847	949,367	1,096,848	1,266,769
South Pacific	Middle East	All Commodities	20,775	75,723	68,698	72,110	77,945	105,152	124,824	145,984	198,139	267,266	359,155
South Pacific	Mediterranean	All Commodities	88,241	193,225	266,663	283,845	312,364	413,061	468,401	522,939	658,711	837,699	1,074,934
South Pacific	North America	All Commodities	252,471	287,432	270,165	294,756	341,007	380,511	445,027	514,376	691,485	936,410	1,280,124
South Pacific	NE Asia	All Commodities	7,868,628	15,189,958	19,120,441	19,795,351	21,337,974	28,935,009	33,814,634	38,663,448	50,432,914	64,185,478	77,783,082
South Pacific	North Europe	All Commodities	687,420	1,123,468	1,044,043	1,084,930	1,168,351	1,462,993	1,680,421	1,889,051	2,436,999	3,194,683	4,203,648
South Pacific	Oceania	All Commodities	328,888	769,007	642,883	620,847	670,147	859,392	886,980	889,885	916,000	947,199	982,614
South Pacific	Europe, Other	All Commodities	6,947	24,745	41,937	43,827	47,892	48,391	51,780	55,968	67,480	80,176	90,611
South Pacific	SE Asia	All Commodities	1,644,798	2,915,819	3,253,137	3,348,223	3,598,756	4,348,435	4,747,342	5,103,754	5,806,370	6,457,267	7,188,285
South Pacific	West Coast S America	All Commodities	280,546	450,209	499,968	521,408	556,460	619,241	619,051	606,351	595,147	567,622	529,404
North Pacific	World	All Commodities	3,917,741	5,016,212	5,863,911	6,146,654	6,653,469	9,235,549	11,345,311	13,581,270	19,357,158	26,495,641	34,111,429
North Pacific	Percent Change	All Commodities	NA	5.07%	5.34%	4.82%	8.25%	6.78%	4.20%	3.66%	3.61%	3.19%	2.56%
North Pacific	Africa	All Commodities	358	4,829	5,044	5,220	5,583	6,330	6,374	6,454	7,299	8,397	9,047
North Pacific	East Coast S America	All Commodities	24,692	44,237	50,361	55,201	60,783	85,028	110,949	136,282	205,263	299,424	418,148
North Pacific	Eastern Europe	All Commodities	5,615	31,842	28,974	28,014	30,141	42,176	50,725	57,787	71,081	83,577	99,829
North Pacific	India	All Commodities	67,197	111,062	84,472	77,107	73,311	92,317	105,580	118,241	155,373	201,702	248,535
North Pacific	Middle East	All Commodities	518	5,754	4,857	5,137	5,513	7,140	7,940	8,734	10,292	12,253	14,967
North Pacific	Mediterranean	All Commodities	4,320	6,283	7,413	9,394	12,168	16,990	21,052	25,257	36,542	52,490	74,221
North Pacific	North America	All Commodities	244,140	247,757	247,935	274,345	300,301	382,070	447,874	513,989	676,059	894,719	1,180,059
North Pacific	NE Asia	All Commodities	2,692,482	3,356,143	4,465,298	4,736,713	5,143,980	7,289,779	9,030,439	10,889,364	15,709,347	21,630,986	27,673,828
North Pacific	North Europe	All Commodities	38,100	62,813	76,920	75,866	78,605	105,629	123,264	143,290	198,450	277,200	386,290
North Pacific	Oceania	All Commodities	379,258	472,017	232,982	232,035	253,518	358,490	473,150	597,483	936,223	1,383,297	1,975,353
North Pacific	Europe, Other	All Commodities	196	1,911	545	585	683	928	1,165	1,400	1,993	2,760	3,733
North Pacific	SE Asia	All Commodities	360,746	557,661	503,571	484,831	515,238	623,072	681,694	737,710	843,795	910,670	947,284
North Pacific	West Coast S America	All Commodities	68,533	31,897	43,732	41,444	42,573	52,641	57,722	62,127	72,247	83,959	98,173
Alaska	World	All Commodities	160,127	270,013	308,713	323,171	353,310	556,744	769,880	1,043,426	1,975,260	3,911,989	7,864,866
Alaska	Percent Change	All Commodities	NA	11.02%	4.57%	4.68%	9.33%	9.52%	6.70%	6.27%	6.59%	7.07%	7.23%
Alaska	Africa	All Commodities	11	13	40	45	52	85	109	136	205	302	434
Alaska	Central America	All Commodities	2,788	318	906	982	1,113	1,744	2,406	3,241	6,024	11,737	24,347
Alaska	East Coast S America	All Commodities	192	495	911	1,006	1,140	1,872	2,595	3,463	5,930	9,799	15,695
Alaska	Eastern Europe	All Commodities	689	2,912	4,073	4,277	4,507	5,366	5,942	6,381	7,054	7,052	6,893
Alaska	India	All Commodities	199	426	635	691	784	1,272	1,643	2,117	3,654	7,041	15,970
Alaska	Middle East	All Commodities	106	227	232	251	278	425	516	615	861	1,188	1,622
Alaska	Mediterranean	All Commodities	129	371	491	542	613	1,002	1,269	1,560	2,307	3,342	4,765
Alaska	North America	All Commodities	20,670	21,551	36,629	39,805	41,912	50,698	58,915	67,905	91,048	126,206	182,752
Alaska	NE Asia	All Commodities	93,217	172,061	212,189	223,134	248,842	423,906	615,963	865,375	1,735,405	3,584,398	7,404,710
Alaska	North Europe	All Commodities	4,337	5,968	6,076	6,179	6,797	10,331	12,941	15,842	23,369	33,590	47,193
Alaska	Oceania	All Commodities	97	3,269	672	678	728	967	1,086	1,218	1,622	2,255	3,188
Alaska	Europe, Other	All Commodities	25	178	55	55	62	96	123	152	227	326	458
Alaska	SE Asia	All Commodities	37,661	64,158	45,759	45,485	46,424	58,889	66,255	75,274	97,325	124,404	156,312
Alaska	West Coast S America	All Commodities	6	69	44	49	56	91	117	148	230	350	526

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Hawaii	World	All Commodities	267,355	497,392	487,349	532,669	573,507	846,145	1,136,761	1,529,835	2,844,503	5,121,466	8,701,201
Hawaii	Percent Change	All Commodities	NA	13.22%	-0.68%	9.30%	7.67%	8.09%	6.08%	6.12%	6.40%	6.06%	5.44%
Hawaii	Africa	All Commodities	161	22	506	794	879	1,168	1,294	1,421	1,848	2,677	4,328
Hawaii	Central America	All Commodities	511	1,214	2,559	2,640	2,860	3,904	4,906	6,090	9,496	15,045	24,174
Hawaii	East Coast S America	All Commodities	439	1,516	3,025	3,306	3,613	5,039	6,589	8,539	14,842	27,108	52,230
Hawaii	Eastern Europe	All Commodities	112	637	1,182	1,344	1,505	2,296	2,992	3,655	5,341	7,682	11,213
Hawaii	India	All Commodities	372	636	1,598	1,795	2,056	4,093	7,209	12,866	43,218	151,319	525,324
Hawaii	Middle East	All Commodities	177	227	253	274	304	464	568	681	972	1,377	1,950
Hawaii	Mediterranean	All Commodities	137	392	681	820	990	1,519	1,971	2,501	3,989	6,332	10,464
Hawaii	North America	All Commodities	8,125	11,817	1,234	1,284	1,329	1,209	951	755	566	587	781
Hawaii	NE Asia	All Commodities	119,151	279,070	246,545	247,283	272,751	414,858	545,648	691,743	1,094,203	1,728,488	2,801,386
Hawaii	North Europe	All Commodities	4,376	6,358	6,611	6,764	7,446	11,285	14,206	17,525	26,618	40,656	62,988
Hawaii	Oceania	All Commodities	43,677	19,259	30,294	40,333	47,188	43,138	39,832	38,807	48,891	83,274	162,138
Hawaii	Europe, Other	All Commodities	25	178	56	56	64	98	126	156	232	336	478
Hawaii	SE Asia	All Commodities	90,076	176,033	191,546	224,570	230,429	353,663	505,223	737,176	1,576,368	3,016,832	4,958,054
Hawaii	West Coast S America	All Commodities	15	33	1,258	1,405	2,092	3,412	5,246	7,918	17,919	39,753	85,693

Table A-6. Containerized Tonnes of Imports to US South Atlantic Coast Ports and Other Coasts, by World Trade Route, for Commodity Groups: 1995 - 2050 (selected years)

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	Agriculture	1,833,381	2,844,099	3,504,348	3,458,769	3,580,640	3,771,751	3,873,112	3,688,652	3,967,527	4,367,599	4,866,916
Savannah	World	Agriculture	70,049	126,012	115,454	103,952	105,282	106,072	102,804	93,876	87,185	78,939	67,999
Charleston	World	Agriculture	68,013	162,798	133,860	116,419	119,070	127,109	126,205	115,804	111,398	105,106	95,863
Jacksonville	World	Agriculture	87,981	144,570	217,005	205,949	208,392	209,571	207,376	194,444	180,446	163,783	141,874
Miami	World	Agriculture	94,034	135,183	161,181	159,557	162,639	160,993	160,449	151,943	142,645	131,330	118,177
Wilmington	World	Agriculture	22,064	32,924	95,845	101,824	109,834	166,330	227,693	280,836	450,903	705,590	1,077,282
Norfolk	World	Agriculture	87,603	153,573	156,815	152,493	155,144	159,270	159,009	140,776	141,024	140,484	135,561
Other N Atlantic	World	Agriculture	547,431	833,036	1,078,937	1,056,183	1,079,747	1,131,344	1,151,942	1,066,641	1,131,626	1,221,736	1,306,074
Gulf Coast	World	Agriculture	318,631	454,386	682,941	677,677	699,920	690,997	669,934	618,137	573,574	528,838	465,379
South Pacific	World	Agriculture	374,345	615,697	593,052	600,538	641,716	661,446	653,613	570,350	570,147	578,825	590,331
North Pacific	World	Agriculture	88,982	146,540	216,676	214,289	224,662	257,381	286,242	302,562	360,364	419,801	479,394
Alaska	World	Agriculture	1,949	120	579	663	756	1,106	1,368	1,639	2,296	3,155	4,306
Hawaii	World	Agriculture	2,668	3,556	4,690	4,466	4,806	6,281	8,247	10,682	21,974	45,986	92,522
USA	World	Extractive	2,075,157	2,645,742	3,104,344	3,324,754	3,474,828	3,963,962	4,106,662	4,173,736	4,444,644	4,865,827	5,419,342
Savannah	World	Extractive	37,352	37,608	43,234	47,269	53,176	58,439	56,731	54,593	50,644	48,459	48,742
Charleston	World	Extractive	25,100	15,749	10,694	11,666	12,317	12,944	12,555	12,173	11,764	11,700	11,955
Jacksonville	World	Extractive	60,932	51,695	78,012	80,688	82,808	86,837	88,559	89,869	93,629	97,488	101,555
Miami	World	Extractive	4,875	3,217	7,065	9,005	12,056	14,042	12,878	11,441	8,475	6,791	6,434
Wilmington	World	Extractive	11,741	8,519	9,058	10,320	11,622	13,524	14,224	14,856	16,561	19,409	23,721
Norfolk	World	Extractive	24,666	26,926	27,706	29,137	30,599	37,800	42,098	45,984	56,629	71,906	92,762
Other N Atlantic	World	Extractive	397,856	446,042	563,625	581,628	597,821	669,830	680,110	684,126	722,348	792,667	892,412
Gulf Coast	World	Extractive	1,199,782	1,466,248	1,763,606	1,891,887	1,978,180	2,292,443	2,369,792	2,381,800	2,455,664	2,567,214	2,696,291
South Pacific	World	Extractive	89,164	276,341	225,021	241,953	251,815	293,494	319,877	344,515	420,227	524,332	647,599
North Pacific	World	Extractive	47,307	88,713	92,950	95,232	98,609	115,296	127,347	140,572	181,101	238,250	312,728
Alaska	World	Extractive	767	4,553	2,158	2,276	2,355	2,685	2,944	3,388	5,576	10,958	23,722
Hawaii	World	Extractive	41,625	45,973	65,632	100,471	116,533	106,306	99,709	95,063	91,326	106,585	146,395
USA	World	Food	4,935,988	6,791,344	8,844,879	8,912,582	9,538,160	11,140,518	11,650,458	12,211,358	13,444,658	14,719,072	16,031,504
Savannah	World	Food	147,810	234,241	398,528	389,107	406,330	491,544	546,264	606,854	751,760	932,281	1,167,619
Charleston	World	Food	110,189	180,322	208,536	213,105	231,011	254,859	264,569	277,653	310,184	347,997	392,223
Jacksonville	World	Food	74,007	67,899	82,861	84,803	89,650	114,337	132,608	151,685	193,334	239,924	292,785
Miami	World	Food	194,692	312,283	478,256	492,887	533,812	601,484	640,537	691,128	812,613	948,070	1,101,669
Wilmington	World	Food	20,212	53,981	33,890	34,332	36,750	46,111	53,453	62,668	91,627	144,299	241,700
Norfolk	World	Food	295,979	385,441	493,825	501,364	525,453	586,818	601,736	618,126	654,122	688,868	718,811
Other N Atlantic	World	Food	2,068,283	2,826,035	3,597,835	3,707,744	4,034,214	4,791,495	4,984,659	5,188,329	5,610,764	5,976,872	6,238,331
Gulf Coast	World	Food	588,173	550,067	865,595	881,495	939,459	1,104,100	1,171,103	1,234,997	1,364,583	1,490,398	1,608,429
South Pacific	World	Food	1,211,732	1,959,379	2,438,745	2,370,682	2,491,481	2,852,741	2,938,072	3,037,554	3,241,574	3,407,068	3,486,654
North Pacific	World	Food	183,347	189,755	211,236	202,699	214,272	254,117	268,072	283,188	314,229	341,866	358,799
Alaska	World	Food	898	1,433	2,780	2,848	3,216	5,628	9,306	15,611	43,972	118,075	279,712
Hawaii	World	Food	21,211	22,736	25,185	23,825	24,349	27,266	28,391	29,598	33,410	42,184	65,947

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	Materials	3,030,549	5,111,901	7,354,936	7,262,662	7,508,182	8,865,633	9,515,837	10,119,199	11,690,248	13,606,581	15,633,168
Savannah	World	Materials	182,218	211,498	324,992	329,398	344,740	402,719	424,956	440,108	474,560	499,543	486,046
Charleston	World	Materials	239,928	410,867	593,941	578,595	591,688	658,513	672,101	676,432	690,607	705,663	705,734
Jacksonville	World	Materials	96,538	234,486	385,999	401,574	431,797	548,714	568,581	566,899	547,140	511,084	469,772
Miami	World	Materials	71,725	121,683	189,396	183,069	185,760	212,693	224,517	233,324	252,377	269,526	275,467
Wilmington	World	Materials	25,448	25,248	23,531	24,623	26,903	38,421	51,505	69,356	130,578	245,455	460,392
Norfolk	World	Materials	157,774	288,028	406,319	399,547	407,421	457,957	478,712	502,388	556,058	612,644	655,280
Other N Atlantic	World	Materials	837,686	1,428,423	2,137,520	2,075,604	2,098,954	2,335,728	2,413,605	2,534,025	2,829,418	3,169,449	3,462,938
Gulf Coast	World	Materials	298,471	448,204	670,773	641,911	645,523	734,889	772,033	793,311	850,907	924,894	1,027,113
South Pacific	World	Materials	799,162	1,590,859	2,119,475	2,122,615	2,239,494	2,763,553	3,036,347	3,236,417	3,689,571	4,044,208	4,018,205
North Pacific	World	Materials	293,699	319,578	378,911	372,973	387,243	472,827	514,765	542,660	607,334	653,516	632,102
Alaska	World	Materials	2,281	4,039	9,131	9,905	10,683	14,295	17,705	22,417	41,972	91,539	201,031
Hawaii	World	Materials	7,377	11,268	8,715	8,877	9,475	12,757	15,738	19,214	30,099	49,105	81,741
USA	World	Consumer Goods	4,825,072	8,914,786	12,665,404	12,719,746	13,572,875	18,209,674	20,795,657	23,798,211	31,528,531	41,318,516	52,579,385
Savannah	World	Consumer Goods	117,268	312,144	604,069	604,030	654,146	925,841	1,054,020	1,205,516	1,573,650	1,973,125	2,256,158
Charleston	World	Consumer Goods	122,759	274,624	395,084	403,497	434,036	596,756	698,626	805,368	1,064,849	1,376,735	1,690,210
Jacksonville	World	Consumer Goods	15,048	20,616	33,967	35,765	37,117	56,112	65,170	80,162	126,742	200,013	284,451
Miami	World	Consumer Goods	186,073	443,450	552,638	551,168	574,712	677,615	748,006	822,100	999,118	1,191,887	1,371,574
Wilmington	World	Consumer Goods	29,814	47,842	52,574	53,124	56,807	76,219	91,684	110,751	163,487	238,027	334,464
Norfolk	World	Consumer Goods	77,733	251,038	510,913	518,038	567,522	843,695	968,388	1,127,781	1,548,456	2,047,524	2,523,751
Other N Atlantic	World	Consumer Goods	711,012	1,099,242	1,697,865	1,738,363	1,874,362	2,574,060	2,958,958	3,391,615	4,487,846	5,830,490	7,159,387
Gulf Coast	World	Consumer Goods	52,683	186,921	301,533	309,595	332,792	440,295	524,492	613,632	842,948	1,134,397	1,475,542
South Pacific	World	Consumer Goods	2,807,019	5,206,180	7,172,174	7,161,237	7,608,273	10,120,232	11,477,775	13,040,602	16,891,863	21,094,311	24,052,931
North Pacific	World	Consumer Goods	691,119	1,045,520	1,310,460	1,308,307	1,391,614	1,822,652	2,079,961	2,377,357	3,110,270	3,912,267	4,476,819
Alaska	World	Consumer Goods	100	29	222	242	279	547	976	1,760	5,918	19,624	59,711
Hawaii	World	Consumer Goods	4,769	7,764	10,887	11,338	12,488	19,523	27,309	38,410	77,210	151,722	274,152
USA	World	Chemicals	8,508,629	13,299,916	15,749,871	16,858,296	17,583,614	20,439,935	22,612,142	24,365,208	28,951,397	35,206,860	43,689,024
Savannah	World	Chemicals	179,892	257,209	452,945	484,710	509,292	627,030	719,008	805,597	1,077,401	1,489,861	1,997,612
Charleston	World	Chemicals	199,896	221,016	434,555	454,970	470,354	571,132	646,052	712,448	911,677	1,203,741	1,557,915
Jacksonville	World	Chemicals	344,491	543,213	896,146	945,644	1,011,806	1,290,426	1,593,157	1,960,127	3,055,385	4,673,528	6,658,407
Miami	World	Chemicals	306,347	354,283	487,130	511,599	537,364	672,348	790,115	906,849	1,304,867	1,963,711	2,851,298
Wilmington	World	Chemicals	162,748	161,468	192,418	204,643	221,206	297,281	392,167	522,097	990,630	1,890,525	3,309,544
Norfolk	World	Chemicals	178,668	232,476	239,873	249,314	258,172	296,919	322,248	336,655	359,692	376,462	403,624
Other N Atlantic	World	Chemicals	3,272,904	4,777,883	6,420,696	6,995,866	7,313,368	8,396,849	9,131,437	9,583,812	10,556,455	11,668,633	13,346,283
Gulf Coast	World	Chemicals	2,239,392	3,549,112	3,860,437	4,069,181	4,219,990	4,727,715	5,049,751	5,219,427	5,483,455	5,595,710	5,746,043
South Pacific	World	Chemicals	864,621	2,233,050	1,801,105	1,960,222	2,100,429	2,551,548	2,906,819	3,203,429	3,858,831	4,486,656	5,088,804
North Pacific	World	Chemicals	475,328	626,075	602,571	616,209	601,368	695,104	754,649	788,937	856,110	894,786	880,204
Alaska	World	Chemicals	29,437	46,279	43,183	47,184	50,893	73,332	105,669	154,219	353,657	813,058	1,656,120
Hawaii	World	Chemicals	24,819	72,844	59,610	60,163	42,171	49,319	53,997	57,432	65,054	73,182	88,110

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	High Technology	1,653,613	2,759,662	3,027,316	3,089,049	3,352,609	5,237,570	6,879,622	8,673,798	13,164,225	18,995,608	26,282,169
Savannah	World	High Technology	132,013	206,136	225,497	230,969	251,379	398,548	528,163	670,955	1,032,407	1,505,361	2,100,165
Charleston	World	High Technology	132,013	206,136	225,497	230,808	250,814	394,501	520,211	658,085	1,004,685	1,454,120	2,014,644
Jacksonville	World	High Technology	132,013	206,136	225,497	230,313	248,985	382,555	496,278	619,350	922,820	1,306,509	1,773,875
Miami	World	High Technology	132,013	206,136	225,497	230,738	250,559	392,908	516,977	652,813	993,463	1,433,781	1,981,265
Wilmington	World	High Technology	132,013	206,136	225,497	230,964	250,738	392,627	516,632	652,704	995,132	1,439,933	1,996,590
Norfolk	World	High Technology	122,849	220,419	237,018	243,811	265,201	417,319	553,662	704,398	1,085,956	1,591,323	2,233,673
Other N Atlantic	World	High Technology	122,849	220,419	236,923	243,359	263,893	409,239	537,883	678,735	1,030,545	1,488,984	2,063,043
Gulf Coast	World	High Technology	130,042	212,905	226,782	230,834	250,726	390,117	510,308	640,509	964,111	1,382,199	1,901,845
South Pacific	World	High Technology	131,993	229,507	252,093	256,704	278,032	434,306	569,023	715,571	1,080,192	1,551,710	2,139,116
North Pacific	World	High Technology	131,968	229,441	263,104	268,881	291,013	450,198	586,293	733,592	1,097,710	1,564,555	2,140,518
Alaska	World	High Technology	111,372	193,878	222,307	227,903	247,737	388,417	511,047	644,910	980,594	1,419,421	1,971,675
Hawaii	World	High Technology	131,248	228,973	239,849	236,419	256,430	399,449	523,461	659,015	998,828	1,442,709	2,000,877
USA	World	Intermed. Manufact.	11,198,220	20,415,170	19,916,585	21,615,808	24,113,816	33,363,534	41,208,285	49,052,493	68,934,623	95,562,514	130,361,355
Savannah	World	Intermed. Manufact.	283,581	411,412	560,656	630,599	712,347	957,676	1,149,929	1,342,848	1,815,671	2,396,395	3,077,631
Charleston	World	Intermed. Manufact.	160,539	581,716	858,606	950,815	1,081,847	1,544,648	1,887,041	2,217,275	2,994,114	3,943,600	5,104,071
Jacksonville	World	Intermed. Manufact.	365,706	629,350	629,425	679,534	760,748	969,292	1,075,539	1,167,920	1,335,135	1,470,630	1,580,916
Miami	World	Intermed. Manufact.	282,397	582,123	810,342	915,923	1,061,618	1,604,233	2,009,756	2,435,890	3,554,824	5,144,901	7,378,118
Wilmington	World	Intermed. Manufact.	71,337	76,785	77,327	88,211	99,662	145,074	193,977	256,125	461,454	842,964	1,530,452
Norfolk	World	Intermed. Manufact.	356,067	400,497	532,479	573,805	630,933	846,714	1,012,208	1,164,572	1,516,616	1,958,688	2,533,329
Other N Atlantic	World	Intermed. Manufact.	1,739,093	3,435,386	3,251,298	3,575,239	4,041,013	5,726,884	7,281,473	8,828,347	12,654,290	17,698,415	24,366,092
Gulf Coast	World	Intermed. Manufact.	2,520,850	4,939,008	3,267,662	3,592,911	4,087,275	5,853,585	7,359,490	8,777,776	12,178,972	16,414,938	21,678,817
South Pacific	World	Intermed. Manufact.	3,255,194	6,554,141	7,388,352	7,871,154	8,603,571	11,579,595	13,966,274	16,251,075	21,816,228	29,086,906	38,050,311
North Pacific	World	Intermed. Manufact.	1,030,557	1,341,971	1,595,810	1,745,594	1,959,970	2,835,623	3,791,039	4,845,263	7,666,216	11,243,557	15,189,189
Alaska	World	Intermed. Manufact.	13,251	18,992	27,525	31,275	36,463	69,568	119,524	197,980	539,367	1,433,715	3,665,434
Hawaii	World	Intermed. Manufact.	29,928	99,229	66,196	79,107	98,171	209,177	354,025	579,004	1,416,787	2,911,447	5,140,852
USA	World	Capital Equipment	3,103,566	5,022,767	6,653,359	7,139,554	7,848,393	11,358,578	13,599,324	15,915,999	21,739,800	29,402,076	39,165,560
Savannah	World	Capital Equipment	133,436	252,940	342,012	371,241	413,238	627,992	806,339	1,012,209	1,591,451	2,464,854	3,639,858
Charleston	World	Capital Equipment	155,517	295,777	359,414	385,503	426,241	623,668	774,075	945,893	1,413,756	2,098,460	3,038,301
Jacksonville	World	Capital Equipment	39,563	29,451	13,859	14,414	15,376	20,649	25,115	30,608	48,299	79,627	129,251
Miami	World	Capital Equipment	54,781	62,825	88,027	93,374	100,476	134,846	159,982	185,676	249,341	330,994	431,325
Wilmington	World	Capital Equipment	23,489	22,944	22,759	23,948	25,360	32,407	37,868	43,090	56,377	75,367	104,576
Norfolk	World	Capital Equipment	195,289	242,499	376,047	398,797	429,949	577,858	680,620	787,408	1,062,312	1,429,744	1,888,904
Other N Atlantic	World	Capital Equipment	532,433	749,538	943,278	1,031,676	1,143,511	1,666,722	2,044,951	2,455,617	3,511,948	4,914,160	6,650,808
Gulf Coast	World	Capital Equipment	202,818	304,680	361,611	393,428	441,770	623,721	758,622	905,729	1,289,842	1,813,803	2,494,533
South Pacific	World	Capital Equipment	1,299,107	2,434,363	3,379,939	3,599,658	3,941,187	5,688,144	6,655,732	7,588,772	9,759,095	12,323,525	15,388,243
North Pacific	World	Capital Equipment	422,136	587,263	730,063	789,147	870,175	1,307,594	1,585,217	1,867,308	2,569,707	3,447,494	4,388,150
Alaska	World	Capital Equipment	72	688	821	866	918	1,155	1,326	1,481	1,861	2,342	2,933
Hawaii	World	Capital Equipment	1,631	2,685	4,198	4,759	5,476	10,415	18,215	31,151	91,466	266,058	753,677

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	Motor Vehicles	2,503,945	2,626,898	3,103,640	3,334,478	3,609,958	5,268,554	6,369,773	7,480,845	10,138,736	13,399,361	17,263,329
Savannah	World	Motor Vehicles	23,908	57,124	87,111	96,116	104,698	157,327	197,800	241,199	351,658	506,811	706,508
Charleston	World	Motor Vehicles	47,583	88,609	142,990	157,378	170,326	251,531	323,126	401,994	599,283	845,933	1,116,410
Jacksonville	World	Motor Vehicles	64,575	131,612	133,630	144,323	156,046	224,364	295,062	384,812	656,089	1,102,814	1,721,505
Miami	World	Motor Vehicles	37,888	16,106	23,871	24,501	25,357	28,715	29,492	30,461	33,945	39,798	47,569
Wilmington	World	Motor Vehicles	2,108	389	602	667	744	1,227	1,811	2,670	5,936	13,717	31,420
Norfolk	World	Motor Vehicles	157,791	211,947	249,300	267,030	271,045	380,920	463,413	532,600	628,523	623,936	525,995
Other N Atlantic	World	Motor Vehicles	319,490	369,132	511,903	528,701	554,213	796,071	921,738	1,041,601	1,327,434	1,656,906	2,006,108
Gulf Coast	World	Motor Vehicles	35,658	42,720	44,747	58,168	69,976	90,908	102,013	115,246	152,320	202,868	272,506
South Pacific	World	Motor Vehicles	1,236,255	1,241,786	1,439,923	1,516,526	1,634,737	2,301,813	2,670,705	3,014,928	3,764,941	4,584,666	5,503,400
North Pacific	World	Motor Vehicles	553,297	441,356	462,130	533,322	614,543	1,024,756	1,351,726	1,699,831	2,594,117	3,779,549	5,253,526
Alaska	World	Motor Vehicles	0	4	7	8	8	12	16	23	47	102	224
Hawaii	World	Motor Vehicles	2,080	2,366	2,986	3,245	3,607	5,651	7,669	10,267	18,350	32,487	56,928

Table A-7. Containerized Tonnes of Exports from South Atlantic Coast Ports and Other Coasts, by World Trade Route, for All Commodities: 1995 - 2050 (selected years)

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	All Commodities	52,079,407	51,663,424	59,866,360	61,938,701	62,671,860	68,136,505	73,311,464	81,026,976	106,038,449	157,207,098	257,492,921
USA	Percent Change	All Commodities	NA	-0.16%	5.03%	3.46%	1.18%	1.69%	1.47%	2.02%	2.73%	4.02%	5.06%
Savannah	World	All Commodities	2,461,566	2,535,755	3,879,928	4,042,908	4,042,517	4,097,605	4,204,825	4,546,836	5,751,825	8,260,339	13,182,596
Savannah	Percent Change	All Commodities	NA	0.60%	15.23%	4.20%	-0.01%	0.27%	0.52%	1.58%	2.38%	3.69%	4.79%
Savannah	Africa	All Commodities	20,059	16,411	18,401	17,603	17,529	20,055	22,993	28,201	63,118	194,904	540,350
Savannah	Central America	All Commodities	75,537	77,185	195,950	204,409	208,072	231,475	250,378	273,550	356,218	561,999	1,006,637
Savannah	East Coast S America	All Commodities	232,511	232,577	148,617	150,606	149,524	158,012	165,073	181,343	223,683	280,747	353,153
Savannah	Eastern Europe	All Commodities	15,856	21,323	62,847	64,364	67,141	81,552	91,920	108,251	177,926	354,280	713,198
Savannah	India	All Commodities	39,454	42,756	78,372	80,239	76,981	81,272	88,885	101,876	160,353	339,148	776,051
Savannah	Middle East	All Commodities	95,964	73,738	72,278	71,461	70,734	74,769	78,296	85,340	105,558	136,037	175,799
Savannah	Mediterranean	All Commodities	117,888	138,886	163,243	165,774	165,773	160,153	169,541	191,422	255,090	353,861	487,676
Savannah	North America	All Commodities	594	1,259	359	346	350	406	463	529	720	1,021	1,432
Savannah	NE Asia	All Commodities	982,947	1,102,116	1,930,910	1,989,338	1,976,538	2,007,433	2,027,614	2,160,904	2,612,216	3,423,674	4,815,105
Savannah	North Europe	All Commodities	578,740	510,412	783,347	808,557	823,289	744,581	706,564	716,474	766,558	873,327	1,024,968
Savannah	Oceania	All Commodities	124,427	136,646	166,171	174,377	166,892	175,514	195,679	222,890	293,828	393,225	514,949
Savannah	Europe, Other	All Commodities	2,252	4,120	3,811	3,972	3,873	2,628	2,085	1,998	1,851	1,777	1,783
Savannah	SE Asia	All Commodities	106,910	129,246	185,139	240,685	244,511	283,241	320,704	376,458	580,745	1,023,547	2,039,183
Savannah	West Coast S America	All Commodities	68,429	49,080	70,483	71,177	71,309	76,513	84,629	97,602	153,961	322,792	732,292
Charleston	World	All Commodities	2,056,106	2,521,756	2,522,798	2,579,246	2,586,736	2,764,538	2,997,287	3,392,062	4,811,514	8,128,076	15,054,946
Charleston	Percent Change	All Commodities	NA	4.17%	0.01%	2.24%	0.29%	1.34%	1.63%	2.51%	3.56%	5.38%	6.36%
Charleston	Africa	All Commodities	24,683	38,174	38,599	37,311	37,261	41,568	46,553	55,579	118,327	366,120	1,033,667
Charleston	Central America	All Commodities	23,226	56,685	73,938	76,380	77,442	87,549	98,094	111,313	169,892	343,376	750,417
Charleston	East Coast S America	All Commodities	82,113	221,299	168,372	174,372	173,812	188,672	200,693	214,567	249,233	293,167	345,864
Charleston	Eastern Europe	All Commodities	61,868	79,077	170,924	176,786	178,815	220,386	249,725	290,937	565,196	1,381,033	3,302,069
Charleston	India	All Commodities	54,827	36,923	118,143	119,766	117,953	133,848	156,591	189,298	313,805	633,945	1,337,068
Charleston	Middle East	All Commodities	52,084	41,257	42,977	42,643	42,640	46,782	50,454	56,044	71,569	94,413	123,899
Charleston	Mediterranean	All Commodities	106,522	194,194	198,634	204,905	208,779	221,371	247,439	285,434	390,376	550,775	773,468
Charleston	North America	All Commodities	486	22	43	43	41	39	40	44	56	74	97
Charleston	NE Asia	All Commodities	614,250	813,289	597,366	610,208	604,161	611,866	626,603	687,184	888,335	1,276,063	1,967,663
Charleston	North Europe	All Commodities	654,377	708,962	791,866	803,703	817,538	843,258	895,964	980,936	1,198,110	1,508,960	1,896,146
Charleston	Oceania	All Commodities	22,282	16,535	16,039	16,697	16,252	16,838	17,973	19,396	23,055	28,072	34,134
Charleston	Europe, Other	All Commodities	3,675	9,902	2,056	2,103	2,150	2,633	2,969	3,351	4,137	4,952	5,680
Charleston	SE Asia	All Commodities	227,626	147,315	148,900	153,688	149,163	166,748	192,218	234,925	416,510	894,659	2,064,331
Charleston	West Coast S America	All Commodities	128,088	158,120	154,941	158,641	160,729	182,982	211,949	253,053	402,913	752,465	1,420,443

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Jacksonville	World	All Commodities	1,398,365	1,251,813	1,173,510	1,189,435	1,193,458	1,320,171	1,445,293	1,609,538	2,158,037	3,274,494	5,351,643
Jacksonville	Percent Change	All Commodities	NA	-2.19%	-2.13%	1.36%	0.34%	2.04%	1.83%	2.18%	2.98%	4.26%	5.04%
Jacksonville	Africa	All Commodities	8,039	3,417	3,446	3,378	3,350	3,553	3,747	4,201	7,063	16,811	42,029
Jacksonville	Central America	All Commodities	192,989	266,796	283,247	283,479	282,411	315,776	342,700	376,640	488,690	719,266	1,144,515
Jacksonville	East Coast S America	All Commodities	341,322	183,729	223,346	226,523	224,068	234,951	242,062	249,862	272,407	302,593	347,929
Jacksonville	Eastern Europe	All Commodities	45,594	117,662	54,612	58,058	63,366	84,357	91,004	105,478	158,968	248,179	382,169
Jacksonville	India	All Commodities	524	1,033	1,224	1,260	1,330	2,069	3,662	7,278	34,224	139,740	416,846
Jacksonville	Middle East	All Commodities	6,388	8,336	7,764	7,567	7,404	7,347	7,221	7,338	8,510	9,932	11,654
Jacksonville	Mediterranean	All Commodities	39,361	88,406	77,917	82,390	83,301	100,903	126,917	153,973	224,664	324,919	452,288
Jacksonville	North America	All Commodities	459	22	847	841	825	981	1,195	1,447	2,046	2,846	3,785
Jacksonville	NE Asia	All Commodities	109,186	77,465	134,942	134,598	135,583	146,316	155,187	163,519	198,533	279,715	450,928
Jacksonville	North Europe	All Commodities	370,529	341,138	265,004	210,607	210,144	223,906	242,107	264,402	318,102	394,349	488,104
Jacksonville	Oceania	All Commodities	24,850	2,229	1,938	1,990	2,033	2,474	2,896	3,411	4,664	6,340	8,385
Jacksonville	Europe, Other	All Commodities	537	167	195	186	184	209	225	246	298	362	431
Jacksonville	SE Asia	All Commodities	27,631	25,130	46,305	48,495	50,551	65,873	83,249	106,417	187,895	391,304	836,359
Jacksonville	West Coast S America	All Commodities	230,955	136,283	131,623	130,062	128,910	131,457	142,821	165,119	251,992	438,137	776,222
Miami	World	All Commodities	1,420,889	1,708,082	1,787,942	1,833,501	1,854,147	2,049,118	2,229,217	2,451,796	3,236,686	5,007,451	8,411,104
Miami	Percent Change	All Commodities	NA	3.75%	1.53%	2.55%	1.13%	2.02%	1.70%	1.92%	2.82%	4.46%	5.32%
Miami	Africa	All Commodities	1,167	3,000	1,831	1,798	1,809	1,988	2,165	2,448	4,158	9,324	21,170
Miami	Central America	All Commodities	648,626	1,036,097	1,097,900	1,122,122	1,139,643	1,273,053	1,379,491	1,502,836	1,944,990	2,912,624	4,637,999
Miami	East Coast S America	All Commodities	343,230	263,230	161,610	168,455	169,189	192,377	207,209	221,039	254,171	294,950	342,887
Miami	Eastern Europe	All Commodities	2,993	2,637	6,538	6,753	7,023	9,011	11,402	15,379	37,298	116,525	319,888
Miami	India	All Commodities	13,312	12,596	23,427	22,583	22,072	21,459	22,079	25,571	54,107	166,532	460,211
Miami	Middle East	All Commodities	1,913	3,851	4,721	4,767	4,911	6,050	7,160	8,292	11,528	16,320	22,593
Miami	Mediterranean	All Commodities	21,410	8,015	22,507	24,015	24,776	27,526	33,502	39,856	56,447	80,393	112,708
Miami	North America	All Commodities	34	562	43	44	46	61	69	81	115	167	233
Miami	NE Asia	All Commodities	62,428	78,235	136,934	139,066	136,986	133,701	133,999	143,426	180,332	256,226	400,074
Miami	North Europe	All Commodities	97,283	123,949	158,564	163,284	164,115	165,722	174,470	184,547	206,449	239,811	282,372
Miami	Oceania	All Commodities	1,751	11,189	5,316	5,423	5,332	5,885	6,582	7,402	9,433	12,217	15,582
Miami	Europe, Other	All Commodities	224	380	332	324	324	353	371	398	461	539	619
Miami	SE Asia	All Commodities	16,274	19,260	15,306	15,698	16,038	19,646	24,806	33,435	76,020	223,137	594,846
Miami	West Coast S America	All Commodities	210,244	145,081	152,914	159,167	161,885	192,285	226,062	267,087	401,177	678,683	1,199,922
Wilmington	World	All Commodities	524,501	463,829	424,611	434,999	432,700	428,855	441,631	494,482	755,784	1,606,095	3,816,954
Wilmington	Percent Change	All Commodities	NA	-2.43%	-2.90%	2.45%	-0.53%	-0.18%	0.59%	2.29%	4.33%	7.83%	9.04%
Wilmington	Africa	All Commodities	2,172	2,844	1,840	1,866	1,958	2,420	2,894	3,545	6,638	15,700	36,996
Wilmington	Central America	All Commodities	6,686	6,768	4,904	5,102	5,326	7,104	10,039	16,059	58,804	221,679	643,996
Wilmington	East Coast S America	All Commodities	11,105	19,958	4,415	4,734	4,917	6,457	7,991	9,326	12,183	16,229	25,603
Wilmington	Eastern Europe	All Commodities	23,595	3,097	1,650	1,711	1,808	2,673	3,640	5,197	13,932	47,378	135,837
Wilmington	India	All Commodities	908	5,788	5,248	5,765	5,484	6,875	9,317	14,395	52,495	213,936	673,531
Wilmington	Middle East	All Commodities	4,784	3,447	3,216	3,175	3,217	3,703	4,151	4,668	5,712	7,117	8,650
Wilmington	Mediterranean	All Commodities	18,668	14,104	16,066	16,438	16,307	15,369	15,343	16,224	19,094	23,651	29,228
Wilmington	North America	All Commodities	34	6,994	11	14	14	18	21	24	31	41	52
Wilmington	NE Asia	All Commodities	272,216	169,146	172,130	176,042	176,864	188,720	199,895	219,856	283,305	405,791	630,206
Wilmington	North Europe	All Commodities	127,906	156,483	171,899	179,595	179,625	145,889	125,911	123,260	122,473	129,396	141,180
Wilmington	Oceania	All Commodities	1,913	1,887	2,406	2,478	2,495	3,017	3,566	4,218	5,855	8,151	11,136
Wilmington	Europe, Other	All Commodities	1,332	1,471	999	993	998	883	810	841	918	992	1,038
Wilmington	SE Asia	All Commodities	32,428	55,459	37,384	34,473	31,510	41,843	52,316	67,691	141,482	389,559	1,104,397
Wilmington	West Coast S America	All Commodities	20,754	16,383	2,440	2,612	2,738	3,885	5,737	9,241	32,890	126,435	375,104

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Norfolk	World	All Commodities	2,563,015	2,222,774	2,404,368	2,439,637	2,439,894	2,588,696	2,756,113	3,031,907	4,106,594	6,907,680	13,247,342
Norfolk	Percent Change	All Commodities	NA	-2.81%	2.65%	1.47%	0.01%	1.19%	1.26%	1.93%	3.08%	5.34%	6.75%
Norfolk	Africa	All Commodities	39,326	23,669	38,074	36,718	34,859	37,821	40,996	46,303	72,825	151,249	330,682
Norfolk	Central America	All Commodities	22,495	27,068	48,381	52,802	56,902	67,709	77,430	91,792	133,134	325,091	718,463
Norfolk	East Coast S America	All Commodities	201,753	208,331	158,024	165,191	166,228	190,660	208,649	226,337	268,873	323,082	382,833
Norfolk	Eastern Europe	All Commodities	155,073	109,198	121,546	126,523	135,376	159,995	176,294	219,440	500,822	1,359,003	4,385,798
Norfolk	India	All Commodities	29,940	84,238	133,490	123,392	122,504	137,051	159,690	194,826	351,683	807,180	1,865,576
Norfolk	Middle East	All Commodities	29,488	53,844	50,847	50,978	52,308	61,355	67,319	73,377	86,503	101,218	114,969
Norfolk	Mediterranean	All Commodities	152,746	162,876	149,887	150,861	153,462	161,881	167,935	175,444	195,145	221,123	248,054
Norfolk	North America	All Commodities	3,225	10,394	4,791	5,220	4,680	3,028	2,333	2,010	1,603	1,473	1,489
Norfolk	NE Asia	All Commodities	646,587	610,453	723,321	732,653	729,233	768,359	809,978	870,203	1,089,106	1,472,299	2,129,365
Norfolk	North Europe	All Commodities	929,075	679,837	700,258	714,405	705,344	704,248	723,446	754,397	840,785	971,953	1,132,777
Norfolk	Oceania	All Commodities	83,336	55,086	58,615	62,533	59,552	66,168	77,209	90,598	125,390	175,582	240,874
Norfolk	Europe, Other	All Commodities	44,616	7,237	3,259	3,350	3,435	4,754	6,039	7,701	12,287	18,696	26,332
Norfolk	SE Asia	All Commodities	200,734	169,739	178,231	179,186	179,612	184,826	193,099	216,845	313,542	547,090	1,089,217
Norfolk	West Coast S America	All Commodities	24,622	20,896	35,664	35,821	36,400	40,842	45,696	53,635	94,896	232,642	580,914
Other N Atlantic	World	All Commodities	4,389,059	3,899,241	6,203,920	6,349,270	6,371,192	6,688,957	7,104,069	7,782,771	10,129,036	15,191,797	25,131,406
Other N Atlantic	Percent Change	All Commodities	NA	-2.34%	16.74%	2.34%	0.35%	0.98%	1.21%	1.84%	2.67%	4.14%	5.16%
Other N Atlantic	Africa	All Commodities	81,298	48,848	66,676	63,253	62,715	68,897	75,505	84,676	130,071	249,384	469,916
Other N Atlantic	Central America	All Commodities	132,933	214,880	247,122	281,941	321,291	373,389	411,619	459,725	600,097	850,254	1,259,802
Other N Atlantic	East Coast S America	All Commodities	355,873	310,823	254,531	269,473	270,364	313,468	345,008	377,525	451,092	541,929	640,157
Other N Atlantic	Eastern Europe	All Commodities	105,152	70,437	127,987	131,887	136,913	168,243	204,869	268,345	624,394	1,793,891	4,702,576
Other N Atlantic	India	All Commodities	193,920	161,769	364,584	342,394	338,376	351,157	372,676	408,861	571,785	1,035,127	2,044,701
Other N Atlantic	Middle East	All Commodities	82,141	82,761	81,827	81,632	83,549	93,696	101,418	110,911	129,978	154,320	179,375
Other N Atlantic	Mediterranean	All Commodities	269,097	184,753	194,929	197,624	202,454	212,717	230,202	250,590	301,524	371,307	455,081
Other N Atlantic	North America	All Commodities	19,057	67,070	58,405	61,584	58,674	61,523	63,429	68,278	82,246	98,974	128,919
Other N Atlantic	NE Asia	All Commodities	1,139,066	971,172	2,613,463	2,690,811	2,659,440	2,637,912	2,668,854	2,841,192	3,466,407	4,682,659	6,893,030
Other N Atlantic	North Europe	All Commodities	1,322,246	1,136,246	1,350,358	1,343,099	1,350,160	1,490,649	1,657,511	1,830,828	2,265,792	2,875,625	3,642,514
Other N Atlantic	Oceania	All Commodities	59,484	66,903	105,829	112,674	108,616	118,881	134,682	153,456	201,018	266,255	344,844
Other N Atlantic	Europe, Other	All Commodities	15,127	7,621	10,129	11,211	12,071	17,889	24,403	32,841	56,456	90,823	134,030
Other N Atlantic	SE Asia	All Commodities	398,998	415,960	503,430	510,665	508,499	496,142	505,471	558,492	800,259	1,477,082	3,034,587
Other N Atlantic	West Coast S America	All Commodities	214,666	159,999	244,648	251,023	258,129	284,395	308,421	337,951	447,918	704,127	1,205,974
Gulf Coast	World	All Commodities	14,840,286	15,482,413	16,236,529	16,804,706	17,231,055	18,941,086	20,629,784	22,838,398	29,478,352	42,051,102	64,095,312
Gulf Coast	Percent Change	All Commodities	NA	0.85%	1.60%	3.50%	2.54%	1.91%	1.72%	2.05%	2.58%	3.62%	4.30%
Gulf Coast	Africa	All Commodities	260,083	224,688	278,074	269,646	259,808	293,972	335,966	393,407	611,666	1,422,617	3,393,331
Gulf Coast	Central America	All Commodities	1,501,503	3,206,176	3,996,569	4,109,434	4,357,370	4,908,779	5,481,076	6,043,581	7,381,403	9,121,672	11,088,491
Gulf Coast	East Coast S America	All Commodities	1,319,017	1,468,318	1,417,475	1,466,146	1,466,881	1,667,401	1,839,987	1,988,019	2,366,422	2,841,535	3,364,799
Gulf Coast	Eastern Europe	All Commodities	599,435	504,819	510,353	546,178	592,747	779,099	796,568	881,765	1,375,592	2,795,006	6,055,460
Gulf Coast	India	All Commodities	236,306	215,783	238,784	264,914	282,791	352,769	458,193	606,174	1,169,118	2,700,895	6,051,642
Gulf Coast	Middle East	All Commodities	194,333	276,471	192,317	199,476	215,084	248,752	276,736	309,226	380,582	465,409	533,296
Gulf Coast	Mediterranean	All Commodities	1,300,878	1,450,273	1,267,000	1,427,887	1,543,821	1,646,476	1,781,412	1,981,325	2,479,714	3,140,464	3,871,979
Gulf Coast	North America	All Commodities	160,180	193,249	234,362	241,706	230,910	274,981	318,835	362,051	469,238	610,579	771,786
Gulf Coast	NE Asia	All Commodities	2,396,813	1,666,440	2,153,531	2,205,843	2,196,474	2,250,609	2,307,547	2,408,597	2,803,038	3,767,613	5,865,809
Gulf Coast	North Europe	All Commodities	4,583,587	4,008,599	3,619,630	3,691,406	3,681,708	3,606,571	3,787,974	4,021,956	4,591,524	5,459,348	6,528,773
Gulf Coast	Oceania	All Commodities	318,076	196,902	267,165	281,087	263,206	258,091	281,132	311,979	383,657	487,493	617,005
Gulf Coast	Europe, Other	All Commodities	6,856	2,298	2,334	2,344	2,378	2,582	2,802	3,008	3,508	4,125	4,737
Gulf Coast	SE Asia	All Commodities	795,011	1,028,598	876,091	910,577	950,380	1,186,201	1,368,618	1,609,792	2,312,671	3,460,591	5,677,649
Gulf Coast	West Coast S America	All Commodities	1,168,206	1,039,800	1,182,845	1,188,062	1,186,996	1,374,804	1,601,939	1,917,517	3,150,216	5,773,845	10,250,556

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
South Pacific	World	All Commodities	12,330,677	12,377,115	13,990,486	14,778,152	14,991,215	16,230,344	17,373,926	19,185,628	25,115,618	37,000,215	60,477,487
South Pacific	Percent Change	All Commodities	NA	0.08%	4.17%	5.63%	1.44%	1.60%	1.37%	2.00%	2.73%	3.95%	5.04%
South Pacific	Africa	All Commodities	24,811	27,374	10,201	10,001	9,925	11,511	13,278	15,932	30,885	79,768	194,976
South Pacific	Central America	All Commodities	168,377	318,373	199,483	201,917	203,276	216,312	224,497	233,324	290,899	487,312	964,468
South Pacific	East Coast S America	All Commodities	87,611	87,445	63,947	68,466	68,207	82,839	94,254	105,379	132,864	170,992	220,423
South Pacific	Eastern Europe	All Commodities	25,738	27,999	29,529	32,528	36,393	47,772	51,340	58,896	104,479	249,969	588,451
South Pacific	India	All Commodities	221,410	277,954	371,268	370,384	372,095	426,828	492,622	581,135	902,307	1,688,961	3,374,431
South Pacific	Middle East	All Commodities	15,326	18,244	25,556	24,090	25,719	29,496	33,607	37,901	48,101	60,971	74,375
South Pacific	Mediterranean	All Commodities	64,027	66,108	48,155	49,575	47,669	49,109	51,159	54,755	65,232	81,442	102,719
South Pacific	North America	All Commodities	3,513	2,443	8,524	9,256	8,931	10,334	10,981	11,803	13,812	15,120	19,042
South Pacific	NE Asia	All Commodities	9,066,930	8,755,864	10,511,071	10,831,720	10,968,964	11,696,182	12,332,502	13,432,974	16,734,467	22,645,574	32,711,143
South Pacific	North Europe	All Commodities	400,678	393,804	405,564	418,257	412,437	418,849	446,854	479,591	554,966	657,140	776,758
South Pacific	Oceania	All Commodities	411,065	558,630	546,075	572,757	546,189	594,084	682,547	785,643	1,059,521	1,466,582	2,008,753
South Pacific	Europe, Other	All Commodities	2,391	5,131	4,956	5,304	5,140	4,837	4,681	4,731	4,993	5,386	5,788
South Pacific	SE Asia	All Commodities	1,668,152	1,694,573	1,598,646	2,016,506	2,121,992	2,466,089	2,746,286	3,172,260	4,874,753	8,885,859	18,531,201
South Pacific	West Coast S America	All Commodities	170,649	143,173	169,512	167,391	166,278	176,099	189,319	211,305	298,339	505,139	904,960
North Pacific	World	All Commodities	8,540,792	7,562,829	8,962,502	9,134,588	9,151,660	10,347,090	11,126,312	12,305,492	15,748,257	21,810,441	33,505,170
North Pacific	Percent Change	All Commodities	NA	-2.40%	5.82%	1.92%	0.19%	2.49%	1.46%	2.04%	2.50%	3.31%	4.39%
North Pacific	Africa	All Commodities	19,710	15,534	51,087	49,204	47,966	47,551	47,878	49,169	53,978	66,907	93,003
North Pacific	East Coast S America	All Commodities	39,316	25,945	31,065	33,773	33,975	40,563	45,685	50,581	62,350	78,331	99,175
North Pacific	Eastern Europe	All Commodities	94,172	79,713	58,512	62,135	67,032	88,607	87,706	94,804	143,190	282,504	616,026
North Pacific	India	All Commodities	156,099	121,587	82,093	83,750	85,009	108,622	127,259	150,980	239,906	465,601	954,924
North Pacific	Middle East	All Commodities	65,429	94,367	66,682	69,125	71,879	87,466	96,879	105,476	125,278	148,209	171,633
North Pacific	Mediterranean	All Commodities	35,378	28,851	63,133	66,310	64,961	60,517	60,370	62,643	68,632	77,646	87,651
North Pacific	North America	All Commodities	122,273	94,930	178,836	190,431	181,521	205,561	209,514	216,367	240,147	274,034	339,490
North Pacific	NE Asia	All Commodities	6,509,537	5,686,291	6,633,132	6,746,287	6,739,346	7,330,377	7,660,948	8,278,411	9,962,319	12,514,106	15,701,343
North Pacific	North Europe	All Commodities	87,990	131,483	148,047	151,963	153,648	154,969	163,542	174,545	201,842	240,864	290,424
North Pacific	Oceania	All Commodities	177,248	172,806	225,437	235,880	225,440	225,717	243,966	271,772	337,717	427,597	529,731
North Pacific	Europe, Other	All Commodities	504	440	779	737	724	675	651	667	726	804	882
North Pacific	SE Asia	All Commodities	1,123,594	1,011,988	1,168,609	1,212,592	1,244,824	1,734,063	2,092,741	2,527,336	3,844,832	6,365,340	12,890,349
North Pacific	West Coast S America	All Commodities	94,075	67,400	157,324	155,969	157,068	178,847	201,635	230,448	335,601	587,115	1,069,587
Alaska	World	All Commodities	460,591	435,585	587,818	624,104	641,529	763,515	879,735	1,020,579	1,522,217	2,714,697	5,292,024
Alaska	Percent Change	All Commodities	NA	-1.11%	10.51%	6.17%	2.79%	3.54%	2.87%	3.01%	4.08%	5.96%	6.96%
Alaska	Africa	All Commodities	1,073	271	287	293	299	394	513	703	1,891	6,477	18,957
Alaska	Central America	All Commodities	4,086	1,702	2,136	2,268	2,440	3,843	6,321	11,403	47,333	184,237	539,387
Alaska	East Coast S America	All Commodities	5,537	7,874	4,622	4,927	5,122	6,708	8,299	9,709	13,516	20,075	31,611
Alaska	Eastern Europe	All Commodities	8,288	920	5,744	6,094	6,639	8,755	8,822	9,845	17,120	41,667	104,287
Alaska	India	All Commodities	7,300	1,190	1,084	1,151	1,261	2,314	4,596	9,937	53,360	242,137	783,301
Alaska	Middle East	All Commodities	239	486	507	509	530	708	876	1,051	1,481	2,051	2,743
Alaska	Mediterranean	All Commodities	770	4,029	38,217	38,851	39,201	35,815	33,990	33,940	35,882	39,895	44,506
Alaska	North America	All Commodities	14,208	24,874	4,395	4,378	4,443	5,530	6,097	6,622	7,699	4,637	5,651
Alaska	NE Asia	All Commodities	375,487	336,516	436,702	452,213	476,642	590,649	691,713	800,977	1,113,833	1,620,772	2,371,915
Alaska	North Europe	All Commodities	13,154	19,382	77,375	95,986	86,599	83,734	85,365	89,095	98,630	114,038	134,359
Alaska	Oceania	All Commodities	1,532	8,353	2,560	2,573	2,631	3,183	3,681	4,250	5,759	7,925	10,760
Alaska	Europe, Other	All Commodities	131	298	246	234	229	253	268	289	345	417	494
Alaska	SE Asia	All Commodities	27,090	26,607	11,210	11,760	12,494	17,326	22,694	31,997	85,554	278,753	796,083
Alaska	West Coast S America	All Commodities	1,696	3,084	2,723	2,866	2,999	4,301	6,498	10,759	39,813	151,617	447,970

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Hawaii	World	All Commodities	181,124	165,136	165,220	171,444	176,133	200,435	229,297	279,533	516,076	1,265,439	3,166,630
Hawaii	Percent Change	All Commodities	NA	-1.83%	0.02%	3.77%	2.74%	2.62%	2.73%	4.04%	6.32%	9.38%	9.61%
Hawaii	Africa	All Commodities	258	271	276	282	288	383	502	691	1,876	6,459	18,935
Hawaii	Central America	All Commodities	1,457	1,695	2,188	2,321	2,492	3,898	6,379	11,464	47,402	184,317	539,479
Hawaii	East Coast S America	All Commodities	8,983	6,428	3,492	3,749	3,901	5,148	6,399	7,485	10,419	15,546	24,766
Hawaii	Eastern Europe	All Commodities	355	505	887	925	989	1,469	2,128	3,232	9,836	33,712	96,240
Hawaii	India	All Commodities	801	2,017	4,624	4,565	4,601	5,486	7,503	12,222	49,542	209,911	667,776
Hawaii	Middle East	All Commodities	196	397	463	465	483	642	790	944	1,321	1,818	2,417
Hawaii	Mediterranean	All Commodities	469	597	664	663	677	873	1,040	1,233	1,759	2,517	3,518
Hawaii	North America	All Commodities	41	65	91	92	93	117	131	146	177	96	132
Hawaii	NE Asia	All Commodities	127,665	121,120	85,282	90,085	93,279	106,510	121,304	143,052	214,964	361,521	660,442
Hawaii	North Europe	All Commodities	4,794	6,013	6,938	6,792	6,889	8,018	8,795	9,786	12,505	16,584	22,480
Hawaii	Oceania	All Commodities	18,044	1,737	1,619	1,673	1,726	2,156	2,539	2,979	4,121	5,731	7,825
Hawaii	Europe, Other	All Commodities	131	136	237	227	224	251	267	290	345	415	490
Hawaii	SE Asia	All Commodities	16,494	22,685	56,588	57,626	58,408	62,391	66,682	77,708	129,450	301,101	747,997
Hawaii	West Coast S America	All Commodities	1,435	1,469	1,870	1,980	2,082	3,092	4,838	8,302	32,359	125,711	374,133

Table A-8. Containerized Tonnes of Exports from US South Atlantic Coast Ports and Other Coasts, by World Trade Route, for Commodity Groups: 1995 - 2050 (selected years)

Origin	Destination	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	Agriculture	4,632,086	4,474,776	5,298,749	5,956,437	6,013,915	7,010,871	7,683,843	8,320,033	9,927,144	11,276,932	14,276,978
Savannah	World	Agriculture	46,570	70,939	276,625	347,136	350,599	388,992	411,825	426,545	467,806	489,348	564,936
Charleston	World	Agriculture	51,521	43,656	111,549	132,711	133,847	152,141	165,349	174,973	195,504	214,217	252,398
Jacksonville	World	Agriculture	51,039	18,245	17,750	19,302	19,961	22,142	23,776	24,864	27,187	30,123	32,898
Miami	World	Agriculture	50,305	53,592	74,490	81,391	84,501	95,787	103,905	108,872	116,934	127,321	136,530
Wilmington	World	Agriculture	33,919	27,911	29,194	31,966	32,669	40,133	44,731	48,373	58,413	61,637	79,937
Norfolk	World	Agriculture	172,226	149,045	167,545	183,024	173,342	195,626	212,406	227,908	261,109	286,970	329,651
Other N Atlantic	World	Agriculture	294,104	229,379	150,355	159,490	154,106	175,475	189,666	203,830	231,174	246,935	281,284
Gulf Coast	World	Agriculture	1,406,147	1,610,102	1,811,667	1,960,586	2,059,483	2,283,972	2,461,763	2,622,543	3,010,308	3,415,068	3,995,612
South Pacific	World	Agriculture	656,045	733,315	940,228	1,306,961	1,331,944	1,600,837	1,774,358	1,927,212	2,343,528	2,547,941	3,308,781
North Pacific	World	Agriculture	1,723,866	1,386,883	1,534,899	1,543,382	1,475,485	1,835,577	2,058,692	2,301,061	2,923,002	3,600,249	4,986,696
Alaska	World	Agriculture	39,517	43,360	21,055	22,251	22,446	25,660	27,440	28,608	31,860	32,552	38,645
Hawaii	World	Agriculture	473	854	314	340	351	402	432	464	528	496	599
USA	World	Extractive	3,831,280	3,416,676	4,654,609	5,093,980	5,337,984	5,756,489	5,974,219	6,310,886	7,262,589	8,521,141	10,023,929
Savannah	World	Extractive	684,758	709,458	1,073,893	1,125,398	1,135,289	1,158,553	1,168,562	1,225,336	1,398,831	1,647,390	1,969,734
Charleston	World	Extractive	201,027	281,504	146,649	152,639	154,458	160,459	167,306	180,518	215,209	260,177	312,965
Jacksonville	World	Extractive	62,571	26,961	112,076	104,116	96,308	106,945	111,932	118,750	136,925	160,164	185,088
Miami	World	Extractive	38,525	57,361	62,184	60,762	59,126	63,533	66,102	70,297	81,881	97,762	117,200
Wilmington	World	Extractive	4,105	10,535	16,025	17,037	17,166	18,373	18,942	20,257	24,070	29,289	36,162
Norfolk	World	Extractive	454,247	255,675	159,823	168,328	174,889	180,527	183,035	185,763	197,948	218,954	244,468
Other N Atlantic	World	Extractive	250,247	134,717	662,129	790,037	843,122	955,468	1,004,615	1,063,209	1,239,362	1,479,946	1,787,240
Gulf Coast	World	Extractive	384,792	266,085	271,580	281,964	309,221	322,179	333,181	340,289	349,999	373,805	403,838
South Pacific	World	Extractive	1,061,995	977,597	1,087,398	1,287,019	1,420,460	1,577,385	1,655,170	1,769,728	2,086,181	2,468,688	2,878,344
North Pacific	World	Extractive	451,863	370,038	636,230	675,356	681,881	729,027	744,209	774,547	859,774	944,205	1,004,295
Alaska	World	Extractive	28,373	41,624	80,651	91,902	98,334	105,214	120,990	139,209	190,256	279,334	432,432
Hawaii	World	Extractive	1,480	11,892	34,797	37,803	40,838	47,168	50,420	55,643	67,481	80,955	96,313
USA	World	Food	13,920,999	13,933,579	13,917,781	14,468,771	15,092,393	17,899,241	19,581,133	21,718,835	26,952,578	33,797,713	40,492,989
Savannah	World	Food	155,862	203,363	355,494	360,941	365,546	412,176	427,104	461,402	585,710	808,381	1,112,384
Charleston	World	Food	176,048	339,245	237,221	248,578	259,862	322,113	361,221	421,556	611,426	921,419	1,342,505
Jacksonville	World	Food	521,987	582,975	422,910	438,132	448,541	504,228	556,191	628,104	839,946	1,156,913	1,564,699
Miami	World	Food	308,754	371,249	381,423	390,499	397,128	429,528	438,410	452,341	499,330	579,040	681,607
Wilmington	World	Food	73,763	60,611	51,698	53,042	54,407	64,982	71,226	78,525	94,842	115,578	132,599
Norfolk	World	Food	623,774	502,870	483,044	499,565	510,503	560,248	577,294	616,066	727,872	880,876	1,024,317
Other N Atlantic	World	Food	394,336	352,371	403,067	414,488	424,021	491,110	531,067	576,450	685,093	822,517	967,112
Gulf Coast	World	Food	5,988,071	5,063,281	4,381,618	4,664,817	4,983,395	5,824,773	6,377,970	7,113,496	8,892,435	11,150,219	13,498,480
South Pacific	World	Food	2,968,542	3,291,001	3,466,358	3,561,469	3,639,077	4,309,369	4,723,925	5,213,574	6,315,065	7,726,151	8,940,271
North Pacific	World	Food	2,382,982	2,764,883	3,218,937	3,292,758	3,458,939	4,344,404	4,817,575	5,388,783	6,747,529	8,442,877	9,857,019
Alaska	World	Food	244,182	235,475	336,817	356,843	363,744	446,672	506,837	567,739	729,857	938,579	1,083,983
Hawaii	World	Food	3,782	3,627	11,563	11,878	12,155	14,437	15,849	17,517	21,250	26,112	30,079

Origin	Destination	Produt Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	Materials	11,578,525	11,347,683	14,596,703	14,573,029	14,134,623	12,522,801	11,647,426	11,812,211	12,799,798	15,234,634	19,451,884
Savannah	World	Materials	1,163,096	1,104,555	1,538,679	1,563,534	1,541,539	1,380,178	1,305,829	1,370,799	1,607,310	2,063,244	2,791,769
Charleston	World	Materials	790,664	994,460	973,343	988,055	979,691	862,015	805,085	838,706	984,061	1,307,237	1,885,690
Jacksonville	World	Materials	470,354	408,845	362,937	365,455	364,549	382,908	406,053	434,604	520,145	653,746	836,196
Miami	World	Materials	296,249	365,054	512,418	523,048	522,232	539,498	564,861	605,050	701,509	823,694	951,691
Wilmington	World	Materials	307,293	235,926	248,392	255,371	252,370	207,282	179,504	174,459	170,966	179,114	194,739
Norfolk	World	Materials	640,049	572,844	759,763	751,093	732,267	661,561	628,645	639,929	714,004	983,671	1,686,072
Other N Atlantic	World	Materials	1,551,376	1,602,353	2,545,439	2,506,716	2,406,190	2,052,726	1,843,267	1,810,873	1,813,032	1,994,079	2,371,394
Gulf Coast	World	Materials	1,412,247	1,014,954	1,267,826	1,294,062	1,286,104	1,208,506	1,220,605	1,295,369	1,540,705	2,048,864	2,964,435
South Pacific	World	Materials	2,672,455	3,225,587	4,443,685	4,366,403	4,194,395	3,677,501	3,309,712	3,227,290	3,178,504	3,351,802	3,677,733
North Pacific	World	Materials	2,186,845	1,726,548	1,802,790	1,818,248	1,719,062	1,442,141	1,289,297	1,322,914	1,478,083	1,727,478	1,973,619
Alaska	World	Materials	52,398	520	257	249	233	216	195	185	171	174	191
Hawaii	World	Materials	22,107	34,246	37,418	35,987	34,608	29,879	26,865	26,434	26,119	27,214	29,317
USA	World	Consumer Goods	847,186	1,077,698	1,075,390	1,104,854	1,140,726	1,375,319	1,659,480	2,060,443	3,725,313	8,112,301	17,846,489
Savannah	World	Consumer Goods	23,152	20,811	42,074	42,746	43,773	53,116	63,461	77,272	121,743	203,596	340,256
Charleston	World	Consumer Goods	41,360	51,031	43,759	44,881	46,437	57,327	69,218	86,277	157,863	363,027	893,429
Jacksonville	World	Consumer Goods	20,150	12,901	9,253	9,424	9,572	10,594	11,488	12,305	14,490	17,683	21,518
Miami	World	Consumer Goods	148,506	293,229	208,578	208,339	209,203	221,615	232,684	243,498	271,682	311,457	354,722
Wilmington	World	Consumer Goods	2,801	1,922	1,107	1,146	1,105	1,506	1,922	2,518	4,997	11,248	24,285
Norfolk	World	Consumer Goods	47,059	47,803	51,308	52,716	54,906	68,700	85,217	111,113	250,054	738,454	2,015,075
Other N Atlantic	World	Consumer Goods	144,302	163,714	192,319	196,799	203,002	246,484	295,556	362,509	625,593	1,265,450	2,548,702
Gulf Coast	World	Consumer Goods	54,313	110,715	126,094	128,229	131,397	157,281	182,712	214,873	332,728	634,622	1,301,041
South Pacific	World	Consumer Goods	292,670	302,466	322,197	337,951	354,471	448,766	573,628	754,282	1,527,734	3,547,761	7,882,426
North Pacific	World	Consumer Goods	56,956	49,548	56,101	59,757	63,455	83,805	114,619	162,551	367,579	922,792	2,276,636
Alaska	World	Consumer Goods	89	12	12	12	13	16	20	25	42	79	153
Hawaii	World	Consumer Goods	64	110	124	131	129	164	210	279	581	1,392	3,149
USA	World	Chemicals	11,052,480	12,538,495	14,341,717	14,610,364	14,651,508	15,774,957	17,195,874	19,219,471	26,419,531	43,025,880	77,569,002
Savannah	World	Chemicals	188,651	213,355	364,741	367,261	367,022	406,021	457,012	523,920	751,553	1,242,549	2,245,078
Charleston	World	Chemicals	484,433	422,574	510,223	510,421	509,053	585,304	673,874	787,974	1,222,659	2,344,315	4,826,042
Jacksonville	World	Chemicals	107,323	47,187	97,476	99,642	99,607	107,311	115,957	126,679	163,268	235,580	365,272
Miami	World	Chemicals	96,708	131,751	138,087	138,901	138,699	147,472	157,123	167,462	213,169	334,031	589,381
Wilmington	World	Chemicals	25,255	70,480	16,433	16,699	16,894	18,723	21,165	24,743	37,455	67,058	132,598
Norfolk	World	Chemicals	226,518	311,914	383,919	386,506	385,755	425,518	473,799	542,234	804,463	1,448,758	2,890,187
Other N Atlantic	World	Chemicals	646,800	647,067	904,032	917,268	928,255	1,020,347	1,119,983	1,258,746	1,790,699	2,998,785	5,407,386
Gulf Coast	World	Chemicals	4,660,102	6,775,811	7,449,335	7,516,245	7,482,074	7,947,168	8,616,075	9,559,276	12,823,901	20,169,561	34,378,691
South Pacific	World	Chemicals	3,167,304	2,629,066	2,541,682	2,683,421	2,775,779	3,027,928	3,349,026	3,832,428	5,513,297	9,160,206	16,609,776
North Pacific	World	Chemicals	1,092,892	896,253	1,314,392	1,331,326	1,322,777	1,379,706	1,443,711	1,548,469	2,016,637	3,494,896	7,840,027
Alaska	World	Chemicals	65,448	82,506	114,706	117,021	119,048	133,477	151,952	178,160	262,076	429,942	779,755
Hawaii	World	Chemicals	123,855	81,058	47,864	48,786	49,604	55,409	62,913	73,648	108,223	177,800	322,969

Origin	Destination	Produt Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	High Technology	395,800	445,133	453,974	478,786	503,471	684,943	928,259	1,333,466	3,593,678	11,459,749	31,668,016
Savannah	World	High Technology	30,983	35,308	35,394	37,368	39,276	53,567	72,782	104,850	285,624	944,461	2,687,065
Charleston	World	High Technology	30,983	35,308	35,394	37,310	39,141	52,933	71,315	101,614	268,375	857,104	2,370,829
Jacksonville	World	High Technology	30,983	35,308	35,394	37,232	38,996	52,233	69,646	97,904	246,947	747,275	1,983,824
Miami	World	High Technology	30,983	35,308	35,394	37,270	39,065	52,562	70,417	99,572	255,994	794,015	2,151,390
Wilmington	World	High Technology	30,983	35,308	35,394	37,370	39,300	53,748	73,242	106,012	293,515	989,198	2,857,141
Norfolk	World	High Technology	31,514	35,472	36,016	37,966	39,916	54,041	73,024	104,837	283,297	895,860	2,444,431
Other N Atlantic	World	High Technology	31,514	35,472	35,996	37,809	39,618	52,637	69,703	97,421	243,132	705,221	1,798,592
Gulf Coast	World	High Technology	29,147	33,287	36,001	38,013	39,894	53,598	71,558	100,463	256,291	748,114	1,927,665
South Pacific	World	High Technology	31,497	35,373	35,452	37,092	39,300	54,515	75,309	110,239	307,874	1,003,557	2,832,511
North Pacific	World	High Technology	30,970	35,393	35,295	36,850	38,765	52,722	71,500	102,753	277,831	873,250	2,364,618
Alaska	World	High Technology	30,406	32,037	34,277	35,781	37,694	52,240	72,277	106,626	307,878	1,033,860	2,956,568
Hawaii	World	High Technology	29,233	31,664	32,154	35,486	37,400	51,677	71,004	103,656	289,665	947,854	2,678,055
USA	World	Intermed. Manufact.	3,114,731	2,093,043	2,965,042	2,985,974	3,044,215	3,746,108	4,602,709	5,481,527	8,273,481	14,061,311	25,531,916
Savannah	World	Intermed. Manufact.	58,832	75,238	91,185	90,739	88,921	105,812	127,479	149,622	218,501	354,858	630,924
Charleston	World	Intermed. Manufact.	133,493	173,761	280,473	278,167	272,114	330,957	396,566	465,699	694,446	1,202,883	2,228,395
Jacksonville	World	Intermed. Manufact.	52,980	42,679	36,083	36,349	36,104	37,914	39,348	40,445	44,255	50,109	56,226
Miami	World	Intermed. Manufact.	151,217	160,514	156,518	164,951	172,012	222,760	285,660	365,122	677,443	1,409,613	2,761,845
Wilmington	World	Intermed. Manufact.	28,774	3,639	19,623	15,309	11,156	14,298	18,636	24,444	47,410	112,112	288,085
Norfolk	World	Intermed. Manufact.	103,540	160,104	187,392	181,475	186,670	228,236	278,350	330,163	509,929	953,587	1,975,344
Other N Atlantic	World	Intermed. Manufact.	566,618	360,385	799,522	803,114	836,254	1,049,415	1,305,509	1,559,782	2,339,118	3,970,319	7,366,661
Gulf Coast	World	Intermed. Manufact.	543,944	311,016	522,354	525,791	527,863	639,711	774,374	909,148	1,291,525	1,965,124	3,127,008
South Pacific	World	Intermed. Manufact.	788,434	559,191	512,333	525,409	535,674	647,444	796,022	947,738	1,446,610	2,473,783	4,512,441
North Pacific	World	Intermed. Manufact.	418,387	159,434	168,174	171,455	176,125	212,729	258,194	303,045	455,620	777,012	1,440,896
Alaska	World	Intermed. Manufact.	55	6	40	40	13	16	19	22	69	165	281
Hawaii	World	Intermed. Manufact.	130	1,122	372	377	392	476	572	659	893	1,285	1,961
USA	World	Capital Equipment	1,992,706	1,778,904	1,960,525	2,049,154	2,120,180	2,582,014	3,074,303	3,621,382	5,267,716	8,156,857	13,003,234
Savannah	World	Capital Equipment	90,412	82,391	80,341	85,314	87,618	107,192	129,354	154,627	228,911	358,908	585,929
Charleston	World	Capital Equipment	135,611	149,107	145,445	149,845	155,053	182,208	206,701	231,800	305,523	432,888	638,982
Jacksonville	World	Capital Equipment	44,149	25,850	31,697	32,193	32,338	35,167	37,240	39,084	45,868	61,524	94,831
Miami	World	Capital Equipment	216,677	181,410	162,118	168,658	172,023	202,666	226,902	246,836	300,469	376,862	471,056
Wilmington	World	Capital Equipment	16,572	17,149	6,094	6,378	6,819	8,895	11,236	13,974	22,579	38,873	68,886
Norfolk	World	Capital Equipment	186,029	151,100	151,851	154,981	157,543	184,989	212,502	240,653	320,700	455,214	668,127
Other N Atlantic	World	Capital Equipment	327,023	284,172	390,346	404,131	416,239	505,488	596,085	694,832	979,368	1,455,815	2,217,038
Gulf Coast	World	Capital Equipment	329,347	274,481	335,401	358,704	376,019	459,701	540,550	624,978	898,948	1,401,076	2,192,663
South Pacific	World	Capital Equipment	494,635	442,873	467,558	488,347	505,903	632,317	791,431	983,571	1,564,788	2,603,579	4,451,892
North Pacific	World	Capital Equipment	128,865	132,838	135,647	142,662	149,170	189,630	238,362	295,888	468,755	774,740	1,313,614
Alaska	World	Capital Equipment	108	35	4	4	4	5	5	6	8	11	15
Hawaii	World	Capital Equipment	463	414	578	622	616	774	973	1,163	1,223	2,120	3,766

Origin	Destination	Produt Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	Motor Vehicles	713,614	557,438	601,870	617,352	632,846	803,762	964,218	1,148,723	1,816,622	3,560,580	7,628,485
Savannah	World	Motor Vehicles	19,250	20,336	21,501	22,471	22,935	31,999	41,417	52,464	85,837	147,604	254,521
Charleston	World	Motor Vehicles	10,968	31,109	38,743	36,639	37,079	59,082	80,652	102,944	156,456	224,810	303,711
Jacksonville	World	Motor Vehicles	36,830	50,861	47,934	47,589	47,481	60,728	73,661	86,797	119,025	161,376	211,090
Miami	World	Motor Vehicles	82,965	58,614	56,733	59,683	60,157	73,697	83,153	92,746	118,274	153,656	195,681
Wilmington	World	Motor Vehicles	1,038	348	652	680	723	915	1,027	1,177	1,536	1,988	2,522
Norfolk	World	Motor Vehicles	78,060	35,947	23,706	23,982	24,103	29,250	31,839	33,242	37,219	45,336	59,671
Other N Atlantic	World	Motor Vehicles	182,741	89,611	120,716	119,418	120,384	139,806	148,618	155,119	182,465	252,690	389,997
Gulf Coast	World	Motor Vehicles	32,177	22,681	34,654	36,294	35,606	44,198	50,998	57,963	81,512	144,649	305,880
South Pacific	World	Motor Vehicles	197,099	180,645	173,594	184,079	194,213	254,282	325,343	419,567	832,037	2,116,746	5,383,311
North Pacific	World	Motor Vehicles	67,166	41,012	60,037	62,794	66,001	77,346	90,153	105,490	153,456	252,942	447,749
Alaska	World	Motor Vehicles	15	8	6	0	0	0	0	0	0	1	1
Hawaii	World	Motor Vehicles	136	148	34	35	40	49	60	72	113	210	422

Table A-9. TEUs of Imports to US South Atlantic Coast Ports and Other Coasts, by World Trade Route, for All Commodities: 1995 - 2050 (selected years)

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	All Commodities	6,149,984	10,615,461	14,237,352	12,891,228	13,864,939	18,318,933	21,317,783	24,392,355	32,233,589	42,426,911	55,122,665
USA	Percent Change	All Commodities	NA	11.54%	10.28%	-9.45%	7.55%	5.73%	3.08%	2.73%	2.83%	2.79%	2.65%
Savannah	World	All Commodities	196,136	396,563	602,107	617,399	664,876	916,546	1,105,626	1,310,895	1,848,206	2,585,808	3,527,589
Savannah	Percent Change	All Commodities	NA	15.12%	14.94%	2.54%	7.69%	6.63%	3.82%	3.46%	3.49%	3.42%	3.15%
Savannah	Africa	All Commodities	317	495	447	456	482	620	725	813	961	1,075	1,161
Savannah	Central America	All Commodities	2,783	1,188	2,594	2,677	2,840	3,577	4,250	4,990	6,863	9,311	12,402
Savannah	East Coast S America	All Commodities	13,690	26,692	29,046	29,754	31,345	39,422	45,234	51,090	65,008	83,015	106,409
Savannah	Eastern Europe	All Commodities	5,958	2,346	5,736	5,589	5,646	6,788	7,616	8,418	10,012	11,718	13,770
Savannah	India	All Commodities	3,293	19,932	18,788	19,036	19,758	24,231	27,346	29,988	35,812	42,182	47,686
Savannah	Middle East	All Commodities	5,054	7,443	11,162	11,556	12,109	14,294	15,083	15,748	16,981	18,120	19,156
Savannah	Mediterranean	All Commodities	4,501	7,893	13,414	16,070	17,465	21,689	24,887	28,032	36,154	46,437	58,404
Savannah	North America	All Commodities	1,268	286	384	409	436	541	618	698	888	1,107	1,341
Savannah	NE Asia	All Commodities	105,028	207,498	365,781	376,948	410,597	594,678	738,304	899,142	1,330,929	1,938,178	2,726,954
Savannah	North Europe	All Commodities	32,024	61,854	59,298	61,148	65,845	86,019	99,397	111,930	143,041	183,424	232,898
Savannah	Oceania	All Commodities	79	3,475	9,848	9,209	10,026	15,636	20,457	25,638	38,899	57,824	82,857
Savannah	Europe, Other	All Commodities	664	5,075	3,520	3,275	3,260	3,932	4,379	4,822	5,943	7,265	8,668
Savannah	SE Asia	All Commodities	18,720	51,096	77,345	78,517	82,238	101,932	113,932	125,975	152,648	181,613	210,897
Savannah	West Coast S America	All Commodities	2,556	1,290	2,745	2,756	2,831	3,187	3,398	3,611	4,067	4,540	4,984
Charleston	World	All Commodities	273,581	564,694	756,533	713,361	766,376	1,053,532	1,282,451	1,522,373	2,125,422	2,917,229	3,905,324
Charleston	Percent Change	All Commodities	NA	15.60%	10.24%	-5.71%	7.43%	6.57%	4.01%	3.49%	3.39%	3.22%	2.96%
Charleston	Africa	All Commodities	5,025	8,875	13,662	13,023	13,996	18,742	22,637	26,812	36,535	47,624	59,790
Charleston	Central America	All Commodities	1,229	6,111	9,331	8,708	9,266	11,299	13,397	15,769	21,746	30,070	41,265
Charleston	East Coast S America	All Commodities	9,424	27,594	50,896	48,532	51,571	67,694	78,533	88,543	107,842	127,660	151,404
Charleston	Eastern Europe	All Commodities	5,026	8,711	13,616	12,243	12,529	14,723	15,935	16,960	19,082	21,432	24,325
Charleston	India	All Commodities	20,045	30,633	79,093	74,441	77,894	102,067	121,575	139,073	179,882	227,727	279,255
Charleston	Middle East	All Commodities	3,592	7,203	12,411	12,027	12,661	15,784	17,576	19,810	25,914	34,595	45,858
Charleston	Mediterranean	All Commodities	14,485	32,599	39,164	38,958	43,737	62,409	79,507	97,987	146,012	212,123	299,184
Charleston	North America	All Commodities	183	329	1,560	1,412	1,595	2,040	2,564	2,800	3,225	3,807	4,653
Charleston	NE Asia	All Commodities	73,923	144,489	174,165	165,831	181,777	272,874	346,313	428,115	647,354	958,669	1,371,783
Charleston	North Europe	All Commodities	95,939	223,567	273,094	254,635	272,962	375,057	457,816	544,126	758,110	1,029,679	1,356,128
Charleston	Oceania	All Commodities	2,212	877	2,353	2,172	2,415	3,404	4,098	4,843	6,696	9,165	12,207
Charleston	Europe, Other	All Commodities	1,588	7,385	8,901	7,893	8,218	10,144	11,625	12,991	16,497	21,008	26,334
Charleston	SE Asia	All Commodities	34,367	42,817	55,223	51,336	53,782	65,687	73,841	82,026	100,335	120,100	140,179
Charleston	West Coast S America	All Commodities	6,542	23,502	23,062	22,149	23,973	31,609	37,034	42,578	56,191	73,571	92,958

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Jacksonville	World	All Commodities	22,148	26,885	39,632	195,591	207,389	285,008	360,091	453,996	722,891	1,093,184	1,540,227
Jacksonville	Percent Change	All Commodities	NA	3.95%	13.81%	393.52%	6.03%	6.56%	4.79%	4.74%	4.76%	4.22%	3.49%
Jacksonville	Africa	All Commodities	38	168	243	1,191	1,234	1,419	1,562	1,712	2,046	2,389	2,720
Jacksonville	Central America	All Commodities	3,282	2,733	1,846	9,222	9,868	12,736	15,301	18,672	26,802	37,280	49,458
Jacksonville	East Coast S America	All Commodities	3,214	6,425	13,403	67,194	72,330	102,772	141,501	196,027	363,013	590,376	849,213
Jacksonville	Eastern Europe	All Commodities	201	329	290	1,441	1,514	1,826	2,145	2,522	3,391	4,561	6,084
Jacksonville	India	All Commodities	36	35	77	399	436	613	721	844	1,150	1,551	2,065
Jacksonville	Middle East	All Commodities	8	28	22	109	115	141	156	172	214	270	341
Jacksonville	Mediterranean	All Commodities	836	296	359	1,753	1,831	2,072	2,161	2,261	2,588	3,128	3,899
Jacksonville	North America	All Commodities	159	165	144	751	808	964	1,054	1,123	1,284	1,493	1,759
Jacksonville	NE Asia	All Commodities	4,854	8,253	9,668	49,393	54,181	85,328	113,508	144,848	227,305	344,714	503,855
Jacksonville	North Europe	All Commodities	2,262	4,306	7,707	35,485	35,291	40,785	41,991	41,750	42,785	44,441	46,313
Jacksonville	Oceania	All Commodities	568	14	41	205	230	346	438	531	780	1,112	1,508
Jacksonville	Europe, Other	All Commodities	5	143	329	1,580	1,677	2,099	2,415	2,722	3,404	4,101	4,712
Jacksonville	SE Asia	All Commodities	1,822	3,090	2,926	14,265	14,678	18,615	21,071	24,115	31,508	40,540	50,687
Jacksonville	West Coast S America	All Commodities	2,864	901	2,575	12,602	13,197	15,292	15,868	16,098	16,622	17,224	17,615
Miami	World	All Commodities	191,197	303,908	484,732	533,234	567,097	717,307	822,175	928,169	1,190,658	1,517,631	1,909,779
Miami	Percent Change	All Commodities	NA	13.74%	10.03%	10.01%	6.35%	4.81%	2.77%	2.45%	2.52%	2.46%	2.32%
Miami	Africa	All Commodities	23	763	995	1,147	1,255	1,738	2,373	3,279	6,524	12,065	19,968
Miami	Central America	All Commodities	53,590	145,454	142,125	155,228	162,669	186,857	206,464	225,196	268,042	315,875	369,057
Miami	East Coast S America	All Commodities	26,133	25,872	34,743	38,178	39,766	47,259	52,542	57,495	68,643	83,123	102,749
Miami	Eastern Europe	All Commodities	549	844	1,146	1,226	1,248	1,309	1,290	1,279	1,282	1,323	1,430
Miami	India	All Commodities	1,895	3,114	4,416	4,849	5,049	6,206	6,940	7,571	9,245	11,272	13,175
Miami	Middle East	All Commodities	1,912	991	1,797	1,997	2,091	2,408	2,569	2,711	2,988	3,264	3,514
Miami	Mediterranean	All Commodities	8,004	18,006	43,639	45,360	47,458	71,156	79,958	87,259	106,370	130,142	159,711
Miami	North America	All Commodities	1,154	612	2,017	2,288	2,612	3,837	4,867	5,757	7,192	8,138	8,739
Miami	NE Asia	All Commodities	40,232	58,022	103,217	114,885	124,234	177,459	221,092	266,742	383,451	533,465	713,422
Miami	North Europe	All Commodities	27,402	59,595	71,607	82,117	90,626	108,040	119,632	131,535	162,380	202,855	252,975
Miami	Oceania	All Commodities	58	396	2,369	2,356	2,614	4,313	5,702	7,176	10,765	16,183	24,187
Miami	Europe, Other	All Commodities	156	1,002	1,748	1,855	1,929	2,414	2,869	3,334	4,561	6,048	7,549
Miami	SE Asia	All Commodities	13,620	22,162	27,491	30,098	31,874	41,700	48,412	56,270	74,735	96,201	121,010
Miami	West Coast S America	All Commodities	14,472	27,074	47,422	51,632	53,672	62,631	67,474	72,646	84,481	97,677	112,291
Wilmington	World	All Commodities	26,268	40,285	45,717	85,683	92,819	139,503	182,438	230,356	357,183	533,105	770,210
Wilmington	Percent Change	All Commodities	NA	8.93%	4.31%	87.42%	8.32%	8.49%	5.51%	4.77%	4.48%	4.09%	3.75%
Wilmington	Africa	All Commodities	8	13	62	123	139	215	316	471	1,091	2,570	5,810
Wilmington	Central America	All Commodities	122	108	280	557	612	990	1,437	1,978	3,517	5,870	9,308
Wilmington	East Coast S America	All Commodities	415	261	1,855	3,608	3,995	5,959	8,435	11,599	21,332	38,006	63,804
Wilmington	Eastern Europe	All Commodities	522	151	263	509	580	833	1,160	1,474	2,463	3,663	4,842
Wilmington	India	All Commodities	273	321	141	277	312	499	649	840	1,435	2,549	4,742
Wilmington	Middle East	All Commodities	16	23	23	45	50	75	95	118	175	255	365
Wilmington	Mediterranean	All Commodities	201	649	278	498	530	732	865	1,013	1,427	2,078	3,114
Wilmington	North America	All Commodities	10	35	46	93	104	160	205	259	420	703	1,227
Wilmington	NE Asia	All Commodities	16,370	27,163	29,233	53,138	60,299	93,431	122,639	153,782	230,480	328,280	447,867
Wilmington	North Europe	All Commodities	2,380	1,976	2,781	5,112	5,496	8,723	12,201	16,327	30,862	55,220	90,200
Wilmington	Oceania	All Commodities	15	37	79	147	168	274	345	420	608	868	1,213
Wilmington	Europe, Other	All Commodities	18	18	80	149	165	255	380	557	1,184	2,404	4,543
Wilmington	SE Asia	All Commodities	5,571	9,134	9,697	17,714	18,443	24,099	28,585	34,289	50,127	74,439	112,067
Wilmington	West Coast S America	All Commodities	347	396	899	1,715	1,936	3,257	5,126	7,230	12,062	16,199	19,108

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Norfolk	World	All Commodities	252,672	439,601	631,842	699,550	747,670	986,995	1,137,987	1,297,150	1,719,736	2,294,811	3,028,714
Norfolk	Percent Change	All Commodities	NA	11.71%	12.85%	10.72%	6.88%	5.71%	2.89%	2.65%	2.86%	2.93%	2.81%
Norfolk	Africa	All Commodities	1,234	3,228	6,560	7,297	7,851	9,448	10,098	10,213	10,987	11,875	13,168
Norfolk	Central America	All Commodities	2,586	2,238	15,700	16,721	17,485	18,706	19,454	20,417	23,489	27,609	32,526
Norfolk	East Coast S America	All Commodities	30,600	53,915	82,209	96,745	103,745	135,683	151,219	164,122	188,724	216,186	254,825
Norfolk	Eastern Europe	All Commodities	3,573	9,276	10,355	10,922	11,228	13,639	15,372	16,990	20,892	25,433	30,816
Norfolk	India	All Commodities	8,365	17,955	34,479	37,298	38,327	46,748	52,613	57,615	71,774	88,296	104,576
Norfolk	Middle East	All Commodities	3,642	3,716	5,094	5,887	5,994	6,651	6,661	6,949	7,937	9,458	11,426
Norfolk	Mediterranean	All Commodities	24,347	32,421	41,293	45,408	48,508	58,659	63,873	67,052	78,969	94,160	111,501
Norfolk	North America	All Commodities	208	270	894	1,062	1,126	1,640	2,072	2,542	3,752	5,328	7,196
Norfolk	NE Asia	All Commodities	36,420	99,550	181,253	202,452	224,834	352,943	442,793	541,945	805,356	1,170,381	1,642,146
Norfolk	North Europe	All Commodities	121,200	175,594	185,230	200,572	208,250	233,341	244,119	253,264	277,728	308,855	343,863
Norfolk	Oceania	All Commodities	1,223	1,891	2,222	2,329	2,453	2,983	3,203	3,413	3,926	4,553	5,257
Norfolk	Europe, Other	All Commodities	1,713	3,914	3,790	4,053	4,232	4,861	5,317	5,694	6,492	7,351	8,220
Norfolk	SE Asia	All Commodities	16,722	37,851	59,474	65,340	70,114	97,827	117,157	142,507	214,445	318,795	454,890
Norfolk	West Coast S America	All Commodities	842	782	3,267	3,472	3,523	3,865	4,123	4,427	5,267	6,528	8,304
Other N Atlantic	World	All Commodities	1,159,283	1,866,836	2,608,418	2,425,426	2,623,821	3,414,396	3,921,006	4,433,331	5,797,003	7,617,592	9,900,757
Other N Atlantic	Percent Change	All Commodities	NA	10.00%	11.80%	-7.02%	8.18%	5.41%	2.81%	2.49%	2.72%	2.77%	2.66%
Other N Atlantic	Africa	All Commodities	12,258	22,158	40,165	38,908	43,192	56,502	63,013	66,781	77,745	85,174	92,898
Other N Atlantic	Central America	All Commodities	16,407	23,556	38,932	35,108	36,577	39,901	42,770	46,023	55,698	68,411	83,797
Other N Atlantic	East Coast S America	All Commodities	93,786	145,752	242,058	231,049	250,145	336,913	387,330	435,222	549,436	696,921	897,071
Other N Atlantic	Eastern Europe	All Commodities	17,918	45,552	61,998	55,901	59,726	77,061	89,056	101,240	129,981	163,382	202,145
Other N Atlantic	India	All Commodities	57,505	111,836	160,674	148,984	155,512	207,886	246,393	278,815	364,992	472,193	590,981
Other N Atlantic	Middle East	All Commodities	18,150	38,133	47,546	45,116	48,132	61,183	69,942	80,195	106,759	142,635	188,087
Other N Atlantic	Mediterranean	All Commodities	70,296	115,858	148,045	141,127	154,756	185,664	204,395	218,091	255,532	293,641	328,726
Other N Atlantic	North America	All Commodities	6,374	3,059	4,842	4,648	5,206	6,472	7,503	8,481	11,734	17,285	25,702
Other N Atlantic	NE Asia	All Commodities	244,821	378,991	625,896	578,819	634,792	913,818	1,120,746	1,346,177	1,958,705	2,825,303	3,969,913
Other N Atlantic	North Europe	All Commodities	478,399	752,660	863,483	808,930	876,554	1,060,839	1,157,172	1,245,840	1,485,467	1,786,592	2,125,154
Other N Atlantic	Oceania	All Commodities	24,571	31,989	53,371	44,987	48,863	69,800	72,431	74,975	80,047	83,574	84,164
Other N Atlantic	Europe, Other	All Commodities	6,194	15,782	15,475	13,851	15,104	17,925	20,488	21,798	25,072	30,233	37,601
Other N Atlantic	SE Asia	All Commodities	85,269	128,525	177,743	163,742	178,779	247,199	294,348	350,609	498,285	694,824	931,885
Other N Atlantic	West Coast S America	All Commodities	27,335	52,984	128,190	114,255	116,481	133,233	145,419	159,084	197,549	257,425	342,633
Gulf Coast	World	All Commodities	309,888	537,528	744,092	672,705	722,461	929,264	1,068,601	1,201,285	1,536,370	1,974,756	2,534,587
Gulf Coast	Percent Change	All Commodities	NA	11.64%	11.45%	-9.59%	7.40%	5.16%	2.83%	2.37%	2.49%	2.54%	2.53%
Gulf Coast	Africa	All Commodities	2,779	5,473	6,130	5,659	6,047	6,927	7,412	7,672	8,467	9,147	9,712
Gulf Coast	Central America	All Commodities	29,683	85,781	127,780	114,170	121,014	144,129	160,057	186,054	243,421	316,545	406,446
Gulf Coast	East Coast S America	All Commodities	48,028	73,300	178,273	161,359	172,021	216,166	238,446	251,475	269,415	281,944	300,546
Gulf Coast	Eastern Europe	All Commodities	7,086	12,768	20,837	17,823	18,381	22,579	25,154	27,296	32,274	38,484	46,021
Gulf Coast	India	All Commodities	7,563	10,056	10,862	9,750	10,110	13,015	15,098	16,783	22,639	30,833	41,916
Gulf Coast	Middle East	All Commodities	2,049	3,654	5,389	5,045	5,392	7,048	8,208	9,423	12,410	16,252	20,942
Gulf Coast	Mediterranean	All Commodities	18,214	25,050	23,733	21,785	23,745	33,119	40,561	48,150	70,216	104,805	157,012
Gulf Coast	North America	All Commodities	218	457	1,791	1,696	1,913	2,228	2,432	2,654	3,285	4,270	5,662
Gulf Coast	NE Asia	All Commodities	36,797	60,875	78,979	72,433	79,474	120,953	155,555	192,252	283,791	402,356	546,813
Gulf Coast	North Europe	All Commodities	127,066	185,512	199,659	184,097	202,303	263,643	303,397	342,059	450,317	602,237	800,985
Gulf Coast	Oceania	All Commodities	4,076	5,333	7,111	5,752	6,416	10,188	11,498	12,690	14,943	16,647	17,361
Gulf Coast	Europe, Other	All Commodities	1,177	3,190	5,236	4,462	4,659	5,833	6,749	7,496	9,551	12,434	16,310
Gulf Coast	SE Asia	All Commodities	12,550	21,965	24,739	22,087	23,158	28,976	35,033	37,650	49,458	64,477	81,709
Gulf Coast	West Coast S America	All Commodities	12,601	40,113	53,450	46,587	47,828	54,440	57,601	59,631	66,182	74,307	83,152

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
South Pacific	World	All Commodities	2,563,634	4,778,391	6,372,607	5,616,420	6,042,027	7,937,940	9,123,523	10,303,360	13,204,243	16,767,558	20,978,966
South Pacific	Percent Change	All Commodities	NA	13.26%	10.07%	-11.87%	7.58%	5.61%	2.82%	2.46%	2.51%	2.42%	2.27%
South Pacific	Africa	All Commodities	732	1,171	2,081	1,923	2,114	2,721	3,087	3,390	4,025	4,511	4,927
South Pacific	Central America	All Commodities	41,110	44,720	119,316	102,259	106,821	111,313	114,544	118,396	129,428	144,307	162,931
South Pacific	East Coast S America	All Commodities	6,422	13,021	24,827	21,867	23,308	28,505	31,409	34,284	41,651	51,340	64,436
South Pacific	Eastern Europe	All Commodities	2,090	9,715	15,418	13,433	14,703	19,737	22,657	25,835	33,585	43,284	55,555
South Pacific	India	All Commodities	92,312	148,731	159,688	137,470	140,721	160,387	169,721	173,287	186,281	202,771	223,507
South Pacific	Middle East	All Commodities	2,064	6,499	9,912	9,043	9,943	14,410	17,871	21,691	31,778	45,895	65,898
South Pacific	Mediterranean	All Commodities	11,368	23,262	42,230	37,403	40,075	48,941	54,084	58,623	69,531	83,203	98,694
South Pacific	North America	All Commodities	4,899	6,873	7,555	7,022	7,460	9,519	10,742	11,588	13,162	14,509	15,410
South Pacific	NE Asia	All Commodities	1,802,259	3,534,800	4,514,222	3,978,056	4,295,455	5,831,814	6,870,280	7,925,312	10,542,627	13,793,623	17,646,922
South Pacific	North Europe	All Commodities	114,650	201,763	229,196	204,496	219,950	262,797	288,525	312,439	377,475	467,809	585,635
South Pacific	Oceania	All Commodities	35,139	82,724	82,400	67,553	71,379	95,152	102,453	108,201	121,678	137,787	159,728
South Pacific	Europe, Other	All Commodities	2,024	5,594	10,985	9,939	11,054	10,657	11,169	11,184	10,979	10,836	10,573
South Pacific	SE Asia	All Commodities	430,418	673,295	891,163	775,051	816,420	981,090	1,055,064	1,124,079	1,265,626	1,401,161	1,534,471
South Pacific	West Coast S America	All Commodities	18,146	26,223	263,614	250,904	282,626	360,896	371,916	375,052	370,417	366,521	350,279
North Pacific	World	All Commodities	1,041,877	1,437,190	1,751,400	1,088,979	1,167,503	1,544,645	1,799,403	2,057,800	2,691,347	3,474,461	4,369,382
North Pacific	Percent Change	All Commodities	NA	6.64%	6.81%	-37.82%	7.21%	5.76%	3.10%	2.72%	2.72%	2.59%	2.32%
North Pacific	Africa	All Commodities	52	123	217	145	162	205	224	240	274	293	298
North Pacific	East Coast S America	All Commodities	6,006	1,559	2,712	1,812	2,053	3,158	4,560	6,297	11,277	18,802	29,562
North Pacific	Eastern Europe	All Commodities	829	1,860	5,392	3,185	3,258	3,560	3,597	3,480	3,305	3,386	3,779
North Pacific	India	All Commodities	20,620	40,833	23,625	14,581	15,072	18,935	21,490	23,552	29,334	37,153	46,541
North Pacific	Middle East	All Commodities	44	275	1,232	806	874	1,308	1,706	2,110	2,983	4,133	6,035
North Pacific	Mediterranean	All Commodities	823	1,575	1,647	1,043	1,136	1,705	2,128	2,569	3,765	5,418	7,462
North Pacific	North America	All Commodities	14,726	6,031	7,728	4,978	5,548	6,420	6,651	6,869	7,457	8,293	9,212
North Pacific	NE Asia	All Commodities	830,802	1,141,286	1,444,543	901,377	970,317	1,305,110	1,533,753	1,766,509	2,335,268	3,032,482	3,814,797
North Pacific	North Europe	All Commodities	6,719	12,528	17,081	11,195	12,579	17,885	22,916	29,033	47,422	77,077	121,599
North Pacific	Oceania	All Commodities	10,291	20,236	35,357	20,296	21,290	26,723	29,260	30,975	34,117	36,316	39,360
North Pacific	Europe, Other	All Commodities	25	238	132	82	90	131	169	211	325	491	734
North Pacific	SE Asia	All Commodities	122,073	198,236	195,193	119,505	124,893	148,587	161,333	173,525	201,039	232,617	268,134
North Pacific	West Coast S America	All Commodities	26,466	8,562	11,156	6,684	6,864	7,452	7,798	8,278	9,628	11,299	13,092
Alaska	World	All Commodities	32,317	52,487	58,584	62,544	67,998	104,895	137,781	173,752	263,023	378,115	519,582
Alaska	Percent Change	All Commodities	NA	10.19%	3.73%	6.76%	8.72%	9.06%	5.61%	4.75%	4.23%	3.70%	3.23%
Alaska	Africa	All Commodities	2	11	2	2	3	4	6	9	16	27	44
Alaska	Central America	All Commodities	102	184	488	549	604	979	1,422	1,955	3,463	5,740	8,998
Alaska	East Coast S America	All Commodities	90	387	1,237	1,450	1,693	2,929	4,605	6,759	13,280	24,003	40,662
Alaska	Eastern Europe	All Commodities	20	75	49	55	62	97	128	165	265	413	627
Alaska	India	All Commodities	47	96	170	192	221	359	443	542	790	1,128	1,581
Alaska	Middle East	All Commodities	23	40	40	45	50	75	95	118	175	255	365
Alaska	Mediterranean	All Commodities	43	94	166	191	218	365	471	587	881	1,282	1,818
Alaska	North America	All Commodities	6	58	77	88	98	150	189	234	354	536	807
Alaska	NE Asia	All Commodities	22,358	36,841	40,679	43,863	48,331	78,218	105,367	134,426	205,494	295,041	401,781
Alaska	North Europe	All Commodities	1,136	1,371	2,166	2,261	2,472	3,618	4,541	5,532	7,986	11,204	15,345
Alaska	Oceania	All Commodities	25	61	128	137	156	258	324	395	574	821	1,149
Alaska	Europe, Other	All Commodities	2	31	20	21	23	33	42	52	77	109	151
Alaska	SE Asia	All Commodities	8,457	13,232	13,337	13,664	14,035	17,761	20,087	22,906	29,565	37,412	46,057
Alaska	West Coast S America	All Commodities	6	7	26	28	32	48	59	72	103	143	197

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Hawaii	World	All Commodities	64,399	84,512	112,040	117,018	126,038	182,573	236,713	302,765	506,237	873,849	1,565,782
Hawaii	Percent Change	All Commodities	NA	5.59%	9.85%	4.44%	7.71%	7.69%	5.33%	5.05%	5.27%	5.61%	6.01%
Hawaii	Africa	All Commodities	2	12	19	21	24	40	65	102	256	638	1,577
Hawaii	Central America	All Commodities	128	340	761	851	950	1,492	2,142	2,967	5,547	10,247	18,982
Hawaii	East Coast S America	All Commodities	94	409	1,347	1,571	1,831	3,154	4,950	7,271	14,392	26,371	45,627
Hawaii	Eastern Europe	All Commodities	20	75	50	55	63	98	130	169	277	447	720
Hawaii	India	All Commodities	73	183	385	432	485	805	1,152	1,662	3,718	9,155	24,248
Hawaii	Middle East	All Commodities	23	40	40	45	50	75	95	118	175	255	365
Hawaii	Mediterranean	All Commodities	146	94	350	399	454	721	980	1,305	2,298	4,029	7,071
Hawaii	North America	All Commodities	13	59	78	89	99	151	190	235	355	536	807
Hawaii	NE Asia	All Commodities	41,650	56,092	75,417	78,919	85,340	126,596	165,945	213,247	359,729	632,032	1,163,490
Hawaii	North Europe	All Commodities	1,745	1,372	3,608	3,860	4,275	6,564	8,958	12,088	22,809	45,238	93,317
Hawaii	Oceania	All Commodities	7,269	4,862	7,224	7,194	7,821	11,197	14,711	18,937	31,467	47,745	64,738
Hawaii	Europe, Other	All Commodities	2	31	20	21	23	33	42	52	77	109	151
Hawaii	SE Asia	All Commodities	13,189	20,937	22,713	23,533	24,591	31,595	37,286	44,527	64,995	96,779	144,119
Hawaii	West Coast S America	All Commodities	46	7	27	30	34	52	67	85	143	268	569

Table A-10. TEUs of Imports to US South Atlantic Coast Ports and Other Coasts, by World Trade Route, for Commodity Groups: 1995 - 2050 (selected years)

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	Agriculture	230,928	399,197	557,172	508,782	520,905	560,278	578,636	555,259	593,652	645,331	706,910
Savannah	World	Agriculture	8,260	14,314	10,540	10,205	10,380	10,755	10,894	10,680	10,857	10,876	10,705
Charleston	World	Agriculture	10,647	25,297	18,586	16,557	16,712	17,353	17,300	16,336	16,056	15,576	14,896
Jacksonville	World	Agriculture	2,907	2,279	4,938	23,184	23,987	29,353	31,082	30,816	31,151	30,726	29,642
Miami	World	Agriculture	15,842	33,114	45,492	49,068	50,790	55,077	56,823	55,759	57,301	58,771	60,117
Wilmington	World	Agriculture	328	572	1,718	3,226	3,480	5,960	9,071	12,744	26,298	48,599	78,407
Norfolk	World	Agriculture	7,121	22,647	26,809	28,308	29,037	31,443	32,555	29,915	31,986	34,360	36,979
Other N Atlantic	World	Agriculture	60,282	110,958	180,595	159,004	161,403	174,737	179,272	168,056	176,576	187,295	200,258
Gulf Coast	World	Agriculture	29,236	67,160	84,791	73,620	75,366	79,679	80,954	79,269	79,149	78,462	76,771
South Pacific	World	Agriculture	60,914	94,235	136,248	116,280	119,124	122,684	124,544	114,141	116,981	121,090	127,180
North Pacific	World	Agriculture	34,070	26,909	45,419	27,198	28,298	29,794	30,907	29,890	30,872	31,354	32,382
Alaska	World	Agriculture	0	0	0	0	0	0	0	0	0	0	0
Hawaii	World	Agriculture	1,315	1,705	2,002	2,056	2,248	3,299	5,009	7,340	15,772	27,052	37,865
USA	World	Extractive	36,778	72,896	90,461	81,431	80,183	102,461	99,221	95,172	93,439	96,292	102,628
Savannah	World	Extractive	724	935	628	591	590	644	633	618	604	598	595
Charleston	World	Extractive	3,402	2,519	589	517	497	524	422	335	248	218	209
Jacksonville	World	Extractive	165	503	205	931	897	947	837	744	639	589	563
Miami	World	Extractive	1,419	2,126	28,223	27,468	27,573	43,898	46,247	47,332	50,506	54,615	60,228
Wilmington	World	Extractive	130	332	873	1,587	1,655	1,968	2,211	2,456	2,995	3,583	4,192
Norfolk	World	Extractive	2,620	1,742	2,244	2,176	2,094	2,460	2,177	1,961	1,837	1,875	1,972
Other N Atlantic	World	Extractive	11,925	17,632	17,706	14,830	14,235	17,821	15,907	14,497	14,578	15,967	17,490
Gulf Coast	World	Extractive	5,061	12,918	8,794	7,255	7,090	8,154	7,322	6,612	6,051	5,995	6,110
South Pacific	World	Extractive	7,003	28,522	15,206	12,442	12,103	12,761	11,412	9,963	7,860	6,634	6,122
North Pacific	World	Extractive	4,289	5,161	4,127	2,500	2,487	2,746	2,575	2,278	1,654	1,189	960
Alaska	World	Extractive	1	0	0	0	0	0	0	0	0	1	1
Hawaii	World	Extractive	30	506	11,866	11,134	10,961	10,535	9,478	8,376	6,468	5,025	4,184
USA	World	Food	617,603	966,055	1,292,180	1,190,714	1,291,988	1,501,653	1,573,631	1,651,828	1,816,084	1,979,423	2,142,020
Savannah	World	Food	10,137	21,033	27,666	27,851	29,811	38,160	44,905	52,287	69,912	92,651	120,744
Charleston	World	Food	18,563	33,578	40,237	38,249	41,072	47,544	52,428	58,010	71,135	86,183	102,577
Jacksonville	World	Food	2,054	1,872	1,610	7,862	8,233	9,215	10,041	10,881	12,761	14,830	16,927
Miami	World	Food	30,158	56,357	76,490	85,921	94,138	111,459	123,682	138,329	172,759	212,577	258,639
Wilmington	World	Food	394	607	337	662	749	1,228	1,849	2,739	5,931	12,573	25,822
Norfolk	World	Food	45,898	60,708	85,707	93,998	99,429	110,173	112,402	114,645	118,349	120,085	119,288
Other N Atlantic	World	Food	239,768	390,174	499,314	467,053	518,254	618,315	649,769	683,124	747,035	796,105	820,938
Gulf Coast	World	Food	33,897	41,285	74,409	67,321	73,523	83,860	87,791	91,958	100,263	107,066	110,956
South Pacific	World	Food	188,553	312,734	426,886	361,390	383,400	429,324	434,437	438,947	444,828	444,379	435,655
North Pacific	World	Food	38,571	37,854	47,155	28,000	30,195	36,011	37,494	39,140	42,501	45,470	47,300
Alaska	World	Food	0	0	0	0	0	0	0	0	0	0	0
Hawaii	World	Food	9,586	9,846	12,172	11,972	12,685	15,546	17,565	19,798	25,762	35,316	52,450

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	Materials	467,743	926,434	1,442,841	1,288,778	1,344,485	1,634,184	1,800,131	1,937,599	2,283,860	2,728,139	3,255,402
Savannah	World	Materials	19,239	39,227	64,118	63,969	66,956	80,525	88,048	93,775	107,687	124,718	142,720
Charleston	World	Materials	47,232	93,278	123,534	110,244	112,608	128,356	135,866	142,187	158,648	178,129	195,110
Jacksonville	World	Materials	3,103	1,413	9,214	42,900	43,310	48,428	49,227	49,787	51,249	52,702	53,079
Miami	World	Materials	12,201	22,472	32,081	33,189	33,404	35,483	36,016	37,166	40,143	44,079	48,546
Wilmington	World	Materials	695	1,013	1,164	2,150	2,321	3,230	4,155	5,313	9,520	18,796	39,112
Norfolk	World	Materials	27,569	45,571	69,615	73,631	76,072	91,119	99,465	107,730	127,293	150,078	171,405
Other N Atlantic	World	Materials	86,733	172,798	366,651	322,687	333,402	408,353	448,798	488,432	582,906	694,989	807,635
Gulf Coast	World	Materials	21,333	44,270	77,361	65,717	67,011	78,508	83,309	88,525	105,046	129,370	163,860
South Pacific	World	Materials	180,247	403,607	570,753	493,678	524,183	653,164	733,640	791,756	937,641	1,124,586	1,349,807
North Pacific	World	Materials	67,041	98,588	122,457	74,417	78,544	98,010	110,318	118,896	140,332	168,236	202,865
Alaska	World	Materials	0	0	0	0	0	0	0	0	0	1	1
Hawaii	World	Materials	2,261	4,196	5,853	6,110	6,576	8,812	10,937	13,422	21,519	36,732	64,630
USA	World	Consumer Goods	1,749,934	3,369,853	4,523,539	3,942,419	4,218,120	5,626,158	6,465,869	7,425,343	9,866,084	13,007,590	16,854,917
Savannah	World	Consumer Goods	41,485	110,544	216,900	219,280	234,893	318,951	364,661	416,864	547,057	707,241	889,375
Charleston	World	Consumer Goods	51,226	108,552	159,779	152,137	163,283	220,010	258,961	299,102	395,825	515,544	652,828
Jacksonville	World	Consumer Goods	632	706	1,157	5,875	6,305	9,018	11,029	14,401	26,230	47,052	75,455
Miami	World	Consumer Goods	56,578	133,883	153,722	168,937	177,851	216,688	244,439	271,812	335,247	407,243	486,130
Wilmington	World	Consumer Goods	1,994	3,631	4,260	7,851	8,476	11,776	14,428	17,750	27,257	42,030	65,038
Norfolk	World	Consumer Goods	26,580	83,464	153,841	170,954	186,477	269,343	311,275	362,643	497,903	676,584	892,038
Other N Atlantic	World	Consumer Goods	248,667	418,492	599,113	563,668	609,630	828,478	964,531	1,114,973	1,499,830	2,003,560	2,613,639
Gulf Coast	World	Consumer Goods	16,082	70,822	102,703	92,862	98,571	125,804	147,773	171,737	231,592	306,452	394,938
South Pacific	World	Consumer Goods	968,327	1,898,312	2,493,196	2,164,422	2,308,353	3,056,310	3,486,722	3,982,506	5,224,241	6,755,536	8,501,029
North Pacific	World	Consumer Goods	330,164	532,675	627,027	583,629	610,023	546,302	627,470	721,680	958,818	1,253,666	1,591,172
Alaska	World	Consumer Goods	0	0	0	0	0	0	0	0	1	1	1
Hawaii	World	Consumer Goods	8,180	8,769	11,813	12,738	14,183	23,385	34,459	51,715	121,810	292,195	692,343
USA	World	Chemicals	394,235	602,231	779,553	689,446	728,796	893,163	990,505	1,061,415	1,279,147	1,608,856	2,045,600
Savannah	World	Chemicals	22,891	30,749	41,713	41,894	43,988	52,950	59,168	64,141	78,519	99,698	126,618
Charleston	World	Chemicals	26,852	52,051	59,086	54,751	58,144	73,719	83,321	91,034	114,081	149,660	196,780
Jacksonville	World	Chemicals	2,268	1,391	1,710	8,493	8,963	11,010	13,544	16,154	22,646	31,936	44,618
Miami	World	Chemicals	2,561	4,382	6,087	6,545	6,853	8,344	9,294	9,999	12,589	17,051	23,674
Wilmington	World	Chemicals	1,601	1,630	1,613	2,965	3,206	4,598	6,471	8,566	13,465	17,762	20,936
Norfolk	World	Chemicals	24,322	32,092	41,326	44,084	45,161	50,940	54,198	56,564	64,202	76,760	94,751
Other N Atlantic	World	Chemicals	128,478	159,014	193,421	175,780	186,501	229,523	249,321	261,274	306,322	378,657	474,746
Gulf Coast	World	Chemicals	54,001	76,197	86,403	75,811	80,034	97,883	104,058	105,415	115,129	131,649	151,400
South Pacific	World	Chemicals	93,789	190,081	256,049	222,619	236,435	290,964	326,942	354,058	429,401	540,078	687,746
North Pacific	World	Chemicals	36,343	53,650	90,770	55,014	57,883	70,828	80,804	89,513	113,364	146,133	184,268
Alaska	World	Chemicals	0	0	0	0	0	0	0	0	0	0	0
Hawaii	World	Chemicals	1,121	993	1,355	1,449	1,584	2,345	3,308	4,606	9,283	19,220	39,610

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	High Technology	399,689	649,181	724,600	808,602	878,648	1,352,975	1,775,672	2,232,435	3,365,083	4,813,147	6,573,506
Savannah	World	High Technology	34,285	55,686	62,155	65,111	70,994	111,176	147,258	186,973	286,391	415,585	574,789
Charleston	World	High Technology	36,482	59,255	66,139	63,551	69,196	107,528	141,791	179,346	272,712	393,002	540,065
Jacksonville	World	High Technology	6,786	11,022	12,302	62,214	67,096	99,753	127,780	157,665	229,014	316,528	418,737
Miami	World	High Technology	29,438	47,813	53,368	60,357	65,595	101,060	132,477	166,700	251,030	358,448	488,292
Wilmington	World	High Technology	18,322	29,759	33,216	62,541	67,995	104,892	137,778	173,749	263,020	378,112	519,577
Norfolk	World	High Technology	31,926	51,855	57,879	65,378	71,206	110,871	146,321	185,214	282,026	406,909	559,717
Other N Atlantic	World	High Technology	35,868	58,258	65,026	61,422	66,697	102,318	133,855	168,133	252,351	359,257	488,100
Gulf Coast	World	High Technology	33,703	54,741	61,101	56,129	60,904	93,152	121,580	152,401	227,857	323,220	437,689
South Pacific	World	High Technology	38,130	61,932	69,127	62,231	67,652	104,481	137,039	172,504	259,748	370,589	504,388
North Pacific	World	High Technology	53,964	87,649	97,832	62,045	67,328	103,067	134,459	168,503	251,874	357,163	483,421
Alaska	World	High Technology	32,314	52,485	58,582	62,541	67,995	104,892	137,778	173,749	263,020	378,112	519,577
Hawaii	World	High Technology	32,314	52,485	58,582	62,541	67,995	104,892	137,778	173,749	263,020	378,112	519,577
USA	World	Intermed. Manufact.	1,030,852	1,915,209	2,580,934	2,330,763	2,556,337	3,403,918	4,116,783	4,825,468	6,642,697	9,134,185	12,491,152
Savannah	World	Intermed. Manufact.	32,302	65,289	94,627	98,130	107,436	150,253	194,797	244,541	384,769	599,573	902,488
Charleston	World	Intermed. Manufact.	34,969	93,139	127,035	122,455	135,036	182,456	226,070	272,479	394,599	567,766	800,575
Jacksonville	World	Intermed. Manufact.	2,755	3,365	4,664	22,780	23,807	26,888	29,826	33,224	44,321	65,925	106,015
Miami	World	Intermed. Manufact.	24,172	43,505	58,890	66,485	72,475	93,283	112,872	133,187	185,909	258,662	352,650
Wilmington	World	Intermed. Manufact.	1,473	1,520	1,522	2,806	2,941	3,444	3,765	3,980	4,448	5,012	5,739
Norfolk	World	Intermed. Manufact.	34,274	59,879	75,765	84,843	92,888	124,507	154,606	186,974	275,702	406,189	587,215
Other N Atlantic	World	Intermed. Manufact.	191,708	336,534	408,708	390,186	435,826	614,555	786,432	972,279	1,481,353	2,229,524	3,269,578
Gulf Coast	World	Intermed. Manufact.	83,429	110,905	113,756	105,618	117,053	159,693	199,676	241,503	352,434	511,810	733,427
South Pacific	World	Intermed. Manufact.	450,091	953,678	1,376,549	1,236,020	1,353,602	1,777,008	2,087,397	2,369,646	3,038,006	3,855,968	4,896,808
North Pacific	World	Intermed. Manufact.	169,686	242,887	313,185	194,809	208,097	262,051	308,629	351,279	452,065	578,039	724,859
Alaska	World	Intermed. Manufact.	0	0	0	0	0	0	0	0	0	0	0
Hawaii	World	Intermed. Manufact.	5,987	4,500	6,228	6,625	7,170	9,774	12,706	16,370	29,085	55,710	111,791
USA	World	Capital Equipment	675,521	1,068,335	1,412,804	1,289,137	1,413,712	1,976,400	2,347,845	2,732,154	3,695,177	4,939,854	6,465,442
Savannah	World	Capital Equipment	20,852	44,707	60,297	65,826	73,285	111,196	141,991	176,835	273,159	414,885	602,644
Charleston	World	Capital Equipment	27,365	55,408	70,343	69,912	77,532	113,645	142,187	174,986	267,549	409,589	613,994
Jacksonville	World	Capital Equipment	947	762	443	2,250	2,394	3,051	3,622	4,327	6,738	11,285	18,970
Miami	World	Capital Equipment	10,602	11,580	20,397	23,832	26,090	34,094	38,946	43,613	55,216	69,959	87,808
Wilmington	World	Capital Equipment	877	1,116	896	1,667	1,733	1,994	2,109	2,194	2,464	3,001	4,095
Norfolk	World	Capital Equipment	21,421	36,834	61,229	69,438	74,747	101,641	121,557	143,333	204,973	297,862	426,022
Other N Atlantic	World	Capital Equipment	98,715	150,107	190,562	188,051	209,450	297,921	358,831	420,823	578,807	774,935	1,003,183
Gulf Coast	World	Capital Equipment	25,579	44,094	64,874	62,744	70,600	98,574	118,789	140,368	196,080	269,484	359,554
South Pacific	World	Capital Equipment	318,359	540,133	715,732	656,423	715,500	989,495	1,153,725	1,317,268	1,697,627	2,144,511	2,653,243
North Pacific	World	Capital Equipment	147,242	182,066	226,284	147,014	160,181	221,402	261,368	301,956	400,530	522,203	656,270
Alaska	World	Capital Equipment	0	0	0	0	0	0	0	0	0	0	0
Hawaii	World	Capital Equipment	3,296	1,217	1,716	1,913	2,125	3,268	4,557	6,226	11,595	21,279	37,935

Destination	Origin	Product Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	Motor Vehicles	546,700	646,070	833,270	761,154	831,766	1,267,743	1,571,491	1,875,682	2,598,366	3,474,094	4,485,087
Savannah	World	Motor Vehicles	5,961	14,079	23,463	24,542	26,543	41,936	53,270	64,181	89,251	119,983	156,911
Charleston	World	Motor Vehicles	16,843	41,617	91,205	84,987	92,296	162,396	224,106	288,559	434,570	601,562	788,289
Jacksonville	World	Motor Vehicles	532	3,573	3,390	19,101	22,397	47,344	83,103	135,998	298,144	521,611	776,220
Miami	World	Motor Vehicles	8,227	8,675	9,981	11,432	12,329	17,921	21,378	24,264	29,958	36,225	43,694
Wilmington	World	Motor Vehicles	453	104	117	229	254	412	601	866	1,786	3,638	7,291
Norfolk	World	Motor Vehicles	30,943	44,811	57,426	66,740	70,559	94,496	103,430	108,171	115,465	124,109	139,326
Other N Atlantic	World	Motor Vehicles	57,139	52,869	87,322	82,746	88,424	122,376	134,289	141,741	157,245	177,302	205,189
Gulf Coast	World	Motor Vehicles	7,567	15,136	69,900	65,626	72,308	103,957	117,350	123,497	122,768	111,249	99,882
South Pacific	World	Motor Vehicles	258,220	295,157	312,862	290,914	321,675	501,748	627,664	752,573	1,047,909	1,404,186	1,816,989
North Pacific	World	Motor Vehicles	160,505	169,751	177,145	114,353	124,467	174,434	205,379	234,664	299,337	371,009	445,883
Alaska	World	Motor Vehicles	0	0	0	0	0	0	0	0	0	0	0
Hawaii	World	Motor Vehicles	310	296	455	480	509	717	915	1,163	1,923	3,209	5,398

Table A-11. TEUs of Exports from US South Atlantic Coast Ports and Other Coasts, by World Trade Route, for All Commodties: 1995 - 2050 (selected C2118years)

Origin	Destination	Produt Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	All Commodities	5,717,411	5,222,689	6,532,904	6,793,201	6,890,924	7,592,271	8,246,429	9,186,147	12,285,625	18,890,848	32,117,631
USA	Percent Change	All Commodities	NA	-1.79%	7.86%	3.67%	1.44%	1.96%	1.67%	2.18%	2.95%	4.40%	5.45%
Savannah	World	All Commodities	227,918	260,437	388,361	406,627	408,991	420,447	442,855	488,149	637,739	945,571	1,543,369
Savannah	Percent Change	All Commodities	NA	2.70%	14.25%	4.70%	0.58%	0.55%	1.04%	1.97%	2.71%	4.02%	5.02%
Savannah	Africa	All Commodities	2,210	2,479	1,725	1,714	1,706	1,765	1,785	1,853	2,205	3,227	5,610
Savannah	Central America	All Commodities	10,493	3,047	14,284	15,206	15,648	17,665	19,683	22,286	32,946	60,967	121,000
Savannah	East Coast S America	All Commodities	27,164	31,424	9,965	10,572	10,652	11,764	12,689	13,874	16,541	19,613	23,349
Savannah	Eastern Europe	All Commodities	1,354	2,165	4,648	4,710	4,823	5,369	5,787	6,593	10,223	18,820	34,646
Savannah	India	All Commodities	2,882	5,302	10,415	10,549	10,639	11,872	13,401	15,424	23,740	45,280	92,145
Savannah	Middle East	All Commodities	6,813	9,540	7,729	7,751	7,727	7,939	8,014	8,277	8,907	9,577	10,252
Savannah	Mediterranean	All Commodities	11,319	16,606	22,422	23,212	23,477	25,991	28,472	31,885	39,772	48,792	58,602
Savannah	North America	All Commodities	2	2	1	1	1	2	2	2	3	4	5
Savannah	NE Asia	All Commodities	84,816	91,920	204,634	212,565	213,429	214,163	219,054	237,166	295,356	401,199	588,497
Savannah	North Europe	All Commodities	43,152	57,010	60,032	63,041	64,205	62,577	64,770	69,552	80,566	93,373	106,788
Savannah	Oceania	All Commodities	18,734	21,510	23,988	26,211	25,084	26,429	29,978	34,857	46,963	62,478	79,456
Savannah	Europe, Other	All Commodities	68	483	48	48	49	54	58	62	70	80	90
Savannah	SE Asia	All Commodities	10,222	13,551	21,379	23,820	24,311	26,961	30,225	35,523	58,256	119,476	254,497
Savannah	West Coast S America	All Commodities	8,691	5,398	7,090	7,226	7,240	7,896	8,937	10,796	22,190	62,686	168,433
Charleston	World	All Commodities	364,677	414,276	427,016	443,365	449,301	505,916	567,983	648,299	895,918	1,364,276	2,196,283
Charleston	Percent Change	All Commodities	NA	2.58%	1.01%	3.83%	1.34%	2.40%	2.34%	2.68%	3.29%	4.29%	4.88%
Charleston	Africa	All Commodities	5,517	6,052	5,592	5,498	5,474	5,895	6,118	6,439	7,739	10,512	15,593
Charleston	Central America	All Commodities	5,409	13,335	17,652	18,562	19,041	21,404	23,624	26,329	37,621	65,784	123,108
Charleston	East Coast S America	All Commodities	20,283	37,670	31,001	33,098	33,598	38,456	42,588	46,495	54,753	63,909	74,473
Charleston	Eastern Europe	All Commodities	5,872	7,875	13,824	14,271	14,777	17,385	19,710	23,881	45,097	105,708	231,626
Charleston	India	All Commodities	6,158	4,801	17,450	17,865	18,363	22,451	28,060	36,225	71,404	165,422	383,307
Charleston	Middle East	All Commodities	10,780	7,774	3,268	3,289	3,320	3,495	3,614	3,794	4,209	4,672	5,167
Charleston	Mediterranean	All Commodities	24,760	27,593	35,173	36,147	36,517	41,013	45,529	51,025	63,966	79,583	98,083
Charleston	North America	All Commodities	2	2	1	1	1	2	2	2	3	3	4
Charleston	NE Asia	All Commodities	102,109	108,882	94,201	97,799	98,431	102,245	106,386	116,831	148,562	204,566	297,809
Charleston	North Europe	All Commodities	123,746	150,358	159,233	165,600	168,498	198,778	231,411	265,883	344,621	436,016	534,658
Charleston	Oceania	All Commodities	5,667	2,850	2,559	2,775	2,692	2,826	3,134	3,546	4,487	5,552	6,674
Charleston	Europe, Other	All Commodities	400	1,227	372	378	385	413	436	463	529	606	689
Charleston	SE Asia	All Commodities	31,376	19,770	22,592	23,169	23,179	23,400	24,498	27,324	40,318	72,667	133,503
Charleston	West Coast S America	All Commodities	22,601	26,088	24,099	24,914	25,025	28,153	32,873	40,061	72,610	149,278	291,589

Origin	Destination	Produt Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Jacksonville	World	All Commodities	124,569	85,307	94,269	97,729	99,299	112,183	122,307	135,491	181,511	285,999	500,993
Jacksonville	Percent Change	All Commodities	NA	-7.29%	3.39%	3.67%	1.61%	2.47%	1.74%	2.07%	2.97%	4.65%	5.77%
Jacksonville	Africa	All Commodities	1,679	199	369	368	366	419	476	548	812	1,500	3,011
Jacksonville	Central America	All Commodities	17,815	17,602	16,220	16,672	17,091	18,713	19,440	20,620	27,082	45,452	84,278
Jacksonville	East Coast S America	All Commodities	48,126	35,277	30,604	32,522	32,852	37,201	40,284	42,807	47,621	52,281	57,344
Jacksonville	Eastern Europe	All Commodities	2,106	2,502	1,243	1,303	1,410	1,750	1,881	2,217	3,792	7,519	14,949
Jacksonville	India	All Commodities	78	144	204	193	264	294	468	828	3,255	11,935	33,414
Jacksonville	Middle East	All Commodities	117	1,361	1,482	1,488	1,478	1,480	1,484	1,536	1,670	1,828	2,004
Jacksonville	Mediterranean	All Commodities	1,435	822	2,970	3,094	3,247	5,125	6,527	8,296	12,399	17,019	21,872
Jacksonville	North America	All Commodities	2	2	1	1	1	2	2	2	3	3	4
Jacksonville	NE Asia	All Commodities	8,957	6,232	12,212	12,610	13,051	14,741	16,174	18,934	27,245	42,415	70,508
Jacksonville	North Europe	All Commodities	24,114	13,361	14,337	14,725	14,964	17,477	19,427	21,240	24,559	27,533	30,386
Jacksonville	Oceania	All Commodities	5,104	697	511	532	538	613	676	739	907	1,128	1,405
Jacksonville	Europe, Other	All Commodities	90	32	19	18	18	20	22	23	26	30	33
Jacksonville	SE Asia	All Commodities	1,380	1,021	5,636	5,698	5,741	6,063	6,707	7,938	15,295	37,928	89,838
Jacksonville	West Coast S America	All Commodities	13,365	6,055	8,462	8,503	8,339	8,285	8,739	9,763	16,845	39,428	91,946
Miami	World	All Commodities	300,850	258,875	278,640	295,065	301,741	343,887	383,650	431,894	584,994	877,896	1,392,760
Miami	Percent Change	All Commodities	NA	-2.96%	2.48%	5.89%	2.26%	2.65%	2.21%	2.40%	3.08%	4.14%	4.72%
Miami	Africa	All Commodities	155	522	431	432	433	461	488	526	723	1,278	2,497
Miami	Central America	All Commodities	120,696	159,594	166,634	177,636	183,704	211,713	236,761	266,538	359,614	529,984	805,715
Miami	East Coast S America	All Commodities	89,467	45,825	25,542	27,697	28,194	33,236	36,552	38,849	42,917	46,381	50,031
Miami	Eastern Europe	All Commodities	705	582	902	940	975	1,308	1,679	2,198	4,068	8,056	15,497
Miami	India	All Commodities	1,072	1,325	3,676	3,607	3,603	3,690	3,938	4,497	7,811	18,390	43,053
Miami	Middle East	All Commodities	1,409	295	743	742	740	792	822	854	952	1,078	1,210
Miami	Mediterranean	All Commodities	2,327	1,949	5,516	5,746	5,960	8,741	10,927	13,713	20,375	28,302	37,323
Miami	North America	All Commodities	2	2	1	1	1	2	2	2	3	4	5
Miami	NE Asia	All Commodities	14,782	8,500	12,775	13,238	13,341	13,937	15,063	17,291	24,857	39,761	68,610
Miami	North Europe	All Commodities	17,257	11,363	30,353	31,356	30,691	30,423	31,554	33,302	38,147	44,699	52,513
Miami	Oceania	All Commodities	482	633	570	592	600	660	707	757	901	1,105	1,370
Miami	Europe, Other	All Commodities	144	60	18	18	17	20	21	23	26	29	33
Miami	SE Asia	All Commodities	3,484	1,884	2,284	2,394	2,491	3,081	4,019	5,615	13,464	36,191	87,820
Miami	West Coast S America	All Commodities	48,868	26,341	29,195	30,666	30,990	35,823	41,115	47,731	71,137	122,640	227,083
Wilmington	World	All Commodities	54,094	22,298	19,557	20,479	21,143	24,479	28,956	36,222	71,317	178,500	435,375
Wilmington	Percent Change	All Commodities	NA	-16.24%	-4.28%	4.71%	3.24%	2.97%	3.42%	4.58%	7.04%	9.58%	9.33%
Wilmington	Africa	All Commodities	108	78	75	78	81	105	131	166	338	914	2,357
Wilmington	Central America	All Commodities	1,369	709	874	932	993	1,398	1,993	3,066	9,855	33,242	89,926
Wilmington	East Coast S America	All Commodities	3,044	1,586	807	890	926	1,197	1,444	1,628	2,028	2,519	3,268
Wilmington	Eastern Europe	All Commodities	777	212	197	207	225	309	391	496	903	1,868	3,868
Wilmington	India	All Commodities	161	299	290	281	290	394	586	996	3,991	15,840	47,813
Wilmington	Middle East	All Commodities	285	214	264	270	282	354	421	484	622	779	949
Wilmington	Mediterranean	All Commodities	2,080	1,471	905	942	957	897	899	950	1,092	1,284	1,536
Wilmington	North America	All Commodities	3	2	1	1	1	1	2	2	2	3	3
Wilmington	NE Asia	All Commodities	26,735	8,945	8,495	8,878	9,116	10,446	11,941	14,104	21,224	35,337	63,266
Wilmington	North Europe	All Commodities	13,040	4,754	4,571	4,718	4,815	4,756	4,827	5,091	5,862	6,986	8,617
Wilmington	Oceania	All Commodities	753	385	465	484	489	554	608	662	807	997	1,242
Wilmington	Europe, Other	All Commodities	41	13	12	12	12	14	15	16	19	22	25
Wilmington	SE Asia	All Commodities	4,201	2,768	1,977	2,114	2,245	3,027	4,137	5,976	15,456	45,099	117,626
Wilmington	West Coast S America	All Commodities	1,497	863	624	671	710	1,027	1,361	2,586	9,317	53,612	94,879

Origin	Destination	Produt Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Norfolk	World	All Commodities	368,035	353,597	380,265	388,736	391,428	419,754	447,059	488,878	640,788	993,433	1,720,759
Norfolk	Percent Change	All Commodities	NA	-0.80%	2.45%	2.23%	0.69%	1.41%	1.27%	1.80%	2.74%	4.48%	5.65%
Norfolk	Africa	All Commodities	3,033	5,770	7,748	7,751	7,805	8,949	9,915	10,949	14,000	19,726	30,344
Norfolk	Central America	All Commodities	3,917	4,721	10,200	10,813	11,333	14,068	15,999	18,309	27,717	52,473	105,522
Norfolk	East Coast S America	All Commodities	33,903	37,096	22,833	24,106	24,290	27,084	28,819	30,243	33,107	36,160	39,757
Norfolk	Eastern Europe	All Commodities	13,937	11,433	15,897	16,555	17,529	21,044	23,639	29,193	60,182	157,833	388,415
Norfolk	India	All Commodities	2,536	8,528	15,651	15,756	16,128	18,209	20,882	24,906	42,356	86,137	170,070
Norfolk	Middle East	All Commodities	4,403	6,790	4,305	4,337	4,382	4,803	5,155	5,535	6,317	7,144	8,010
Norfolk	Mediterranean	All Commodities	22,400	31,471	31,498	31,919	32,059	34,274	34,187	34,690	36,374	39,186	43,468
Norfolk	North America	All Commodities	97	97	113	113	116	135	148	158	169	173	170
Norfolk	NE Asia	All Commodities	73,620	78,387	110,577	113,324	114,054	118,994	125,325	136,310	168,796	231,189	353,020
Norfolk	North Europe	All Commodities	149,256	130,760	116,719	117,910	117,382	121,023	125,659	131,981	148,689	171,396	200,761
Norfolk	Oceania	All Commodities	15,985	11,851	10,981	11,723	11,496	12,717	14,483	16,717	23,726	36,032	56,735
Norfolk	Europe, Other	All Commodities	15,134	1,730	1,046	1,020	979	1,096	1,153	1,215	1,371	1,560	1,782
Norfolk	SE Asia	All Commodities	25,756	22,178	24,148	24,657	25,110	27,746	31,009	36,001	54,893	98,684	188,144
Norfolk	West Coast S America	All Commodities	4,139	2,787	8,548	8,752	8,764	9,612	10,688	12,671	23,091	55,741	134,562
Other N Atlantic	World	All Commodities	740,845	663,327	952,192	977,979	983,430	1,042,163	1,111,109	1,224,451	1,634,357	2,586,973	4,574,573
Other N Atlantic	Percent Change	All Commodities	NA	-2.19%	12.81%	2.71%	0.56%	1.17%	1.29%	1.96%	2.93%	4.70%	5.87%
Other N Atlantic	Africa	All Commodities	16,023	11,123	18,302	18,151	18,326	20,912	22,769	24,530	29,598	37,949	50,468
Other N Atlantic	Central America	All Commodities	38,666	40,530	47,861	51,266	54,127	67,381	76,532	86,262	113,810	158,980	226,434
Other N Atlantic	East Coast S America	All Commodities	73,878	56,390	43,749	46,849	47,159	53,282	57,344	60,752	67,705	74,978	83,146
Other N Atlantic	Eastern Europe	All Commodities	14,277	10,529	26,492	27,768	29,438	37,585	46,090	60,791	143,862	424,427	1,121,252
Other N Atlantic	India	All Commodities	15,738	19,171	48,631	48,474	48,795	51,948	56,605	64,188	97,691	184,615	359,475
Other N Atlantic	Middle East	All Commodities	18,520	22,384	18,305	18,582	18,990	21,780	24,061	26,420	31,450	36,834	42,491
Other N Atlantic	Mediterranean	All Commodities	42,138	35,471	47,808	49,930	50,912	58,188	62,142	66,710	77,067	89,316	103,655
Other N Atlantic	North America	All Commodities	144	249	468	454	460	494	549	654	887	1,153	1,429
Other N Atlantic	NE Asia	All Commodities	189,203	157,650	316,929	322,757	319,725	314,735	325,800	360,349	473,325	700,716	1,161,151
Other N Atlantic	North Europe	All Commodities	220,190	218,505	246,450	251,900	254,086	264,026	270,066	277,047	293,790	315,558	341,553
Other N Atlantic	Oceania	All Commodities	14,156	12,116	26,307	29,137	28,382	31,658	36,229	41,724	55,975	76,819	106,912
Other N Atlantic	Europe, Other	All Commodities	3,270	1,538	1,340	1,383	1,434	1,890	2,224	2,563	3,299	4,120	5,030
Other N Atlantic	SE Asia	All Commodities	54,349	50,191	71,741	72,605	73,273	77,606	86,604	102,873	171,890	347,199	717,153
Other N Atlantic	West Coast S America	All Commodities	40,295	27,481	37,808	38,723	38,323	40,677	44,096	49,589	74,010	134,310	254,395
Gulf Coast	World	All Commodities	485,632	668,007	937,607	983,478	1,009,186	1,205,541	1,357,021	1,531,381	2,051,545	3,013,773	4,709,706
Gulf Coast	Percent Change	All Commodities	NA	6.58%	11.96%	4.89%	2.61%	3.59%	2.43%	2.45%	2.97%	3.92%	4.57%
Gulf Coast	Africa	All Commodities	4,339	9,271	11,920	11,738	11,707	13,552	15,189	17,510	26,672	50,426	103,394
Gulf Coast	Central America	All Commodities	66,706	152,147	378,483	405,018	425,379	541,449	611,981	683,742	848,036	1,062,880	1,346,973
Gulf Coast	East Coast S America	All Commodities	72,542	112,581	91,549	97,782	98,402	108,076	114,902	120,643	133,284	146,917	161,967
Gulf Coast	Eastern Europe	All Commodities	17,216	18,794	19,439	20,444	21,781	27,144	30,167	35,514	59,274	119,007	238,725
Gulf Coast	India	All Commodities	11,024	8,055	20,583	21,284	22,488	29,408	38,577	52,652	120,284	314,371	746,936
Gulf Coast	Middle East	All Commodities	8,636	12,233	13,579	13,790	14,088	15,353	16,600	18,047	21,321	25,235	29,946
Gulf Coast	Mediterranean	All Commodities	19,551	39,822	53,745	55,155	55,817	65,545	72,655	80,051	96,965	117,659	142,621
Gulf Coast	North America	All Commodities	2	2	4	4	4	6	7	9	12	17	27
Gulf Coast	NE Asia	All Commodities	75,050	39,340	65,607	67,804	69,763	79,676	92,098	106,638	151,958	235,781	385,337
Gulf Coast	North Europe	All Commodities	134,645	193,256	199,476	203,063	201,442	221,219	242,507	263,988	318,191	388,697	480,026
Gulf Coast	Oceania	All Commodities	10,566	10,714	7,552	8,144	7,811	8,091	8,964	10,045	12,759	16,305	20,531
Gulf Coast	Europe, Other	All Commodities	204	151	241	243	248	270	291	313	367	433	508
Gulf Coast	SE Asia	All Commodities	12,613	10,760	12,210	12,785	13,261	15,811	19,321	24,464	46,441	105,744	230,069
Gulf Coast	West Coast S America	All Commodities	52,538	60,880	63,220	66,225	66,996	77,942	93,762	117,714	215,981	432,300	822,645

Origin	Destination	Produt Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
South Pacific	World	All Commodities	1,640,588	1,483,657	1,722,819	1,780,055	1,794,697	1,921,938	2,066,830	2,296,057	3,099,866	4,964,520	8,966,347
South Pacific	Percent Change	All Commodities	NA	-1.99%	5.11%	3.32%	0.82%	1.38%	1.46%	2.13%	3.05%	4.82%	6.09%
South Pacific	Africa	All Commodities	732	752	1,022	988	966	1,110	1,219	1,346	1,761	2,648	4,450
South Pacific	Central America	All Commodities	21,088	23,703	54,405	56,991	58,615	65,996	72,057	78,551	97,581	135,334	207,306
South Pacific	East Coast S America	All Commodities	7,265	8,762	4,200	4,512	4,640	5,689	6,364	7,009	8,178	9,476	11,110
South Pacific	Eastern Europe	All Commodities	3,335	3,135	3,625	3,857	4,204	5,760	6,844	8,772	19,441	55,017	142,682
South Pacific	India	All Commodities	38,890	32,918	49,867	50,687	51,154	58,972	66,131	75,070	107,379	179,008	317,004
South Pacific	Middle East	All Commodities	1,592	1,593	1,800	1,817	1,889	2,264	2,518	2,818	3,519	4,423	5,642
South Pacific	Mediterranean	All Commodities	5,661	11,342	10,871	10,981	10,729	12,585	13,597	14,680	17,631	21,916	27,732
South Pacific	North America	All Commodities	16	92	35	35	36	47	55	62	79	100	126
South Pacific	NE Asia	All Commodities	1,235,707	1,072,011	1,262,966	1,293,154	1,296,106	1,333,761	1,383,631	1,488,614	1,815,059	2,427,272	3,573,294
South Pacific	North Europe	All Commodities	57,732	55,651	82,673	84,629	87,562	102,136	116,608	129,135	154,897	184,295	220,724
South Pacific	Oceania	All Commodities	51,376	75,555	68,897	74,415	73,981	87,638	101,264	115,010	146,180	182,728	223,615
South Pacific	Europe, Other	All Commodities	561	176	507	527	526	499	484	478	471	468	467
South Pacific	SE Asia	All Commodities	194,300	177,598	158,303	173,498	180,345	219,838	267,828	342,202	679,082	1,675,195	4,068,972
South Pacific	West Coast S America	All Commodities	22,334	20,371	23,650	23,963	23,945	25,641	28,230	32,310	48,608	86,639	163,222
North Pacific	World	All Commodities	1,291,329	881,997	974,807	1,018,031	1,042,121	1,162,168	1,239,293	1,362,456	1,716,070	2,365,450	3,559,320
North Pacific	Percent Change	All Commodities	NA	-7.34%	3.39%	4.43%	2.37%	2.20%	1.29%	1.91%	2.33%	3.26%	4.17%
North Pacific	Africa	All Commodities	319	458	510	515	503	599	655	743	1,045	1,842	3,668
North Pacific	East Coast S America	All Commodities	5,574	3,872	1,715	1,875	1,930	2,348	2,683	2,966	3,521	4,172	5,100
North Pacific	Eastern Europe	All Commodities	13,497	6,778	7,743	8,211	8,899	11,904	13,180	15,503	26,899	62,595	157,373
North Pacific	India	All Commodities	8,220	10,683	13,588	13,577	13,615	14,437	15,424	16,914	23,694	41,079	78,006
North Pacific	Middle East	All Commodities	233	508	575	583	612	752	877	1,026	1,361	1,756	2,215
North Pacific	Mediterranean	All Commodities	2,096	3,438	5,081	5,071	5,034	5,307	4,585	3,990	3,169	2,793	2,801
North Pacific	North America	All Commodities	1,462	1,064	524	518	525	687	826	956	1,217	1,468	1,729
North Pacific	NE Asia	All Commodities	1,058,217	714,909	761,006	793,587	809,095	872,390	900,212	962,671	1,121,055	1,377,145	1,768,012
North Pacific	North Europe	All Commodities	13,511	14,212	11,841	12,298	12,340	12,767	13,351	14,166	16,341	19,520	24,174
North Pacific	Oceania	All Commodities	21,227	16,161	20,006	21,624	21,054	22,362	24,965	28,225	36,235	46,841	59,640
North Pacific	Europe, Other	All Commodities	54	16	16	15	15	17	18	20	23	27	31
North Pacific	SE Asia	All Commodities	155,924	99,065	112,641	118,729	125,235	164,868	198,338	239,825	371,035	623,837	1,134,481
North Pacific	West Coast S America	All Commodities	9,258	5,837	7,320	7,446	7,674	8,956	10,142	12,081	21,611	52,213	126,429
Alaska	World	All Commodities	75,591	57,116	102,929	105,290	106,233	117,333	125,082	136,293	179,920	298,492	570,378
Alaska	Percent Change	All Commodities	NA	-5.45%	21.69%	2.29%	0.90%	2.01%	1.29%	1.73%	2.82%	5.19%	6.69%
Alaska	Africa	All Commodities	51	81	79	82	85	110	137	173	353	955	2,463
Alaska	Central America	All Commodities	621	599	746	795	849	1,215	1,804	2,893	9,913	34,258	93,377
Alaska	East Coast S America	All Commodities	1,421	1,543	826	911	948	1,227	1,481	1,671	2,082	2,588	3,362
Alaska	Eastern Europe	All Commodities	189	214	953	1,009	1,092	1,416	1,490	1,661	2,323	3,547	5,733
Alaska	India	All Commodities	90	91	129	119	130	228	423	844	3,948	16,268	49,563
Alaska	Middle East	All Commodities	46	100	104	107	113	150	183	215	290	382	492
Alaska	Mediterranean	All Commodities	114	1,262	1,730	1,732	1,736	1,846	1,628	1,450	1,185	1,074	1,100
Alaska	North America	All Commodities	3	2	3	3	3	4	4	5	5	6	7
Alaska	NE Asia	All Commodities	68,383	46,400	68,416	70,160	71,196	77,163	81,209	86,173	97,998	117,017	147,515
Alaska	North Europe	All Commodities	2,549	4,623	25,777	25,890	25,285	27,237	27,805	28,816	31,555	35,275	40,173
Alaska	Oceania	All Commodities	319	401	438	454	461	527	581	635	784	981	1,236
Alaska	Europe, Other	All Commodities	8	13	13	12	12	14	15	17	20	23	26
Alaska	SE Asia	All Commodities	1,292	1,132	3,076	3,327	3,595	5,141	6,711	9,066	19,769	51,060	126,277
Alaska	West Coast S America	All Commodities	505	656	638	687	728	1,055	1,609	2,675	9,694	35,059	99,053

Origin	Destination	Produt Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
Hawaii	World	All Commodities	16,760	25,304	222,690	223,368	229,475	257,045	285,287	327,528	469,320	773,187	1,422,637
Hawaii	Percent Change	All Commodities	NA	8.59%	106.46%	0.30%	2.73%	2.30%	2.11%	2.80%	3.66%	5.12%	6.29%
Hawaii	Africa	All Commodities	51	81	79	82	85	110	137	173	353	955	2,463
Hawaii	Central America	All Commodities	669	599	842	893	948	1,319	1,914	3,008	10,039	34,395	93,521
Hawaii	East Coast S America	All Commodities	1,421	1,543	826	911	948	1,227	1,481	1,671	2,082	2,588	3,362
Hawaii	Eastern Europe	All Commodities	123	130	179	187	201	268	329	412	744	1,576	3,377
Hawaii	India	All Commodities	73	670	1,517	1,475	1,457	1,451	1,553	1,897	4,920	17,321	50,819
Hawaii	Middle East	All Commodities	46	100	104	107	113	150	183	215	290	382	492
Hawaii	Mediterranean	All Commodities	114	159	247	264	287	337	388	444	572	720	896
Hawaii	North America	All Commodities	1	2	1	1	1	2	2	2	2	3	4
Hawaii	NE Asia	All Commodities	7,771	11,070	206,253	206,724	212,652	238,884	264,681	301,852	414,688	621,768	1,031,829
Hawaii	North Europe	All Commodities	2,069	2,383	2,486	2,488	2,546	2,882	3,109	3,401	4,187	5,295	6,914
Hawaii	Oceania	All Commodities	380	415	481	500	507	579	637	695	849	1,051	1,311
Hawaii	Europe, Other	All Commodities	8	13	13	12	12	14	15	17	20	23	26
Hawaii	SE Asia	All Commodities	3,529	7,483	8,992	9,003	8,956	8,732	9,207	11,022	20,825	51,987	128,493
Hawaii	West Coast S America	All Commodities	505	656	671	721	762	1,092	1,650	2,720	9,747	35,124	99,129

Table A-12. TEUs of Exports from US South Atlantic Coast Ports and Other Coasts, by World Trade Route, for Commodity Groups: 1995 - 2050 (selected years)

Origin	Destination	Produt Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	Agriculture	638,794	469,667	574,275	622,188	626,471	693,063	739,497	792,104	912,470	1,068,908	1,283,122
Savannah	World	Agriculture	8,143	14,473	50,157	55,870	56,421	57,122	58,579	60,875	66,201	72,762	80,016
Charleston	World	Agriculture	18,490	15,149	24,115	25,717	25,708	28,289	31,033	33,980	41,696	52,409	66,457
Jacksonville	World	Agriculture	12,152	3,570	652	684	688	720	715	734	739	756	782
Miami	World	Agriculture	14,165	5,894	24,363	25,216	24,442	22,230	21,273	20,912	20,796	21,596	22,793
Wilmington	World	Agriculture	2,909	738	1,545	1,669	1,710	2,024	2,231	2,446	2,939	3,585	4,430
Norfolk	World	Agriculture	26,225	43,364	41,597	43,660	43,782	44,950	45,997	47,552	50,346	53,269	56,217
Other N Atlantic	World	Agriculture	56,700	39,165	40,848	42,756	42,882	45,935	47,937	50,769	56,026	62,201	69,200
Gulf Coast	World	Agriculture	41,216	62,618	84,411	87,306	86,819	94,506	100,352	106,302	118,743	133,551	150,004
South Pacific	World	Agriculture	195,455	137,794	173,608	195,525	197,755	229,027	249,421	271,726	321,438	389,719	479,436
North Pacific	World	Agriculture	259,697	134,811	126,462	137,111	139,799	161,428	175,003	189,675	225,912	270,700	344,114
Alaska	World	Agriculture	965	517	587	633	638	722	775	837	977	1,172	1,443
Hawaii	World	Agriculture	98	43	130	134	130	139	142	146	158	177	206
USA	World	Extractive	149,418	130,851	143,155	150,972	153,850	164,481	171,485	181,045	206,492	240,235	287,692
Savannah	World	Extractive	0	0	0	0	0	1	1	1	1	1	1
Charleston	World	Extractive	13,325	30,451	13,121	13,420	13,683	14,288	14,477	14,860	16,000	17,409	19,106
Jacksonville	World	Extractive	2,535	659	4,299	4,343	4,357	4,277	4,018	3,701	3,052	2,416	1,880
Miami	World	Extractive	2,141	1,533	4,423	4,501	4,566	4,691	4,552	4,285	3,735	3,170	2,692
Wilmington	World	Extractive	233	99	127	131	131	128	121	114	100	85	73
Norfolk	World	Extractive	3,455	3,072	3,971	4,071	4,158	4,540	4,785	4,912	5,091	5,286	5,682
Other N Atlantic	World	Extractive	21,298	11,172	32,796	35,714	37,041	44,703	52,194	61,837	86,400	118,769	161,672
Gulf Coast	World	Extractive	10,569	11,944	14,575	14,996	15,554	17,952	20,187	22,271	26,270	30,348	35,546
South Pacific	World	Extractive	62,762	46,379	44,633	46,063	46,255	45,610	43,899	42,478	40,000	37,767	36,359
North Pacific	World	Extractive	32,095	24,292	22,963	25,400	25,734	25,933	24,986	24,381	23,742	22,982	22,752
Alaska	World	Extractive	154	0	197	202	201	192	180	170	150	130	115
Hawaii	World	Extractive	545	560	1,202	1,267	1,297	1,323	1,260	1,221	1,151	1,076	1,013
USA	World	Food	1,042,016	991,244	1,246,333	1,301,669	1,354,581	1,643,036	1,774,612	1,930,132	2,263,554	2,638,765	2,985,594
Savannah	World	Food	13,166	25,240	36,819	37,718	38,222	42,399	42,006	43,391	47,616	53,487	58,764
Charleston	World	Food	35,397	42,220	34,027	35,236	35,560	40,263	41,199	43,990	50,732	58,738	62,900
Jacksonville	World	Food	18,654	7,942	8,276	8,696	9,064	12,014	13,598	15,682	20,844	26,974	33,882
Miami	World	Food	25,940	23,215	25,239	26,924	28,414	38,920	44,852	51,389	66,357	83,505	102,231
Wilmington	World	Food	6,055	3,001	2,005	2,061	2,098	2,317	2,439	2,571	2,820	3,089	3,310
Norfolk	World	Food	84,714	70,116	67,315	69,178	70,445	78,276	79,562	83,980	96,787	113,625	130,834
Other N Atlantic	World	Food	52,642	38,376	45,582	47,348	48,728	57,957	62,308	67,896	80,889	95,769	110,403
Gulf Coast	World	Food	43,379	48,631	248,726	267,706	284,829	384,652	434,763	483,815	589,217	701,765	815,420
South Pacific	World	Food	334,264	342,860	321,212	330,538	337,494	380,541	404,897	431,820	485,444	543,022	596,381
North Pacific	World	Food	361,358	334,956	358,617	375,956	398,986	496,400	536,299	588,596	697,102	822,723	926,026
Alaska	World	Food	64,005	47,075	90,597	92,345	92,722	100,431	103,794	108,018	116,536	126,450	135,366
Hawaii	World	Food	1,069	3,160	3,516	3,610	3,674	4,040	4,246	4,478	4,922	5,402	5,803

Origin	Destination	Produt Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	Materials	1,429,033	1,260,944	1,812,279	1,846,752	1,803,011	1,599,091	1,483,824	1,486,205	1,542,776	1,701,377	1,977,632
Savannah	World	Materials	121,685	119,191	170,640	177,480	174,846	155,395	147,818	154,497	174,018	201,752	232,254
Charleston	World	Materials	119,265	123,011	132,636	136,902	135,767	120,467	114,051	117,030	127,108	142,592	161,186
Jacksonville	World	Materials	32,154	23,305	17,720	17,821	17,455	16,327	15,658	15,206	14,889	14,824	14,832
Miami	World	Materials	42,584	46,506	78,777	86,870	89,534	100,999	112,977	127,008	161,133	205,398	262,333
Wilmington	World	Materials	15,670	5,519	4,832	4,993	4,946	4,157	3,744	3,638	3,545	3,611	3,806
Norfolk	World	Materials	78,859	72,155	107,283	107,397	105,595	97,355	93,091	93,448	99,374	129,385	210,192
Other N Atlantic	World	Materials	228,957	206,256	345,686	347,317	337,035	290,736	263,037	256,990	246,962	248,220	260,973
Gulf Coast	World	Materials	79,405	97,726	115,200	123,510	125,904	129,174	136,020	147,221	176,483	216,773	270,852
South Pacific	World	Materials	342,821	334,600	554,830	555,280	534,032	451,719	392,797	370,363	337,520	326,473	335,409
North Pacific	World	Materials	360,515	219,340	268,955	273,559	262,727	219,933	193,265	189,827	191,175	201,496	213,995
Alaska	World	Materials	1,008	0	1,141	1,141	1,093	909	774	718	628	581	574
Hawaii	World	Materials	5,421	11,418	10,697	10,490	10,141	8,569	7,566	7,320	7,074	7,331	8,089
USA	World	Consumer Goods	231,760	240,034	227,623	238,059	246,456	284,595	329,804	396,261	660,827	1,333,529	2,808,417
Savannah	World	Consumer Goods	6,775	4,954	8,845	9,296	9,654	10,879	12,320	14,564	22,245	37,092	63,865
Charleston	World	Consumer Goods	14,824	13,514	11,698	12,306	12,712	14,062	15,579	18,090	27,958	48,183	79,740
Jacksonville	World	Consumer Goods	4,460	1,141	730	781	799	913	994	1,061	1,204	1,371	1,551
Miami	World	Consumer Goods	45,343	70,717	40,898	41,467	41,918	43,531	44,400	45,543	48,221	52,059	56,956
Wilmington	World	Consumer Goods	1,155	214	100	108	115	144	187	251	519	1,192	2,658
Norfolk	World	Consumer Goods	13,131	11,928	11,733	12,268	12,689	14,447	16,517	19,550	32,200	62,805	122,288
Other N Atlantic	World	Consumer Goods	47,089	36,835	47,791	50,372	52,359	62,093	73,198	88,971	156,328	342,853	767,411
Gulf Coast	World	Consumer Goods	8,415	30,964	39,826	40,772	41,300	45,830	49,044	54,298	67,425	92,606	139,627
South Pacific	World	Consumer Goods	71,594	56,998	53,846	57,541	60,868	75,438	95,429	124,349	243,306	545,940	1,209,791
North Pacific	World	Consumer Goods	17,790	10,981	10,195	11,044	11,828	14,938	19,632	26,687	57,126	142,374	352,325
Alaska	World	Consumer Goods	71	0	38	41	43	44	47	54	77	120	193
Hawaii	World	Consumer Goods	59	56	25	27	29	39	54	77	193	519	1,255
USA	World	Chemicals	881,671	961,647	1,174,347	1,189,947	1,209,024	1,374,897	1,559,789	1,806,386	2,660,967	4,493,315	8,164,072
Savannah	World	Chemicals	29,183	31,874	45,347	45,558	46,232	51,292	56,931	64,482	88,575	133,253	208,800
Charleston	World	Chemicals	70,927	79,218	76,308	77,112	77,433	88,111	100,228	116,416	181,144	328,944	618,713
Jacksonville	World	Chemicals	15,133	7,074	13,582	13,919	14,042	15,229	16,546	18,019	22,343	28,941	38,262
Miami	World	Chemicals	12,514	11,096	9,746	9,896	9,885	10,188	10,735	11,632	15,686	23,876	36,868
Wilmington	World	Chemicals	2,136	2,484	834	836	860	969	1,078	1,236	1,736	2,754	4,808
Norfolk	World	Chemicals	49,653	60,653	58,249	58,709	59,078	69,593	81,356	95,939	144,340	241,563	422,494
Other N Atlantic	World	Chemicals	95,562	104,527	142,056	144,040	145,947	163,345	183,632	211,147	312,612	544,638	1,019,890
Gulf Coast	World	Chemicals	184,039	304,739	297,945	304,487	305,438	351,817	404,371	470,267	702,639	1,197,147	2,129,490
South Pacific	World	Chemicals	314,867	280,562	234,540	237,412	243,580	275,749	314,262	370,899	576,529	1,064,938	2,148,537
North Pacific	World	Chemicals	105,045	73,646	88,652	90,757	93,697	109,926	126,699	146,386	206,759	320,574	537,752
Alaska	World	Chemicals	445	0	503	503	518	583	646	736	1,008	1,505	2,488
Hawaii	World	Chemicals	485	124	197,256	197,416	203,193	228,517	253,234	288,645	395,526	590,670	977,159

Origin	Destination	Produt Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	High Technology	131,020	126,769	128,256	135,369	142,824	186,113	241,363	327,237	751,563	2,031,388	5,059,358
Savannah	World	High Technology	10,007	10,246	10,366	10,961	11,582	15,226	19,921	27,305	64,839	182,497	469,632
Charleston	World	High Technology	10,640	9,713	9,827	10,372	10,940	14,253	18,478	25,039	57,561	156,119	389,719
Jacksonville	World	High Technology	8,809	9,808	9,923	10,452	11,004	14,195	18,225	24,397	53,733	137,314	325,205
Miami	World	High Technology	11,546	9,237	9,345	9,854	10,384	13,460	17,368	23,406	52,824	140,200	344,755
Wilmington	World	High Technology	16,832	9,113	9,220	9,745	10,301	13,527	17,676	24,197	57,255	160,185	409,821
Norfolk	World	High Technology	9,984	9,798	9,913	10,471	11,055	14,454	18,811	25,594	59,053	159,534	396,357
Other N Atlantic	World	High Technology	9,841	10,006	10,123	10,659	11,215	14,408	18,406	24,462	52,709	131,984	309,471
Gulf Coast	World	High Technology	7,408	11,427	11,561	12,176	12,815	16,505	21,169	28,295	62,046	157,988	373,949
South Pacific	World	High Technology	8,587	8,380	8,478	8,960	9,472	12,439	16,254	22,250	52,648	147,296	376,847
North Pacific	World	High Technology	11,709	10,475	10,597	11,171	11,767	15,240	19,644	26,440	59,414	156,125	378,895
Alaska	World	High Technology	8,553	9,522	9,634	10,182	10,763	14,135	18,470	25,284	59,827	167,382	428,236
Hawaii	World	High Technology	8,553	9,522	9,634	10,182	10,763	14,135	18,470	25,284	59,827	167,382	428,236
USA	World	Intermed. Manufact.	510,513	397,994	499,967	521,437	542,934	663,217	811,573	967,626	1,464,202	2,457,037	4,358,533
Savannah	World	Intermed. Manufact.	13,082	19,733	27,229	28,397	29,363	35,270	42,603	49,776	71,669	110,220	178,519
Charleston	World	Intermed. Manufact.	35,085	38,794	40,504	41,965	43,220	51,120	59,485	67,578	94,119	150,786	255,533
Jacksonville	World	Intermed. Manufact.	12,482	4,081	5,282	5,466	5,536	5,968	6,361	6,674	7,327	8,025	8,778
Miami	World	Intermed. Manufact.	46,020	27,835	27,667	29,113	30,234	37,036	46,523	59,061	108,537	216,456	404,059
Wilmington	World	Intermed. Manufact.	5,931	253	407	426	446	547	676	809	1,194	1,848	2,972
Norfolk	World	Intermed. Manufact.	23,875	25,412	26,928	27,787	28,489	32,938	37,869	42,812	59,645	99,176	186,027
Other N Atlantic	World	Intermed. Manufact.	87,291	84,871	109,184	113,405	116,951	140,188	169,490	203,106	322,703	602,892	1,215,028
Gulf Coast	World	Intermed. Manufact.	64,163	41,728	57,335	60,154	62,373	77,147	95,568	114,596	178,349	307,807	544,411
South Pacific	World	Intermed. Manufact.	135,502	121,434	164,622	172,080	181,400	226,743	282,551	338,176	492,605	753,259	1,210,414
North Pacific	World	Intermed. Manufact.	78,638	29,057	34,467	36,067	37,823	47,140	59,080	71,675	110,273	183,066	321,178
Alaska	World	Intermed. Manufact.	222	0	232	242	254	317	395	476	715	1,150	1,956
Hawaii	World	Intermed. Manufact.	134	1	8	8	8	10	13	16	24	38	65
USA	World	Capital Equipment	412,217	355,810	385,552	407,209	421,051	493,555	568,243	649,667	889,237	1,298,580	2,015,201
Savannah	World	Capital Equipment	19,056	19,159	21,217	22,503	23,021	26,553	30,493	34,937	47,415	68,196	105,521
Charleston	World	Capital Equipment	39,892	34,765	35,067	37,146	38,973	45,405	51,118	57,071	73,961	101,171	145,868
Jacksonville	World	Capital Equipment	8,254	5,187	6,085	6,215	6,247	6,478	6,599	6,730	7,514	9,796	14,793
Miami	World	Capital Equipment	61,341	41,297	36,921	38,379	38,960	43,127	46,367	49,009	56,033	65,685	78,113
Wilmington	World	Capital Equipment	2,375	796	450	471	492	610	739	884	1,307	2,036	3,325
Norfolk	World	Capital Equipment	40,896	34,651	36,838	38,462	39,394	45,346	51,373	57,653	75,652	105,885	156,734
Other N Atlantic	World	Capital Equipment	75,837	68,207	95,585	101,486	105,144	123,930	141,730	159,981	211,068	292,760	424,126
Gulf Coast	World	Capital Equipment	39,559	45,710	49,637	52,859	54,608	63,499	71,297	79,089	102,852	142,589	203,616
South Pacific	World	Capital Equipment	89,186	76,421	73,564	77,657	80,745	97,796	119,107	144,848	224,007	368,135	641,990
North Pacific	World	Capital Equipment	34,556	25,126	25,426	27,193	28,614	35,802	44,265	54,156	83,588	135,475	232,359
Alaska	World	Capital Equipment	30	0	0	0	0	0	0	1	1	1	2
Hawaii	World	Capital Equipment	223	114	97	103	103	117	135	154	212	304	462

Origin	Destination	Produt Group	1995	2000	2003	2004	2005	2010	2015	2020	2030	2040	2050
USA	World	Motor Vehicles	290,969	287,727	361,117	379,599	390,721	490,224	566,239	649,484	933,536	1,627,715	3,178,008
Savannah	World	Motor Vehicles	6,821	15,567	17,741	18,846	19,649	26,311	32,183	38,320	55,160	86,312	145,996
Charleston	World	Motor Vehicles	6,832	27,442	49,714	53,188	55,304	89,659	122,335	154,245	225,639	307,924	397,061
Jacksonville	World	Motor Vehicles	9,935	22,541	27,720	29,351	30,107	36,062	39,594	43,286	49,867	55,581	61,027
Miami	World	Motor Vehicles	39,254	21,545	21,262	22,845	23,404	29,705	34,601	39,649	51,670	66,042	81,961
Wilmington	World	Motor Vehicles	799	81	38	41	44	56	65	77	104	135	172
Norfolk	World	Motor Vehicles	37,242	22,448	16,436	16,734	16,744	17,855	17,698	17,437	18,299	22,906	33,933
Other N Atlantic	World	Motor Vehicles	65,629	63,912	82,542	84,881	86,128	98,868	99,177	99,292	108,662	146,888	236,399
Gulf Coast	World	Motor Vehicles	7,478	12,520	18,390	19,511	19,545	22,458	24,250	25,177	27,521	33,201	46,790
South Pacific	World	Motor Vehicles	85,549	78,229	93,486	98,999	103,096	126,876	148,212	179,149	326,368	787,971	1,931,181
North Pacific	World	Motor Vehicles	29,924	19,314	28,474	29,773	31,144	35,429	40,418	44,632	60,980	109,936	229,924
Alaska	World	Motor Vehicles	138	0	0	0	0	0	0	0	1	2	5
Hawaii	World	Motor Vehicles	173	305	125	130	136	156	167	185	233	288	349

Appendix B

TRADE AND PORT MODEL REGION CONCORDANCES

Appendix B. Trade and Port Model Region Concordances

Trade Model Maritime Groups (Regions)	Port Model Maritime Groups (Regions)	Trade Model Export Regions	Port Model Regions	Short Code for Port Model Regions
AR	AR	ARG	ECSA	ECSA
AT	AT	ONEU	Other Europe	OEUR
AU	AU	ANZ	Oceania	OC
BE	BE	ONEU	Northern Europe	NEUR
BG	BG	EEUR	Eastern Europe	EE
BO	BO	WLAT	ECSA	ECSA
BR	BR	BRA	ECSA	ECSA
CA	CA	CANA	North America	NAM
CB	CB	CAM	Caribbean	CAM
CIS	CIS	RUUA	Eastern Europe	EE
CL	CL	WLAT	WCSA	WCSA
CN	CN	CNHK	Northeast Asia	NEA
CO	CO	WLAT	WCSA	WCSA
CR	CR	CAM	Central America	CAM
CS	CS	EEUR	Eastern Europe	EE
DE	DE	GER	Northern Europe	NEUR
DK	DK	ONEU	Northern Europe	NEUR
EAF	EAF	EAFR	Africa	AF
EC	EC	WLAT	WCSA	WCSA
ES	ES	OSEU	Mediterranean	MED
FI	FI	SCAN	Northern Europe	NEUR
FR	FR	FRA	Northern Europe	NEUR
GR	GR	OSEU	Mediterranean	MED
HK	HK	CNHK	Northeast Asia	NEA
HU	HU	EEUR	Eastern Europe	EE
IA	IA	IND	India and Other Asia	India
ID	ID	SEAS	Southeast Asia	SEA
IE	IE	UKIR	Northern Europe	NEUR
IL	IL	ISR	MIDDLE EAST	MEA
IT	IT	ITA	Northern Europe	NEUR
JP	JP	JAPA	NE Asia	NEA
KR	KR	KORE	NE Asia	NEA
MED	MED	OMEA	Mediterranean	MED
MX	MX	MEXA	Central America	CAM
MY	MY	SEAS	Southeast Asia	SEA
NAF	NAF	NAFR	Africa	AF
NL	NL	ONEU	Northern Europe	NEUR
NW	NW	SCAN	Northern Europe	NEUR
NZ	NZ	ANZ	Oceania	OC
OCLA	OCLA	CAM	Central America	CAM
OELA	OELA	OELAT	ECSA	ECSA
OINS	OINS	OINS	India and Other Asia	India
OREG	OREG	OREG	Oceania	OC
OSAF	OSAF	OSAF	Africa	AF
OWE	OWE	EEUR	Eastern Europe	EE

Trade Model Maritime Groups (Regions)	Port Model Maritime Groups (Regions)	Trade Model Export Regions	Port Model Regions	Short Code for Port Model Regions
PA	PA	CAM	Central America	CAM
PE	PE	WLAT	WCSA	WCSA
PG	PG	OMEA	MIDDLE EAST	MEA
PH	PH	SEAS	Southeast Asia	SEA
PK	PK	OINS	India and Other Asia	India
PL	PL	EEUR	Eastern Europe	EE
PT	PT	OSEU	Mediterranean	Med
RO	RO	EEUR	Eastern Europe	EE
SE	SE	SCAN	Northern Europe	NEUR
SG	SG	SEAS	Southeast Asia	SEA
SZ	SZ	ONEU	Other Europe	OEUR
TH	TH	SEAS	Southeast Asia	SEA
TR	TR	MEDR	Mediterranean	MED
TW	TW	TAW	Northeast Asia	NEA
UK	UK	UKIR	Northern Europe	NEUR
USAK	USAK	USA	US Alaska	USAK
USGC	USGC	USA	US Gulf Coast	USGC
USGL	USGL	USA	US Great Lakes	USGL
USHI	USHI	USA	US Haiwaii	USHI
USNA	USNANF	USA	US North Atlantic Norfolk	USNANF
USNA	USNAO	USA	US North Atlantic Other	USNAO
USNP	USNP	USA	US North Pacific	USNP
USSA	USSAC	USA	US South Atlantic Charleston	USSAC
USSA	USSAJ	USA	US South Atlantic Jacksonville	USSAJ
USSA	USSAM	USA	US South Atlantic Miami	USSAM
USSA	USSAS	USA	US South Atlantic Savanah	USSAS
USSA	USSAW	USA	US South Atlantic Wilmington	USSAW
USSP	USSP	USA	US South Pacific	USSP
USGE	USGL	USA	US Gulf Coast	USGL
VE	VE	OELAT	East Coast South America	ECSA
VN	VN	SEAS	Southeast Asia	SEA
WAF	WAF	WAFF	Africa	AF
ZA	ZA	SAFR	Africa	AF
OTH	OTH	OREG	Other	OTH

Appendix C

TRADE AND PORT MODEL PRODUCT (COMMODITY) CONCORDANCES

Appendix C. Trade and Port Model Product (Commodity) Concordances

Commodity Code	Product (Commodity) Description	Aggregate Commodity Group	Port Model Major Aggregate Commodity Group	GPA Aggregate Group	GPA Aggregate Group Short Title	Port Model Major Aggregate Commodity Group Short Title
C1A	Grain	PRIMARY FOOD/BEVERAGE	AGRICULTURE	Food	food	agr
C1B	Oil Seeds	PRIMARY FOOD/BEVERAGE	AGRICULTURE	Food	food	agr
C1C	Veg. and Fruits - req Refrigeration	REFRIGERATED PRODUCTS	AGRICULTURE	Food	food	agr
C1D	Veg. and Fruits - non-Refrigerated	PRIMARY FOOD/BEVERAGE	AGRICULTURE	Food	food	agr
C1E	Cork and Wood	OTHER AGRICULTURE	AGRICULTURE	forest and paper	pap	agr
C1F	Natural Rubber	OTHER AGRICULTURE	AGRICULTURE	chemical	chem	agr
C1G	Cotton	OTHER AGRICULTURE	AGRICULTURE	textiles	tex	agr
C1H	Other Raw Textile Materials	OTHER AGRICULTURE	AGRICULTURE	textiles	tex	agr
C1I	Other Agriculture	OTHER AGRICULTURE	AGRICULTURE	textiles	tex	agr
C1J	Coffee	PRIMARY FOOD/BEVERAGE	AGRICULTURE	food	food	agr
C1K	Cut Flowers and Foliage, etc.	OTHER AGRICULTURE	AGRICULTURE	retail consumer	cons	agr
C2A	Stone, Clay and Other Crude Minerals	BULK ORES	EXTRACTIVE	clay	clay	ext
C2B	Crude Fertilizers	BULK ORES	EXTRACTIVE	clay	clay	ext
C2C	Ores	BULK ORES	EXTRACTIVE	mineral	min	ext
C2D	Coal and Coke	COAL	EXTRACTIVE	mineral	min	ext
C2E	Crude Petroleum	CRUDE PETROLEUM	EXTRACTIVE	chemical	chem	ext
C2F	Natural Gas	NATURAL GAS	EXTRACTIVE	chemical	chem	ext
C2G	Scrap	BULK ORES	EXTRACTIVE	metal and ore	ore	ext
C311A	Refrigerated Meat/Dairy/Fish	REFRIGERATED PRODUCTS	FOOD	food	food	food
C311B	Other Meat/Dairy/Fish/Fruit/Veg.	NONREFRIGERATED	FOOD	food	food	food
C311C	Sugar	NONREFRIGERATED	FOOD	food	food	food
C311D	Animal Feed	OTHER FOOD	FOOD	food	food	food
C311E	Animal and Vegetable Oils	OILS & FATS	FOOD	food	food	food
C311F	Other Food	PROCESSED	FOOD	food	food	food
C313	Beverages	BEVERAGES	FOOD	food	food	food
C314	Tobacco	TOBACCO	FOOD	retail consumer	cons	food
C321	Textiles	TEXTILES, APPAREL, FOOTWEAR	MATERIALS	textiles	tex	mat
C322	Wearing Apparel	TEXTILES, APPAREL, FOOTWEAR	CONSUMER	textiles	tex	cons
C323	Leather and Products	TEXTILES, APPAREL, FOOTWEAR	MATERIALS	Retail consumer	cons	mat
C324	Footwear	TEXTILES, APPAREL, FOOTWEAR	MATERIALS	retail consumer	cons	cons
C331	Wood Products	WOOD & PAPER	MATERIALS	forest and paper	pap	mat
C332	Furniture and Fixtures	CONSUMER	CONSUMER	retail consumer	cons	cons
C341A	Waste Paper	WOOD & PAPER	MATERIALS	forest and paper	pap	mat
C341B	Pulp	WOOD & PAPER	MATERIALS	forest and paper	pap	mat
C341C	Paper and Paperboard and Products	WOOD & PAPER	MATERIALS	forest and paper	pap	mat
C342	Printing and Publishing	CONSUMER	CONSUMER	retail consumer	cons	cons
C3511A	Organic Chemicals	INDUS.CHEM.	CHEMICALS	chemicals	chem	chem
C3511B	Inorganic Chemicals	INDUS.CHEM.	CHEMICALS	chemical	chem	chem
C3512	Fertilizers and Pesticides	INDUS.CHEM.	CHEMICALS	chemical	chem	chem
C3513	Synthetic Resins	INDUS.CHEM.	CHEMICALS	chemical	chem	chem
C3521	Paints, Varnishes and Lacquers	CONSUMER CHEMICALS	CHEMICALS	chemical	chem	chem
C3522	Drugs and Medicines	HIGH TECH	HIGHTECH	retail consumer	cons	htech
C3523	Soap and Cleaning Preparations	CONSUMER CHEMICALS	CONSUMER	retail consumer	cons	cons
C3529	Chemical Products, nec.	INDUS.CHEM.	CHEMICALS	chemical	chem	chem
C353	Petroleum Refineries	FUELS	FUELS	chemical	chem	chem

Commodity Code	Product (Commodity) Description	Aggregate Commodity Group	Port Model Major Aggregate Commodity Group	GPA Aggregate Group	GPA Aggregate Group Short Title	Port Model Major Aggregate Commodity Group Short Title
C354	Petroleum and Coal Products	FUELS	FUELS	chemical	chem	chem
C355	Rubber Products	INTERM. MATERIALS	INTER.MFG.	retail consumer	cons	intm
C356	Plastic Products, nec.	INTERM. MATERIALS	INTER.MFG.	retail consumer	cons	intm
C361	Pottery, China etc.	INTERM. MATERIALS	INTER.MFG.	mineral	min	intm
C362	Glass and Products	INTERM. MATERIALS	INTER.MFG.	mineral	min	intm
C369	Non-Metallic Products, nec.	INTERM. MATERIALS	INTER.MFG.	clay	clay	intm
C371	Iron and Steel	PRIMARY METALS	INTER.MFG.	iron & steel	stl	intm
C372	Non-Ferrous Metals	PRIMARY METALS	INTER.MFG.	metal and ore	ore	intm
C381	Metal Products	PRIMARY METALS	INTER.MFG.	metal and ore	ore	intm
C3821	Engines and Turbines	CAPITAL	CAPITALEQUIP.	Hardware,Appliances,Machinery&Auto Parts	cap	cap
C3822	Agricultural Machinery	CAPITAL	CAPITALEQUIP.	Hardware,Appliances,Machinery&Auto Parts	cap	cap
C3823	Metal and Wood Working Machinery	CAPITAL	CAPITALEQUIP.	Hardware,Appliances,Machinery&Auto Parts	cap	cap
C3824	Special Industrial Machinery	CAPITAL	CAPITALEQUIP.	Hardware,Appliances,Machinery&Auto Parts	cap	cap
C3825	Office and Computing Machinery	HIGH TECH	HIGHTECH	Hardware,Appliances,Machinery&Auto Parts	cap	htech
C3829	Machinery and Equipment, nec.	CAPITAL	CAPITALEQUIP.	Hardware,Appliances,Machinery&Auto Parts	cap	cap
C3831	Electrical Industrial Machinery	CAPITAL	CAPITALEQUIP.	Hardware,Appliances,Machinery&Auto Parts	cap	cap
C3832A	Radio and TV	HIGH TECH	HIGHTECH	Hardware,Appliances,Machinery&Auto Parts	cap	htech
C3832B	Semi-conductors, Electronic Tubes,etc	HIGH TECH	HIGHTECH	Hardware,Appliances,Machinery&Auto Parts	cap	htech
C3832C	Other Communications Equipment	HIGH TECH	HIGHTECH	Hardware,Appliances,Machinery&Auto Parts	cap	htech
C3833	Electrical Appliances and Houseware	CONSUMER	CONSUMER	Hardware,Appliances,Machinery&Auto Parts	cap	cap
C3839	Electrical Apparatus, nec.	CAPITAL	CAPITALEQUIP.	Hardware,Appliances,Machinery&Auto Parts	cap	cap
C3841	Shipbuilding and Repairing	TRANSPORT	CAPITALEQUIP.	Hardware,Appliances,Machinery&Auto Parts	cap	cap
C3842	Railroad Equipment	TRANSPORT	CAPITALEQUIP.	Hardware,Appliances,Machinery&Auto Parts	cap	cap
C3843	Motor Vehicles and Parts	MOTOR VEHICLES	CAPITALEQUIP.	Hardware,Appliances,Machinery&Auto Parts	auto	auto
C3843A	Motor Vehicles	MOTOR VEHICLES	CAPITALEQUIP.	Hardware,Appliances,Machinery&Auto Parts	auto	auto
C3843B	Parts of Motor Vehicles	MOTOR VEHICLES	CAPITALEQUIP.	Hardware,Appliances,Machinery&Auto Parts	auto	auto
C3844	Motorcycles and Bicycles	MOTOR VEHICLES	CAPITALEQUIP.	Hardware,Appliances,Machinery&Auto Parts	auto	auto
C3845	Aircraft	TRANSPORT	CAPITALEQUIP.	Hardware,Appliances,Machinery&Auto Parts	cap	cap
C3849	Transport Equipment, nec.	TRANSPORT	CAPITALEQUIP.	Hardware,Appliances,Machinery&Auto Parts	cap	cap
C3851	Professional Equipment	HIGH TECH	HIGHTECH	Hardware,Appliances,Machinery&Auto Parts	cap	htech
C3852	Photographic and Optical Goods	CONSUMER	CONSUMER	retail consumer	cons	cons
C3853	Watches and Clocks	CONSUMER	CONSUMER	retail consumer	cons	cons
C390	Other Manufacturing, nes.	CONSUMER	CONSUMER	retail consumer	cons	cons
C390A	Toys, Games and Sporting Goods	CONSUMER	CONSUMER	retail consumer	cons	cons
C390B	Jewelry	CONSUMER	CONSUMER	retail consumer	cons	cons
C390C	Misc. Manufacturing Goods	CONSUMER	CONSUMER	retail consumer	cons	cons

Appendix D

ADDENDUM TO FINAL REPORT

Savannah Harbor Expansion Project
Deep-Draft Channel Improvements
Economic Analysis: Commodity Projections
Part 3: South Atlantic Region Waterborne Trade Forecast
Part 4: Savannah Harbor Waterborne Trade Forecast
Final Report
Savannah District In-House Review

A draft report was submitted on August 12, 2004. The draft report was reviewed by Wesley Bushnell, and his comments were received on September 24 and responded to on September 29. Based on these responses and a non-response to GEC's October 22 request for other comments from the District, the Project Manager directed GEC in late October to submit a "Final Report." A Final Report was submitted on November 17. These comments were received from the District on November 24. A conference call to discuss these comments was held with the District on February 22, with Jeff Morris, Elizabeth Hilliard, and Alan Garrett (briefly) participating.

1. Statement and Basis of Concern: On Table 2: Port Characteristics, page 5, no data is included for Charleston under TEU Storage Capacity. It is important that this data is included since it provides input to "TEU Storage per Daily TEUs" calculations which is one of three separate measures of port effectiveness.

Specific Action Needed: Please include TEU Storage Capacity data for Charleston in Table 2.

Response: This will be added.

2. Statement and Basis of Concern: Also, but not as significant a concern as the prior comment, several cities including Charleston do not have data in the Post Panamax Cranes column.

Specific Action Needed: Please include this data for each city if it is readily available. Also, you're missing an "n" in Savanah.

Response: We will check this for Post Panamax cranes and add an "n" to "Savanah."

3. Statement and Basis of Concern: On page 5, Table 2: Port Characteristics, does not have a column for TEUs per Day. This data should be made transparent in Table 2 since it is an input to all three port effectiveness measures.

Specific Action Needed: Please include a column in Table 2 for TEUs per Day.

Response: We can add a column for average TEUs per day.

4. Statement and Basis of Concern: On page 6, Table 3. Port Effectiveness Measures in the "TEUs per Crane per Day" column does not appear to include Post Panamax cranes. If TEUs per day for Savannah equal 1,422 (203.24 TEUs per Day per Berth * 7 Berths), then 109.44 "TEUs per Crane per Day" equates to 13 "Ship-to-shore Cranes".

Specific Action Needed: If post-Panamax cranes are not included in the calculations for "TEUs per Crane per Day", then specify in title that post-Panamax are not included.

Response: A note should be added to Table 2 to indicate that the column "Ship to Shore Cranes" includes all cranes capable of working Panamax and Post-Panamax beam vessels.

5. Statement and Basis of Concern: On page 7, it is stated that "post-Panamax ship-to-shore cranes appears not to have a significiant impact on port shares". It would appear that Post Panamax cranes impact the ability of ports to handle larger vessels. On what basis was this statement made.

Specific Action Needed: Please provide more detail for the reason that post-Panamax ship-to-shore cranes do not (at this time) have a significant impact on port shares.

Response: There are no regularly scheduled Post-Panamax container vessels calling U.S. East Coast ports at this time. Consequently, although ports have striven to have the capability to work wide beam Post-Panamax vessels with larger (Post-Panamax) cranes, there has yet to be any regular Post-Panamax vessels calling that require these cranes. Therefore, at present there is no statistical or other relationship between the presence of Post-Panamax cranes and the absence of Post-Panamax vessels at U.S. East Coast ports.

6. Statement and Basis of Concern: A 10.6% TEU growth rate for 2005 appears high. This rate of growth in pre-base years may be seen as inflating benefits in the base year.

Specific Action Needed: Please explain in further detail the increase in growth rates for extractives and agriculture. Is the rate of growth due to reallocations of shipping bulk commodity exports from bulk/breakbulk to less expensive empty containers? Does this translate to real growth for the nation? How much of this growth rate is due to new growth? How much is due to transferring of cargo from one port to another? How much is due to change in origins and destinations?

Response: This is a compound average annual rate of growth for the period 2000 to 2005. It would include the actual (historical) volumes until 2003, then projections for 2004 and 2005. According to the detailed historical data in the appendix, Savannah Harbor volume of export TEUs increased from 260,437 (loaded) TEUs in 2000 to 388,361 (loaded) TEUs in 2003. The projected increases in exports after 2003 are relatively modest when compared to the actual reported volumes between 2000 and 2003. The data for the commodities up to and through 2003 is historical (actual) reported. Years 2004 and beyond are forecasted

7. Statement and Basis of Concern: In Table 19, metric tonnes of imports for trade of extractives between Savannah and Eastern Europe jumps from 4,691 in 1995 to 201,255 in 2000 to 265 in 2003. Table A-6

Specific Action Needed: Please explain this steep spike for extractive imports.

Response: There are several observed fluctuations in the commodity statistics reflected in the Customs District data that occur prior to the forecast period beginning with 2004. Some of these fluctuations may be attributable to conversions of actual data to abbreviated commodity groups, but the data is as reported by Customs. Some of the markets such as Eastern Europe and commodities such as extractives and agriculture have been noted to have been volatile with respect to supply (world region) and demand. For example the Customs District data shows large imports of clay from Eastern Europe in 1997 (287,831 tons), 1998 (176,274 tons), 1999 (295,377 tons) and 2000 (201,255 tons), which had declined to 46,868 tons in 2001, 262 tons in 2002 and 265 tons in 2003.

8. Statement and Basis of Concern: Reference page 6 Table 3, since Savannah leads Charleston in 2 of the 3 primary criteria i.e. TEU's per Day per Berth and TEU per Crane per Day, why then is it assumed throughout the report that Charleston will lead Savannah in its projected long term market share, as it seems more likely that in a competitive market profit seeking shippers would ultimately chose the most effective port?

Specific Action Needed: Please explain.

Response: Page 6 item 2 indicates that higher volumes per crane "should be negative to port share." Thus, one of these factors noted in statement 8 (TEUs per Day per Berth) is positive for Savannah Harbor, and one factor (TEUs per Crane per Day) is negative.

9. Statement and Basis of Concern: Reference page 6 last paragraph, "In today's environment, channel and port depth is not a reasonable measure for determining port share or potential port traffic." This statement conflicts with what many shipping companies such as MSC have stated. They have stated that they would be willing to send more vessels to Savannah if the port depth were deeper.

Specific Action Needed: Please explain.

Response: What is being said here is that among the principal container ports in a region, such as the South Atlantic, there are generally no major differences in channel depths. Consequently, most container lines have made port choice decisions on factors other than depth.

10. Statement and Basis of Concern: Reference page 11 regarding the port choice model, Savannah has, for almost all commodities listed, higher T-stats than Charleston. Why then in a competitive market should it be assumed that Charleston would be the long term chosen port with a slightly higher market share?

Specific Action Needed: Please explain.

Response: As noted in the teleconference, an earlier draft used the trade region of Northern Europe, for which Savannah Harbor has a much smaller market share than Charleston Harbor. The T-stats were correspondingly higher for Charleston and lower for Savannah. As an example of trade region commodity flows, we substituted the data for North East Asia, which is a very strong market for Savannah Harbor compared to Charleston Harbor. Correspondingly, the T-stats in this example (North East Asia) are quite high for Savannah Harbor; but this is not the case for all trade regions (as noted).

11. Statement and Basis of Concern: Reference page 11 regarding the port choice model, what is Durbin-Watson stat showing the amount of nonstationarity of the model and more importantly what is the F-stat showing the overall model fit?

Specific Action Needed: Please provide this information on Table 4. Coefficients Developed by the Post Choice Model.

Response: Nonstationarity is not particularly applicable to the relatively stable forecast time series.

12. Statement and Basis of Concern: General Comment – Why were part 3 (South Atlantic Region) and part 4 (Savannah Harbor) not separated into two separate headers in the report? In my opinion there should be a separate section and conclusion for each. The conclusion of the South Atlantic Region section should lead the reader into the narrative about the Savannah section.

Specific Action Needed: Please split the document into two sections: South Atlantic Region and Savannah Harbor.

Response: As discussed in the teleconference, originally we had a separate part 4 for Savannah Harbor that began with what is now section VI, Detailed Outputs for Savannah Harbor. Our technical editor was of the opinion that the discussion of Savannah Harbor in terms of commodity projections was not particular to only this section but occurred in the prior sections as well. Moreover, the methodology and data were common to both "parts" (South Atlantic Ports and Savannah Harbor), and a division into parts three and four would leave the methodology section contained in part three. Because of the methodological overlap between Outputs for South Atlantic Ports (including Savannah) and Outputs for Savannah Harbor, it was decided to include the latter as section VI and to distinguish each section with the expression "detailed" to indicate the respective emphases (South Atlantic Ports and Savannah).

The document can be "split," but a note will need to be included in part four referencing the discussion of shared methodology in part three.

13. Statement and Basis of Concern: General Comment regarding the appendices– There is no narrative for the reader that corresponds to the tables in the appendices.

Specific Action Needed: Please provide summary narrative about the appendices within the given appendix.

Response: A narrative summary can be provided that links the detailed appendices to more abbreviated tables in the text.

14. Statement and Basis of Concern: How does the port choice model relate to the pooled cross-section time-series model?

Specific Action Needed: Please explain.

Response: The "port choice model" attempts to explain the trends and projections for individual ports based on existing trends and long-term commodity forecasts for the nation. The pooled cross-section time-series model applies to existing countries and export regions to pick up long-term trends in the countries over time and longer-term shifts resulting from improving incomes and industrial bases as measured through the cross-sectional elements in the data set (refer to Final Report, Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections, Part 1, World Waterborne Trade Forecast).

15. Statement and Basis of Concern: Does the port choice model group commodities into respective price elasticities so that the impacts may be estimated appropriately?

Specific Action Needed: Please explain.

Response: No.

GENERAL RE-EVALUATION REPORT
APPENDIX A: ECONOMICS
SAVANNAH HARBOR EXPANSION PROJECT
Chatham County, Georgia and Jasper County, South Carolina

January 2012

ATTACHMENT 6
GEC Regional Port Analysis

US Army Corps
of Engineers
Savannah District
South Atlantic Division

Final Report

SAVANNAH HARBOR EXPANSION PROJECT

REGIONAL PORT ANALYSIS

US Army Corps of Engineers
Savannah District
Savannah, Georgia

Final Report

SAVANNAH HARBOR EXPANSION PROJECT

REGIONAL PORT ANALYSIS

Contract No. DACA-03-02-D-0003
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Prepared by

GEC
Gulf Engineers & Consultants
9357 Interline Avenue
Baton Rouge, Louisiana 70809
Phone – 225/612-3000

U.S. ARMY CORPS OF ENGINEERS
SAVANNAH DISTRICT
SAVANNAH, GEORGIA

July 2007

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

The Savannah Harbor Expansion Project (SHEP) Regional Port Analysis (RPA) is an attempt to develop a regional systems approach to assessing capacity and related environmental and institutional issues for the U. S. South Atlantic container ports, including Norfolk. The focus was to identify regional locations that should be improved rather than treat port capacity and expansion on a case-by-case basis. The regional port concept reflected a view that fewer ports might need to be developed and this would be less costly and more environmentally favorable.

A detailed scope of work envisioned extensive discussions with ports and shipping lines as well as with environmental interests in order to present a balanced view of this regional port concept. The scope included a port capacity analysis for the existing, proposed, and prospective marine container terminals in the South Atlantic (Jacksonville to Norfolk) region. The scope for the environmental survey would compile secondary information and evaluation of each port and site under consideration for improvement. Finally, the institutional analysis scope would identify any show stoppers affecting capacity expansion and development particular to each port and site.

Although the scope was ambitious, the execution was constrained by subsequent delays and developments that ultimately precluded contact with the ports and necessitated the exclusive use of existing secondary information about the general conditions in the vicinity of the ports. Consequently, much of the execution of the scope of the RPA has been desktop in orientation.

Although there are specific results for the capacity analysis, environmental issues survey, and institutional analysis, these are general findings rather than specific assessments of particular marine terminals and sites. From a capacity perspective, the existing and proposed facilities are described. In general, although there is abundant marine container port capacity at present among the major ports (Norfolk, Wilmington, Charleston, Savannah, and Jacksonville), continued rapid growth will necessitate expansion and/or new developments at multiple sites.

The environmental issues survey evaluated the following resources: geology and soils; air quality; water quality; sediment quality; Coastal Zone Management Act (CZMA) resources; noise environment; wetlands; wildlife resources (including invasive species, threatened and endangered species, unique or unusual habitats, and Essential Fish Habitat [EFH]); cultural resources; hazardous, toxic, and radioactive waste (HTRW); socioeconomic profile (including environmental justice); transportation; and recreation. Data on these environmental resources were collected for each Region of Interest from environmental agencies as well as through independent research of public information. The level of constraint posed by each environmental resource and anticipated degree of impact resulting from port expansion were assessed.

The institutional analysis of particular circumstances affecting capacity utilization and expansion at each port was also general in nature. It is noted that existing port capacity is affected by various practices among the parties who own, operate, and commercially utilize these facilities. Many of these practices have been inherited from a different set of perspectives similar to when public ports were often seen as an important contributor to local urban economies. The institutional emphasis on public ports is now shifting away from public ownership adjacent to urban areas toward private sector participation and more rural locations.

TABLE OF CONTENTS

TABLE OF CONTENTS

Section			Page
I	INTRODUCTION		1
	A.	Objectives	1
	B.	Execution	2
II	PORT CAPACITY ANALYSIS		3
	A.	Port Capacity Inputs	3
	B.	Port Demand Projections	5
	C.	Port Capacity Projections	6
	D.	Port Demand and Capacity Shifts	7
II	ENVIRONMENTAL ISSUES SURVEY		12
	A.	Environmental Resource Constraint Determinations	12
		1. Geology and Soils	12
		2. Air Quality	14
		3. Water Quality	14
		4. Sediment Quality	14
		5. Noise Environment	15
		6. Coastal Zone Management Act Resources	15
		7. Wetlands	16
		8. Wildlife Resources	16
	B.	Institutional Analysis	21

Appendix A: ROI LOCATION MAPS

Attachment 1: FIRST INTERIM REPORT (Revised September 2006)
SAVANNAH HARBOR EXPANSION PROJECT
REGIONAL PORT ANALYSIS, PORT CAPACITY ANALYSIS

Attachment 2: SECOND INTERIM REPORT (Revised March 8, 2007)
SAVANNAH HARBOR EXPANSION PROJECT
REGIONAL PORT ANALYSIS, ENVIRONMENTAL ISSUES SURVEY
INSTITUTIONAL ANALYSIS

LIST OF TABLES

Number		Page
1	Existing South Atlantic Marine Container Terminals -- Norfolk to Jacksonville	4
2	Developing/Proposed South Atlantic Marine Containers Terminals -- Norfolk to Jacksonville	4
3	Other Potential South Atlantic Marine Container Terminal Sites -- Norfolk to Jacksonville	5
4	Projected TEUs for South Atlantic Ports, 2005-2050 (000,000)	6
5	Estimated TEU Annual Capacity of South Atlantic Ports, Existing, Developing, and Other Terminals (000,000)	7
6	Estimated TEU Annual Capacity of Total South Atlantic Ports, Existing, Developing, and Other Terminals, Excluding One Port (000,000)	9
7	Estimated TEU Annual Capacity and Shifting Throughput Growth at South Atlantic Ports (000,000)	10
8	Estimated TEU Annual Capacity and Throughput Growth at South Atlantic Ports (000,000)	11
9	Constraint Determination and Anticipated Impact Levels for Regional Port Expansion ROIs	13

REGIONAL REPORT

REGIONAL PORT ANALYSIS: SUMMARY

I. INTRODUCTION

A. OBJECTIVES

The Savannah Harbor Expansion Project (SHEP) Regional Port Analysis (RPA) technical scope was designed to address public review comments and items of litigation interest resulting from the 1998 Feasibility Study by The Georgia Ports Authority (GPA). At that time, some project stakeholders expressed that there should be a study of allocating Federal improvement funds at one regional port in the South Atlantic range, rather than deepening several ports. They seemed to believe that this would make sense economically (since fewer funds would be expended) and environmentally (since the impact of dredging would only occur at one port rather than at several). The regional port concept was envisioned as a separate task in the overall economic analysis, with an approach that would likely require extensive discussion with port authorities and shipping lines, as well as with environmental interests, in order to present a balanced view of the concept. It was also presumed that it might also be necessary to include economic development specialists and other local government authorities in these discussions.

The RPA scope of work developed in 2004 identified five tasks as follows: (1) Port Capacity Analysis; (2) Port Infrastructure Survey; (3) Hub and Spoke Analysis; (4) Environmental Survey; and (5) Institutional Analysis.[1] The port capacity analysis would pertain to the various container ports and existing and developing marine container terminals in the South Atlantic (Jacksonville to Norfolk). The port infrastructure survey would be an inventory of port capacity inputs and the ability to increase throughput volumes of container traffic. The hub and spoke analysis would evaluate the feasibility of regional load center ports that would feed container traffic to other ports.

The RPA scope for the environmental survey would compile existing secondary information on environmental resources and would require evaluation for each port and related site under consideration for expansion or development. Also, landside potentials for intermodal operations would be inventoried and arrayed. Finally, an assessment would be made of the secondary environmental impacts.

The RPA included an institutional analysis component that would focus on other "critical factors" (in addition to the capacity analysis and the environmental survey) enabling or inhibiting a port to expand, including such things as legal authority, non-federal sponsorship, and community acceptance. The institutional analysis was intended to concentrate on "deal makers and breakers" for particular ports and sites, such as intermodal access, dredge disposal, and bridge clearances. It was also envisioned that the institutional analysis would address whether the states under consideration would be both able and willing to fund a regional port. Similarly, the institutional analysis presumed that the shipping industry would need to be persuaded that designation of regional port improvements would better serve their needs.

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[1] *Economic Analysis Work Plan Savannah Harbor Expansion Project Deep-Draft Channel Improvements, Final Report* (February 2004), prepared for the Savannah District, Corps of Engineers.

The scope of work for the RPA provided for three interim reports that would pertain to: (1) Port Capacity Analysis; (2) Environmental Issues Survey and Institutional Analysis; and (3) Summary Report.

B. EXECUTION

Data collection on marine container terminal infrastructure for the South Atlantic ports, including Norfolk, commenced through website searches in June 2005 in preparation for subsequent port site visits for confirming capacity inputs and documenting secondary data related to the survey of environmental resources. In preparation for meetings with the ports and site visits, letters were sent in late August 2005 from the Savannah District to the senior executives, including port directors, assistant directors, and executives related to operations, engineering and planning, etc., at adjacent public ports (Norfolk, Wilmington, Charleston, and Jacksonville) explaining the purpose of the RPA and advising that G.E.C., Inc. (GEC) would be contacting them concerning matters related to port capacity and expansion.

In September, all further work on the RPA was put on hold until further notice, with no outside contacts to be made pending Corps resolution of issues raised about the scope with regard to inclusion of ports other than Savannah Harbor. Late November communications were sent from the Savannah District Commander to the respective Commanders of districts covered by the RPA ports, including Norfolk, Wilmington, Charleston, and Jacksonville, requesting district assistance with the RPA in lieu of direct contact with the ports. The status of the execution of the moribund RPA was discussed at the Mobile District at a December 7 progress report meeting and presentation. As of late December 2005, there was still no closure on how to begin the execution of the RPA in terms of direct interaction with different Corps Districts and possible local port participation through districts to document the capacity and related environmental secondary information available or otherwise sought for these tasks.

At the request of the Savannah District, a description of the secondary information sought for the RPA tasks was prepared January 6, 2006. A January 10 conference call among the Corps resulted in agreement that the Planning Chiefs in the various districts would be the initial points of contact for any possible interaction with the ports. In a followup conference call on January 12, members of the GEC team for capacity analysis and the environmental survey were introduced to the district points of contact. The districts were requested to assist GEC to compile existing secondary data and perform port liaison to the extent that this was possible with the resources available. Subsequently, GEC met with the districts as follows: (1) Jacksonville – February 28; (2) Charleston – March 1; and (3) Wilmington – May 16. No meetings or communications were held with the public ports other than GPA on February 27. Some port capacity information other than website related was received (from the Jacksonville District). No further meetings or contacts were held with the districts related to port capacity information. The affected districts and ports have not received or reviewed the information in this report.

Based on initial port capacity assessments, a geographic Region of Interest (ROI) was defined for each port with regard to capacity expansion. This allowed the environmental survey to be initiated March 2006. A draft letter for the District to sign for GEC to send to Federal and state

agencies for secondary data collection was developed for District approval. The letter was reviewed, but no further action was taken pending response from the District. During April, GEC independently initiated environmental agency contacts and pursued related secondary data collection. Subsequently, the institutional analysis was initiated. Similar to the port capacity analysis and environmental survey, the institutional analysis was performed with no contacts with the public ports.

The First Interim Report, Port Capacity Analysis, was delivered July 2006. Internal Technical Review (ITR) comments were received on August 20, 2006, and responded to on September 20, 2006. The Second Interim Report, Environmental Issues Survey and Institutional Analysis, was delivered August 24 in two volumes. ITR comments on Volume II, Attachment containing the detailed environmental issues surveys were received November 1, 2006. An ITR conference call was held December 15, 2006. GEC formal responses to the ITR were submitted January 4, 2007. The second Interim Report was revised in response to the ITR comments and resubmitted on March 20, 2007.

The Third Interim Report, Summary, containing a summary of the previous two interim reports, was submitted May 10, 2007. ITR comments were received June 14 and responded to on June 25. This summary covers the major scope of the RPA with regard to analyses of South Atlantic (including Norfolk) container port capacity, environmental issues associated with container port capacity expansions, and institutional constraints and issues affecting container port capacity and related to expansion. The port capacity analysis, environmental issues survey, and institutional analysis are abstracted from the previous two interim reports in the following sections. Thereafter the next two sections will contain the full reports from capacity analysis and environmental issues survey and institutional analysis (Volume 1). An extensive appendix to the environmental issues survey will not be included in this Final Report but will remain available as resubmitted as a Second Interim Report, revised March 8, 2007.

II. PORT CAPACITY ANALYSIS

A. PORT CAPACITY INPUTS

A port capacity analysis was conducted as the first task of the RPA. Marine container terminal capacities were developed from secondary data for the major ports between Norfolk and Jacksonville, including Wilmington, Charleston, and Savannah. Marine container terminal capacity is expressed in millions of 20-foot equivalent units (TEUs) that can be moved through each terminal during a year. Marine terminal annual TEUs of capacity were developed for existing, developing, and prospective terminals at each port (tables 1, 2, and 3). The first two categories are reasonably robust based on current and planned facilities. The prospective terminals are more conceptual in nature and are not viewed as exhaustive of possible expansion capability at the different ports.

The structure of tables 1, 2 and 3 is similar in that the major physical elements that describe each port terminal are presented, including distance from sea buoy, a proxy for sailing time and other harbor related variables such as pilotage and tug assistance, number of container berths, berth

length, total terminal site space (acres), developed yard space for container storage (loads and empties) channel depth (MLLW) in feet, and rail accessibility to the container yard.

Table 1. Existing South Atlantic Marine Container Terminals – Norfolk to Jacksonville

Port/Terminal	Sea Buoy (miles)	Berth No.	Berth (feet)	Terminal (acres)	Container (storage acres)	Channel (feet)	Rail Access Container
Jacksonville							
Talleyrand	21	6	4800	173	47	38	ND
Blount Island	9	8	6600	754	167	40	ND
Total container storage					214		
Savannah							
Garden City	13	8	9693	1208	407	500x42	ND
Ocean Terminal	13	na	na	208	na	500x42	
Charleston							
Wando Welch	16.4	4	3800	na	194	400-600x45	No
North Charleston	15	3	3500	na	123	400-600x45	ND
Columbus Street	6	2	na	na	78	400-600x45	ND
Total container storage					456		
Wilmington							
Cape Fear River	26	na	6768	na	na	500x42	No
Norfolk							
Norfolk International		5	5730	811	na	50	ND
Portsmouth Marine		3	3540	219	46.8	50	ND
Newport News Marine		na	na	140	43	45	ND
Total build out					664		
Ports/Terminals							

Notes: Rail Access for containers "ND" = "near dock"; na = not available.

Source: G.E.C., Inc.

Table 2. Developing/Proposed South Atlantic Marine Containers Terminals – Norfolk to Jacksonville

Port/Terminal	Sea Buoy (miles)	Berth No.	Berth (feet)	Terminal (acres)	Container (storage acres)	Channel (feet)	Rail Access Container
Jacksonville							
Dames Point	12	2	2,400	158		40	No
Savannah							
Ocean Terminal						500x42	
Charleston							
Charleston Navy		3	3,510	238.7	201.4	400-600x45	No
Wilmington							
Norfolk							
Maersk-SeaLand			4,000	570	291	50	ND
Craney Island			8,400	580		50	ND
Ports/Terminals							

Notes: Rail Access for containers "ND" = "near dock."

Source: G.E.C., Inc.

Table 3. Other Potential South Atlantic Marine Container Terminal Sites – Norfolk to Jacksonville

Port/Terminal	Sea Buoy (miles)	Berth No.	Berth (feet)	Terminal (acres)	Container (storage acres)	Channel (feet)	Rail Access Container
Jacksonville							
Other	21			120		38	ND
Savannah							
Site 1	?				212	42	?
Site 2	?				200	42	?
Charleston							
Jasper County	7			1,776	?	42	?
Other						400-600x45	
Wilmington							
NCIP	9.5		4,000	600	?	42	?
Norfolk							
Other							
Ports/Terminals							

Notes: Rail Access for containers "ND" = "near dock," "?" indicates that rail near dock access unknown and/or non-existent at present but could be planned.

Source: G.E.C., Inc.

B. PORT DEMAND PROJECTIONS

The projected loaded containers for each port developed in 2004 for the period 2004 - 2050 were adjusted to reflect 2005 total reported TEUs of throughput, loaded and empty containers, at each port. The 2005 total TEU volumes were forecasted out to 2050 using the 2004 - 2050 projections of loaded containers (Table 4).[2]

Table 4 reports the import and export containers (loaded), empty containers and total containers for the ports. Savannah, Charleston and Norfolk, the major container ports based on total TEUs, are each near 2.0 million TEUs at the base year, 2005, and each will be nearly 2.5 million total TEUs by 2010. During the each of the three five year periods from 2005 through 2020 these major ports will each grow by a total TEU volume of about 0.5 million TEUs.

[2] The container projections for each port were based on South Atlantic Region Waterborne Trade Forecast and Savannah Harbor Waterborne Trade Forecast as contained in *Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections, Final Report* (November 2004).

Table 4. Projected TEUs for South Atlantic Ports, 2005-2050
(000,000)

Port		2003	2005	2010	2015	2020	2030	2040	2050
Jacksonville	Imports	39,632	207,389	285,008	360,091	453,996	722,891	1,093,184	1,540,227
	Exports	94,269	99,299	112,183	122,307	135,491	181,511	285,999	500,993
	Loaded	133,901	306,688	397,191	482,398	589,487	904,402	1,379,183	2,041,220
	Empty		470,630	609,512	740,267	904,601	1,387,856	2,116,434	3,132,367
	Total		**777,318**	1,006,703	1,222,665	1,494,088	2,292,258	3,495,617	5,173,587
Savannah	Imports	602,107	664,876	916,546	1,105,626	1,310,895	1,848,206	2,585,808	3,527,589
	Exports	388,361	408,991	420,447	442,855	488,149	637,739	945,571	1,543,369
	Loaded	990,468	1,073,867	1,336,993	1,548,481	1,799,044	2,485,945	3,531,379	5,070,958
	Empty		827,653	1,030,450	1,193,448	1,386,563	1,915,973	2,721,712	3,908,299
	Total		**1,901,520**	2,367,443	2,741,929	3,185,607	4,401,918	6,253,091	8,979,257
Charleston	Imports	756,533	766,376	1,053,532	1,282,451	1,522,373	2,125,422	2,917,229	3,905,324
	Exports	427,016	449,301	505,916	567,983	648,299	895,918	1,364,276	2,196,283
	Loaded	1,183,549	1,215,677	1,559,448	1,850,434	2,170,672	3,021,340	4,281,505	6,101,607
	Empty		770,909	988,908	1,173,434	1,376,509	1,915,952	2,715,072	3,869,271
	Total		**1,986,586**	2,548,356	3,023,868	3,547,181	4,937,292	6,996,577	9,970,878
Wilmington	Imports	45,717	92,810	139,503	182,438	230,356	357,183	533,105	770,210
	Exports	19,557	21,143	24,479	28,956	36,222	71,517	178,500	435,375
	Loaded	65,274	113,953	163,982	211,394	266,578	428,700	711,605	1,205,585
	Empty		34,831	50,123	64,615	81,483	131,037	217,510	368,500
	Total		**148,784**	214,105	276,009	348,061	559,737	929,115	1,574,085
Norfolk	Imports	631,842	747,670	986,995	1,137,987	1,297,150	1,719,736	2,294,811	3,028,714
	Exports	320,265	391,428	419,754	447,059	488,878	640,788	993,433	1,720,759
	Loaded	952,107	1,139,098	1,406,749	1,585,046	1,786,028	2,360,524	3,288,244	4,749,473
	Empty		842,857	1,040,901	1,172,829	1,321,542	1,746,631	2,433,083	3,514,295
	Total		**1,981,955**	2,447,650	2,757,875	3,107,570	4,107,155	5,721,327	8,263,768
Grand Total			6,796,163	8,584,257	10,022,346	11,682,507	16,298,359	23,395,726	33,961,576

Notes: Imports and Exports are loaded TEUs from SHEP Commodity Projections.
"Loaded" is the sum of Import and Export TEUs from SHEP Commodity Projections.
"Total" is the number of TEUs (loaded and empty) reported by American Association Port Authorities (May 8, 2006).
"Empty" is the difference between "Total" and "Loaded" TEUs.

Source: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (Final Report, November 2004).

C. PORT CAPACITY PROJECTIONS

The capacity at each port among the existing, developing, and proposed terminals was compared to current and projected annual throughput TEUs (Table 5). The results indicate that there is substantial current capacity (comparing 2005 TEUs with existing capacity), but demand is projected to grow significantly in the near term (2005 to 2020). For example, existing Savannah capacity is 2.652 million TEUs compared to 2005 throughput of 1.902 million TEUs. However, by 2010, the existing terminal capacity at most ports will be nearly fully utilized based on comparing projected 2010 TEUs with existing capacity. For example, 2010 projected TEUs for Savannah are 2.367 million compared to existing capacity of 2.652 million TEUs. Consequently, developing terminals coming on line will be needed to meet projected demand after 2010 at most ports.

Table 5. Estimated TEU Annual Capacity of South Atlantic Ports, Existing, Developing, and Other Terminals (000,000)

Ports	Terminals	TEUs	2005 TEUs	2010 TEUs	2015 TEUs	2020 TEUs	2030 TEUs	2040 TEUs	2050 TEUs
Jacksonville	Existing	1.178	0.777						
	Developing	0.900							
	Other								
	Total	2.078		1.007	1.223	1.494	2.292	3.496	5.174
Savannah	Existing	2.652	1.902						
	Developing	2.421							
	Other	3.300							
	Total	8.373		2.367	2.741	3.185	4.402	6.253	8.979
Charleston	Existing	2.646	1.987						
	Developing	1.430							
	Other	2.000							
	Total	6.076		2.548	3.023	3.547	4.937	6.997	9.971
Wilmington	Existing	0.500	0.149						
	Developing								
	Other	2.000							
	Total	2.500		0.214	0.276	0.348	0.560	0.929	1.574
Norfolk	Existing	3.200	1.982						
	Developing	4.660							
	Other								
	Total	7.860		2.448	2.758	3.108	4.107	5.721	8.264
Total	Existing	10.176	6.797						
	Developing	9.411							
	Other	7.300							
	Total	26.887		8.584	10.021	11.682	16.298	23.396	33.962

Source: G.E.C., Inc.

D. PORT DEMAND AND CAPACITY SHIFTS

A regional port concept that concentrates existing capacity and/or future growth in demand at a particular "port" in the region was examined by shifts in port throughput (Table 6) and shifts in growth of container volumes among adjacent ports (Table 7). The South Atlantic port region, including Norfolk, is dominated by three large container ports (Norfolk, Charleston, and Savannah). Shifts in port throughput for Jacksonville and Wilmington are relatively inconsequential to capacity utilization compared to Norfolk, Charleston, and Savannah. Similarly, shifts in future growth of container volume at Jacksonville and Wilmington can be more readily absorbed by existing and developing capacities at major ports compared to shifts of container volume growth away from the major ports.

In Table 6 the total existing capacity for all ports is 10.176 million TEUs compared to total throughput (2005) of 6.797 million TEUs. If Norfolk existing capacity was excluded (Total, ex Norfolk) the total existing capacity would be 6.976 million TEUs compared to total current throughput of 6.797 million TEUs. Similar results occur for excluding Charleston (Total, ex Charleston) and Savannah (Total, ex Savannah), suggesting that there are limited opportunities to

accommodate a load center port volume at one of the existing major ports without substantial new port capacity, tantamount to a new port at one or more locations for existing capacity and throughput.

A similar analysis with regard to shifting growth TEUs among the ports is contained in Table 7. For example, Jacksonville has 1.178 million TEUs of existing capacity and 0.777 million TEUs of current (2005) throughput. Shifting the growth TEUs projected for Savannah between 2005 and 2010, 0.465 million, to Jacksonville would result in a 2010 throughput of 1.472 million TEUs. Similarly, shifting Savannah growth TEUs to Charleston by 2010 would increase Charleston to 3.862 million TEUs requiring the use of nearly half of the developing capacity (1.430 million TEUs) projected to occur.

The analysis confirms that the major ports are growing rapidly relative to existing terminal capacities and in substantial volumes compared to the capability of planned marine container terminals. Such growth would not be able to be contained at one single load center port by concentrating new growth and capacity at one port. The sizes of the major ports, relative to throughput and projected growth, is such that future traffic could not be readily absorbed by one port in the region.

Table 8 compares the projected growth in TEUs at each port with existing, developing and other capacity, including total capacity. For example while Savannah has sufficient existing capacity (2.652 million TEUs) for current volumes (1.902 million TEUs) the growth in TEUs by 2010, 0.465 million, will increase total throughput to 2.367 million TEUs, thus necessitating new (developing) capacity to become available. Over a longer period of time the ports are even more stretched between growth TEUs and projected increases in total throughput as a result. For example, Charleston and Savannah together are projected to experience nearly one million TEU growth between 2005 and 2010 and nearly two million TEU growth between 2005 and 2015 (Table 8). This kind of very significant sustained growth relative to the thresholds of typical modern container port terminal capacities (about 1.0 million TEUs) suggests that all of the existing ports will be necessary to expand rather than creating a single hub port.[3] This kind of growth is indicative of multiple new Greenfield terminal sites at existing ports and terminals or Greenfield ports rather than employing a single load center hub port that would concentrate containers at existing terminals or accelerate the full utilization of developing terminals.

[3] For example the developing capacity at Charleston is based on a new container terminal on the Cooper River with a projected annual capacity of 1.430 million TEUs. The developing capacity at Savannah is based on two sites which would both have a total annual throughput capacity of about 2.421 million TEUs. These terminal capacities for multiple facilities and multiple ports appear to be required to accommodate the burgeoning container throughput demand for the region.

Table 6. Estimated TEU Annual Capacity of Total South Atlantic Ports, Existing, Developing, and Other Terminals, Excluding One Port (000,000)

Ports	Terminals	TEUs	2005 TEUs	2010 TEUs	2015 TEUs	2020 TEUs	2030 TEUs	2040 TEUs	2050 TEUs
	Capacity								
Total	Existing	10.176	6.797						
	Developing	9.411							
	Subtotal	**19.587**							
	Other	7.300							
	Total	26.887		8.584	10.021	11.682	16.298	23.396	33.962
Total, ex Norfolk	Existing	6.976	6.797						
	Developing	4.751							
	Subtotal	**11.727**							
	Other	7.300							
	Total	19.027		8.584	10.021	**11.682**	16.298	23.396	33.962
Total, ex Wilmington	Existing	9.676	6.797						
	Developing	9.411							
	Subtotal	**19.087**							
	Other	5.300							
	Total	24.387		8.584	10.021	11.682	**16.298**	23.396	33.962
Total, ex Charleston	Existing	7.530	6.797						
	Developing	7.981							
	Subtotal	**15.511**							
	Other	5.300							
	Total	20.811		8.584	10.021	11.682	**16.298**	23.396	33.962
Total, ex Savannah	Existing	7.524	6.797						
	Developing	6.990							
	Subtotal	**14.514**							
	Other	4.000							
	Total	18.514		8.584	10.021	**11.682**	16.298	23.396	33.962
Total, ex Jacksonville	Existing	8.998	6.797						
	Developing	8.511							
	Subtotal	**17.509**							
	Other	7.300							
	Total	24.809		8.584	10.021	11.682	**16.298**	23.396	33.962

Notes: Growth TEUs represent the difference between projected TEUs (2010 - 2050) and 2005 actual TEUs.
Bold entries for existing and developing capacity (subtotal) correspond to nearest projected throughput demand, 2010 to 2050, in bold.

Source: G.E.C., Inc.

Table 7. Estimated TEU Annual Capacity and Shifting Throughput Growth at South Atlantic Ports (000,000)

Ports	Terminals	TEUs	2005 TEUs	2010 TEUs	2015 TEUs	2020 TEUs	2030 TEUs	2040 TEUs	2050 TEUs
Jacksonville	Existing	1.178	0.777						
	Total	2.078		1.007	1.223	1.494	2.292	3.496	5.174
	Growth TEUs			0.230	0.446	0.717	1.515	2.719	4.397
Savannah	Existing	2.652	1.902						
	Total	8.373		2.367	2.741	3.185	4.402	6.253	8.979
	Growth TEUs			0.465	0.839	1.283	2.500	4.351	7.077
Charleston	Existing	2.646	1.987						
	Total	6.076		2.548	3.023	3.547	4.937	6.997	9.971
	Growth TEUs			0.561	1.036	1.560	2.950	5.010	7.984
Wilmington	Existing	0.500	0.149						
	Total	2.500		0.214	0.276	0.348	0.560	0.929	1.574
	Growth TEUs			0.065	0.127	0.199	0.411	0.780	1.425
Norfolk	Existing	3.200	1.982						
	Total	7.860		2.448	2.758	3.108	4.107	5.721	8.264
	Growth TEUs			0.466	0.776	1.126	2.125	3.739	6.282
Total	Existing	10.176	6.797						
	Total	26.887		8.584	10.021	11.682	16.298	23.396	33.962
	Growth TEUs			1.787	3.224	4.885	9.501	16.599	27.165

Notes: Growth TEUS represent the difference between projected TEUs (2010 - 2050) and 2005 actual TEUs.

Source: G.E.C., Inc.

Table 8. Estimated TEU Annual Capacity and Throughput Growth at South Atlantic Ports (000,000)

Ports	Terminals	TEUs	2005 TEUs	2010 TEUs	2015 TEUs	2020 TEUs	2030 TEUs	2040 TEUs	2050 TEUs
Jacksonville	Existing	1.178	0.777						
	Total	2.078		1.007	1.223	1.494	2.292	3.496	5.174
Add Savannah	Growth TEUs			0.465	0.839	1.283	2.500	4.351	7.077
Subtotal				1.472	2.062	2.777	4.792	7.847	12.251
Savannah	Existing	2.652	1.902						
	Total	8.373		2.367	2.741	3.185	4.402	6.253	8.979
Add Jacksonville	Growth TEUs			0.230	0.446	0.717	1.515	2.719	4.397
Subtotal				2.597	3.187	3.902	5.917	8.972	13.376
Savannah	Existing	2.652	1.902						
	Total	8.373		2.367	2.741	3.185	4.402	6.253	8.979
Add Charleston	Growth TEUs			0.561	1.036	1.56	2.95	5.01	7.984
Subtotal				2.928	3.777	4.745	7.352	11.263	16.963
Charleston	Existing	2.646	1.987						
	Total	6.076		2.548	3.023	3.547	4.937	6.997	9.971
Add Savannah	Growth TEUs			0.465	0.839	1.283	2.500	4.351	7.077
Subtotal				3.013	3.862	4.830	7.437	11.348	17.048
Charleston	Existing	2.646	1.987						
	Total	6.076		2.548	3.023	3.547	4.937	6.997	9.971
Add Wilmington	Growth TEUs			0.065	0.127	0.199	0.411	0.780	1.425
Subtotal				2.613	3.150	3.746	5.348	7.777	11.396
Wilmington	Existing	0.500	0.149						
	Total	2.500		0.214	0.276	0.348	0.560	0.929	1.574
Add Savannah	Growth TEUs			0.465	0.839	1.283	2.500	4.351	7.077
Subtotal				0.679	1.115	1.631	3.060	5.280	8.651
Wilmington	Existing	0.500	0.149						
	Total	2.500		0.214	0.276	0.348	0.560	0.929	1.574
Add Charleston	Growth TEUs			0.561	1.036	1.560	2.950	5.010	7.984
Subtotal				0.775	1.312	1.908	3.510	5.939	9.558
Wilmington	Existing	0.500	0.149						
	Total	2.500		0.214	0.276	0.348	0.560	0.929	1.574
Add Norfolk	Growth TEUs			1.787	3.224	4.885	9.501	16.599	27.165
Subtotal				2.001	3.500	5.233	10.061	17.528	28.739
Norfolk	Existing	3.200	1.982						
	Total	7.860		2.448	2.758	3.108	4.107	5.721	8.264
Add Wilmington	Growth TEUs			0.065	0.127	0.199	0.411	0.780	1.425
Subtotal				2.513	2.885	3.307	4.518	6.501	9.689
Total	Existing	10.176	6.797						
	Total	26.887		8.584	10.021	11.682	16.298	23.396	33.962

Notes: Growth TEUS represent the difference between projected TEUs (2010 - 2050) and 2005 actual TEUs.

Source: G.E.C., Inc.

III. ENVIRONMENTAL ISSUES SURVEY

An Environmental Issues Survey was the second task under the RPA. In March 2007 an Environmental Issues Survey was submitted in accordance with the February 2004 scope of work and superseding guidance provided by the Savannah and Mobile districts. The work plan envisioned selection of discrete expansion alternative sites and associated intermodal access points and hinterland corridors for each candidate site, site reconnaissance and primary data collection, and interviews with personnel at pertinent ports. Concern was raised by the Mobile District that an environmental survey of discrete sites prior to a full National Environmental Policy Act (NEPA) analysis would constitute a "pre-decisional" action. Consequently, new guidelines were issued specifying that the survey would evaluate environmental resources that could potentially be impacted during any planned port or deep-draft channel expansion. The survey utilized publicly available information, and no new data were collected. The survey and its findings were presented in the Second Interim Report submitted in March 2007.[4]

The July 2006 Multiport Analysis identified five ports as candidates for the proposed Regional Port: Jacksonville, Savannah, Charleston, Wilmington, and Hampton Roads (Norfolk). To prevent concerns over pre-decisional expansion site selection(s), a Region of Interest (ROI) was selected for each port that was broad in extent and generally included both coastal and inland areas (in the case of Charleston, two ROIs were selected). Location maps for each ROI are presented in Appendix A. The following environmental resources were identified for evaluation: geology and soils; air quality; water quality; sediment quality; Coastal Zone Management Act (CZMA) resources; noise environment; wetlands; wildlife resources (including invasive species, threatened and endangered species, unique or unusual habitats, and Essential Fish Habitat [EFH]); cultural resources; hazardous, toxic, and radioactive waste (HTRW); socioeconomic profile (including environmental justice); transportation; and recreation. Data on these environmental resources were collected for each ROI from environmental agencies as well as through independent research of public information. The level of constraint posed by each environmental resource and the anticipated degree of impact resulting from port expansion were assessed. These data are presented in the Second Interim Report submitted in March 2007 and summarized in Table 9. A synopsis of determinations by environmental resource is presented below.

A. ENVIRONMENTAL RESOURCE CONSTRAINT DETERMINATIONS

1. Geology and Soils

Potential primary impacts to geology or soils that could result from port expansion within the selected ROIs include loss of rare or unique geology features or prime or unique farmland soils resulting from construction of new port facilities and adjacent intermodal rail and surface road accesses and from dredging vessels during dredging operations. Potential secondary impacts to air quality resulting from potential port expansion activities within the ROIs include disturbance or degradation of these features from an increase in cargo vessel traffic and

[4] Savannah Harbor Expansion Project, Regional Port Analysis Environmental Issues Survey Institutional Analysis, Second Interim Report (revised March 8, 2007) Volume I and Volume II: Attachment.

Table 9. Constraint Determination and Anticipated Impact Levels for Regional Port Expansion ROIs

Parameter	Port Expansion Region of Interest																	
	Jacksonville			Savannah			Charleston						Wilmington			Norfolk		
							Berkeley-Charleston County			Jasper County								
	Constraint Determination	Anticipated Impact Level		Constraint Determination	Anticipated Impact Level		Constraint Determination	Anticipated Impact Level		Constraint Determination	Anticipated Impact Level		Constraint Determination	Anticipated Impact Level		Constraint Determination	Anticipated Impact Level	
		Primary	Secondary		Primary	Secondary		Primary	Secondary		Primary	Secondary		Primary	Secondary		Primary	Secondary
Geology and Soils	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Air Quality	M2	M1	M2	S	M1	S	M2	M1	M2	M1	M1	M2	M2	M1	M2	S	M1	S
Water Quality	M2	M1	M2	S	M1	S	M2	M1	M2	M2	M1	M2	S	M1	S	S	M1	S
Sediment Quality	M2	M1	M2	S	M1	S	M2	M1	M2	M2	M1	M2	M2	M1	M2	S	M1	S
Noise Environment	M2	M2	M2	M2	M2	M2	S	M2	S	N	N	N	M2	M2	M2	M2	M2	M2
Coastal Zone Management Act Resources	S	M2	M2	S	M2	M2	S	M2	M2	S	M2	M2	S	M2	M2	S	M2	M2
Wetlands	M2	M1	M2	M2	M1	M2	M2	M1	M2	M2	M1	M2	M2	M1	M2	M2	M1	M2
Wildlife Resources																		
Invasive Species	M2	M1	M2	M2	M1	M2	M2	M1	M2	M2	M1	M2	M2	M1	M2	M2	M1	M2
Natural Areas	M2	M2	M2	M1	M1	M1	M1	M1	M1	M1	M1	M1	S	M2	S	M1	M1	M1
Threatened and Endangered Species	S	S	S	S	S	S	S	S	S	S	M	S	S	S	S	S	S	S
Critical Habitat	S	S	S	N	N	N	N	N	N	N	N	N	S	M1	S	N	N	N
Unique or Unusual Habitats	M1	M1	M1	M1	M1	M1	M2	M2	M2	M2	M2	M2	M2	M2	M2	M1	M1	M1
Essential Fish Habitat	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Cultural Resources	M2	M1	M2	M1	M1	M2	M2	M1	M2	N	N	N	S	M1	S	S	S	S
Hazardous, Toxic, and Radioactive Waste	M2	M1	S	M1	M1	S	M1	M1	S	N	M1	S	M1	M1	S	S	S	S
Socioeconomic Profile	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Environmental Justice	M1	M1	N	M1	M1	N	M1	M1	N	M1	M1	N	M1	M1	N	M1	M1	N
Transportation	S	M1	S	S	M1	S	S	M1	S	S	M1	S	S	M1	S	S	M1	S
Recreation	M2	M1	M2	M1	M1	M1	M2	M1	M2	M1	M1	M1	S	M2	S	M1	M1	M1

Notes:
For Constraint Determination:
S = Substantial Constraint
M2 = Moderate Constraint
M1 = Minor Constraint
N = Not a Constraint at Present
For Anticipated Impact Level:
S = Substantial Adverse Impacts Anticipated
M2 = Moderate Adverse Impacts Anticipated
M1 = Minor Adverse Impacts Anticipated
N = No Appreciable Adverse Impacts Anticipated at Present

Source: G.E.C., Inc., 2006.

transportation vehicles at adjacent intermodal rail and surface road accesses. No rare or environmentally sensitive geologic features are present within any of the selected ROIs. No prime or unique farmland soils are present within the ROIs. Geology and soils are not believed to constitute a constraint to port expansion within any ROI. No appreciable primary or secondary impacts are anticipated to this resource as a result of port expansion activities or consequences.

2. Air Quality

Potential primary impacts to air quality that could result from port expansion within the selected ROIs include temporary increases in emissions from construction equipment during the construction of new port facilities and adjacent intermodal rail and surface road accesses and from dredging vessels during dredging operations. These impacts would be temporary in nature. Potential secondary impacts to air quality resulting from potential port expansion activities within the ROIs include air quality degradation from emissions caused by an increase in cargo vessel traffic and transportation vehicles at adjacent intermodal rail and surface road accesses. Air quality has been assessed as a moderate constraint for all ROIs except Savannah and Norfolk, where it has been assessed as a substantial constraint. Minor primary adverse impacts are anticipated for all ROIs, and moderate secondary adverse impacts are anticipated for the Jacksonville, Charleston, and Wilmington ROIs. Substantial secondary adverse impacts are anticipated for the Savannah and Norfolk ROIs.

3. Water Quality

Potential primary impacts to water quality within the selected ROIs that could result from port expansion activities include emissions from construction and dredging equipment, impairment from runoff at port facility or adjacent intermodal accesses, and temporary impairment from sediment disturbance during dredging operations. Actions or consequences associated with port expansion within the ROIs that could result in secondary adverse impacts to water quality include increases in cargo vessel traffic and associated emissions, increases in point and nonpoint pollution sources associated with the construction of new port facilities and adjacent intermodal rail and surface road accesses, and increases in salinity in coastal river systems associated with channel deepening. Water quality has been assessed as a moderate constraint for all ROIs except Savannah, Wilmington, and Norfolk, where it has been assessed as a substantial constraint. Minor primary adverse impacts are anticipated for all ROIs, and moderate secondary adverse impacts are anticipated for the Jacksonville and Charleston ROIs. Substantial secondary adverse impacts are anticipated for the Savannah, Wilmington, and Norfolk ROIs.

4. Sediment Quality

Sediment quality may pose a potential constraint to some port expansion activities, particularly dredging operations. Significantly contaminated sediments may pose a concern for disposal, and dredging operations may resuspend and redistribute contaminated sediments that were previously restricted in areal extent. Primary adverse impacts to sediment quality within the selected ROIs that could result from potential port expansion activities include emissions and

discharges from construction equipment during the construction of new port facilities and associated intermodal rail and surface road accesses and disturbance and redistribution of any contaminated sediments during dredging operations. Potential secondary adverse impacts to water quality from port expansion activities include increases in emissions and discharges associated with increased cargo vessel traffic and increases in point and nonpoint pollution sources associated with the operation of new port facilities and adjacent intermodal accesses. Sediment quality has been assessed as a substantial constraint for the Savannah, Wilmington, and Norfolk ROIs and a moderate constraint for the remaining ROIs. Minor primary adverse impacts are anticipated for all ROIs, and moderate secondary adverse impacts are anticipated for the Jacksonville and Charleston ROIs. Substantial secondary adverse impacts are anticipated for the Savannah, Wilmington, and Norfolk ROIs.

5. Noise Environment

Actions associated with port expansion within the selected ROIs that could result in primary adverse impacts to the noise environment include construction of new port facilities and adjacent intermodal rail or surface road accesses; these impacts would be temporary in nature. Secondary adverse impacts to the noise environment associated with potential port expansion within the ROIs could include increases in noise levels from equipment and facility operations at new port facilities and adjacent intermodal accesses and from an increase in cargo vessel traffic. Noise environment has been assessed as a moderate constraint for all ports except the Charleston ROIs. Noise environment has been assessed as a substantial constraint for the Berkeley-Charleston County ROI and is not believed to constitute a constraint for the Jasper County ROI. Moderate primary adverse impacts to noise are anticipated for all ROIs except the Jasper County ROI, where no appreciable primary adverse impacts are anticipated. Moderate secondary adverse impacts are anticipated for all ROIs except the Charleston ROIs, where substantial secondary adverse impacts are anticipated for the Berkeley-Charleston County ROI, and no appreciable secondary adverse impacts are anticipated for the Jasper County ROI.

6. Coastal Zone Management Act Resources

Potential primary adverse impacts to CZMA resources within the selected ROIs resulting from port expansion activities include the loss of CZMA resources within the construction footprints of new or expanded port facilities and associated intermodal rail and surface road accesses. Potential secondary impacts to CZMA resources associated with port expansion include the degradation or loss of CZMA resources in the ROI from wave erosion associated with increased commercial vessel traffic and from increased emissions associated with increased vessel and surface vehicle traffic. Such impacts could be minimized by adhering to state coastal management policies as mandated by the Federal consistency provision (Section 307) of the CZMA. CZMA resources have been assessed as a substantial constraint to port expansion within all ROIs. Moderate primary and secondary adverse impacts are anticipated as a result of port expansion activities or consequences within all ROIs.

7. Wetlands

Wetlands comprise a significant percentage of land surfaces within all selected ROIs. Primary impacts to wetlands that could result from potential port expansion include wetland loss from the construction of new port facilities and adjacent intermodal rail or surface road accesses. However, opportunities exist to mitigate these primary wetland impacts by wetland creation on upland or submerged lands in or adjacent to the ROIs. Potential secondary impacts to wetlands resulting from port expansion could include erosion of wetlands from increased wake action caused by an increase in cargo vessel traffic. Wetlands have been assessed as a moderate constraint to port expansion for all ROIs. Minor primary adverse impacts and moderate secondary adverse impacts are anticipated as a result of potential port expansion actions or consequences.

8. Wildlife Resources

a. Invasive Species

Potential primary adverse impacts associated with invasive species resulting from port expansion activities within all selected ROIs include the introduction of new species to the ROIs from fill material used in construction of new port facilities and adjacent intermodal rail and surface road accesses. Additionally, disposal of dredged material from channel deepening operations could result in the introduction of invasive species already present within the ROIs to new areas. Secondary impacts associated with invasive species within the ROIs resulting from port expansion activities could include the introduction of new species as a result of ballast water dumping from commercial vessels utilizing the new or expanded port facilities. Primary impacts associated with invasive species could be reduced or eliminated by using fill material already located within the ROIs and disposing of any dredged material at locations within the ROIs, preventing the offsite spread of invasive species. Secondary impacts associated with invasive species could be reduced by the enforcement of U.S. Coast Guard (USCG) ballast water management guidelines established in 33 CFR 151. Invasive species have been assessed as a moderate constraint to port expansion within all ROIs. Minor primary adverse impacts and moderate secondary adverse impacts are anticipated as a result of port expansion activities or consequences within all ROIs.

b. Natural Areas

Potential primary adverse impacts to natural areas resulting from port expansion activities include loss of natural areas from construction of new port facilities and adjacent intermodal rail and surface road accesses. Secondary impacts to natural areas resulting from potential port expansion within the selected ROIs include erosion of near shore natural areas from increased wake action resulting from an increase in cargo vessel traffic and disturbance of natural areas caused by increases in cargo vessel traffic and surface transport vehicles at intermodal accesses. While it is unlikely that port expansion would occur within any designated preserves, the increase in cargo vessel traffic and surface transport vehicles associated with port expansion could result in adverse impacts to these resources. Additionally, because many state designated natural areas do not necessarily have any legal protection status , these natural areas

could be adversely impacted by the construction of new port facilities and adjacent intermodal rail and surface road accesses. Natural areas have been assessed as a minor constraint for all ROIs except the Jacksonville and Wilmington ROIs, where it has been assessed as a moderate and significant constraint, respectively. Minor primary adverse impacts are anticipated for all ROIs except the Jacksonville and Wilmington ROIs, where moderate primary adverse impacts are anticipated. Minor secondary adverse impacts are anticipated for all ROIs except Jacksonville and Wilmington, where moderate and significant secondary adverse impacts are anticipated, respectively.

c. Threatened and Endangered Species

Potential primary impacts to listed species that could result from port expansion within the selected ROIs include loss of terrestrial and near shore habitat from construction of new port facilities and adjacent intermodal rail or surface road accesses, disturbance of benthic habitat from dredging operations, and incidental or accidental takes of listed species during construction activities. Potential secondary adverse impacts include disturbance of terrestrial habitat from transport vehicles at adjacent intermodal accesses and disturbance of terrestrial, near shore, benthic, and pelagic habitat from increased cargo vessel traffic. Threatened and endangered species has been assessed as a substantial constraint to port expansion at all ROIs. Substantial primary and secondary adverse impacts are anticipated for this resource at all ROIs as a result of port expansion activities or consequences. The National Marine Fisheries Service (NMFS) Southeast Regional Office (SERO) has stated that the species of greatest concern with regard to port expansion in the South Atlantic region is the North Atlantic right whale (*Eubalaena glacialis*), which is particularly vulnerable to secondary impacts such as increased vessel traffic. The SERO indicated that in order for port expansion actions in or near right whale critical habitat to proceed, NMFS may impose reasonable and prudent alternatives on the federal action agency to prevent the expansion project(s) from putting the right whales in a "jeopardy" situation.

d. Critical Habitat

Critical habitat is present within the Jacksonville and Wilmington ROIs. Potential primary impacts to critical habitat resulting from port expansion within these ROIs include loss of critical habitat from construction of new port facilities and adjacent intermodal rail and surface road accesses and disturbance of near shore and aquatic critical habitat from dredging operations. Secondary impacts to critical habitat resulting from potential port expansion within the ROIs include erosion of near shore critical habitat from increased wake action resulting from an increase in cargo vessel traffic and disturbance of near shore, upland, and aquatic critical habitat caused by increases in cargo vessel traffic and surface transport vehicles at intermodal accesses. Although it is unlikely that the construction of new port facilities and adjacent intermodal accesses would occur within a designated critical habitat area, potential secondary impacts from wave erosion and noise disturbance associated with vessel traffic increases are possible. Critical habitat has been assessed as a substantial constraint to port expansion within the Jacksonville and Wilmington ROIs. Substantial primary adverse impacts to critical habitat are anticipated for the Jacksonville ROI, and minor primary adverse impacts to critical habitat are anticipated for the Wilmington ROI. Substantial secondary adverse impacts are anticipated

for both ROIs. No designated critical habitat exists in the other ROIs, and critical habitat is not believed to constitute a constraint to port expansion within these ROIs at this time. No appreciable primary or secondary adverse impacts are anticipated to this resource at the remaining ROIs as a result of port expansion actions or consequences.

e. Unique or Unusual Habitats

Primary adverse impacts to unique or unusual habitats that could result from port expansion within the selected ROIs include loss of terrestrial and near shore habitat from construction of new port facilities and adjacent intermodal rail or surface road accesses and disturbance of benthic habitat from dredging operations. Potential secondary impacts to unique or unusual habitats associated with potential port expansion within the ROIs include disturbance of near shore and benthic habitat from increased cargo vessel traffic and habitat impairment from increased point and nonpoint pollution sources associated with the construction of new port facilities and adjacent intermodal accesses. Unique or unusual habitat has been assessed as a minor constraint to port expansion within the Jacksonville, Savannah, and Norfolk ROIs and as a moderate constraint for the Charleston and Wilmington ROIs. Minor primary and secondary adverse impacts are anticipated as a result of port expansion within the Jacksonville, Savannah, and Norfolk ROIs, and moderate primary and secondary adverse impacts are anticipated for the Charleston and Wilmington ROIs.

f. Essential Fish Habitat

EFH is found throughout all selected ROIs for a large assemblage of managed marine fishes and invertebrates, including various shrimp species, red drum, members of the snapper-grouper complex, and highly migratory managed species. Potential primary adverse impacts to EFH that could result from port expansion activities within the ROIs include loss of near shore EFH from construction of new port facilities and adjacent intermodal rail and surface road accesses and loss or disturbance of benthic EFH from dredging operations. Potential secondary adverse impacts from port expansion include disturbance of near shore, benthic, and pelagic EFH from increased cargo vessel traffic and degradation or loss of EFH from increased point and nonpoint pollution sources associated with port operations. EFH has been assessed as a substantial constraint to port expansion at all ROIs. Substantial primary and secondary adverse impacts are anticipated for EFH at all ROIs as a result of port expansion activities or consequences.

g. Cultural Resources

Potential primary adverse impacts to cultural resources from port expansion activities within the selected ROIs include destruction of cultural resource sites from the construction of new port facilities and adjacent intermodal rail and surface road accesses. Potential secondary impacts include the damage or loss of near shore cultural resources from wave action associated with increased commercial vessel traffic. Significant areas with low densities of cultural resource sites are present within all ROIs except for Norfolk, indicating that construction of new facilities may not pose a significant threat to cultural resources within these ROIs; however, the loss of near shore sites from wave action remains a possibility. Cultural

resources have been assessed as a substantial constraint to port expansion within the Wilmington and Norfolk ROIs, a moderate constraint within the Jacksonville and Berkeley-Charleston County ROIs, and a minor constraint within the Savannah ROI. The resource is not believed to constitute a constraint within the Jasper County ROI at this time. Minor primary adverse impacts are anticipated for all ROIs except Jasper County (where no adverse impacts are anticipated) and Norfolk (where substantial impacts are anticipated). Moderate secondary adverse impacts are anticipated for all ROIs except Jasper County, where no such impacts are anticipated, and the Wilmington and Norfolk ROIs, where substantial secondary adverse impacts are anticipated.

h. Hazardous, Toxic, and Radioactive Waste

HTRW may pose a constraint to port expansion activities. The presence of significant REC sites in a given area may render the area infeasible for port expansion because of HTRW concerns. Additionally, potential port expansion may pose an HTRW concern to the surrounding environment. Potential primary impacts associated with port expansion activities include discharges from construction or dredging equipment during the construction of new port facilities and adjacent intermodal rail and surface road accesses or dredging operations. Potential secondary impacts include increases in point and nonpoint pollution sources associated with the construction of new port facilities and adjacent intermodal accesses, as well as the potential increase in pollutant or contaminant discharges from accidents involving cargo vessels. HTRW has been assessed as a substantial constraint to port expansion within the Norfolk ROI, a moderate constraint within the Jacksonville ROI, and a minor constraint within the Savannah, Berkeley-Charleston County, and Wilmington ROIs and is not believed to constitute a constraint within the Jasper County ROI at this time. Minor primary adverse impacts are anticipated as a result of port expansion for all ROIs except Norfolk, where substantial primary adverse impacts are anticipated. Substantial secondary adverse impacts are anticipated for all ROIs.

i. Socioeconomic Profile

Expansion of port facilities in any of the selected ROIs would likely result in the creation of new jobs and new infrastructure within the ROIs. Potential primary impacts to socioeconomic conditions within the ROIs include the acquisition of property from landowners or residents for the construction of new port facilities and adjacent intermodal rail and surface road accesses. It is anticipated that compensation would be provided to any impacted residents or socioeconomic groups impacted by property acquisition, offsetting or mitigating the impacts. No secondary adverse impacts to socioeconomic conditions are anticipated as a result of port expansion activities. Port expansion would likely constitute a net benefit to socioeconomic conditions within the ROIs. Socioeconomic conditions are not believed to constitute a constraint to port expansion within any ROI. Port expansion would likely constitute a net benefit to socioeconomic conditions within all ROIs, and no net primary or secondary adverse impacts are anticipated as a result of port expansion actions or consequences.

j. Environmental Justice

All selected ROIs except Jasper County contain areas with significant minority and/or poverty levels that are subject to Environmental Justice consideration. Construction of

new port facilities and adjacent intermodal rail and surface road accesses in these areas could result in primary adverse impacts to minority or disadvantaged populations. However, ample areas exist within the ROIs for port expansion that would not result in disproportionate impacts to such groups, and the construction of new port facilities and the associated increase in jobs and infrastructure could result in a net benefit to minority and disadvantaged populations within the ROIs. Environmental justice has been assessed as a minor constraint to port expansion within all ROIs. Minor primary adverse impacts are anticipated for all ROIs, and no net secondary adverse impacts are anticipated for any ROI as a result of port expansion actions or consequences.

k. Transportation

All ROIs except Jasper County contain extensive networks of surface roads, railroads, and waterways with shipping channels that support residential and commercial traffic activity in the area. Potential primary adverse impacts to transportation resulting from port expansion activities include the temporary disruption of traffic on surface roads and railways in construction areas for expanded port facilities or adjacent intermodal rail and surface road accesses, and temporary disruption of vessel traffic in areas selected for channel modification. Additionally, the construction of landside features could result in the permanent loss of portions of surface roads or railroads within the construction footprint of the expanded facilities. Traffic disruptions from construction activities would likely be temporary in nature, however, and any permanent surface route closures from construction activities could be offset by construction of new nearby routes to replace the closed routes. Potential secondary impacts to transportation resulting from port expansion activities within the ROIs include increased use of transportation routes from commercial vehicle, train, and vessel traffic associated with expanded port facilities. Such increases in traffic could require substantial additions to or modifications of the existing transportation infrastructures. Transportation has been assessed as a substantial constraint to port expansion within all ROIs. Minor primary adverse impacts and substantial secondary adverse impacts are anticipated as a result of port expansion activities or consequences within all ROIs.

l. Recreation

Common recreational activities within the selected ROIs include boating, fishing, birding, and touring historic sites and natural areas. Potential primary adverse impacts to recreation within the ROIs resulting from port expansion include loss of near shore recreational space from the construction of new port facilities and adjacent intermodal rail and surface road accesses; secondary adverse impacts include the disturbance of waterborne and ecotourist recreation activities from increased cargo vessel traffic. Recreation has been assessed as a substantial constraint to port expansion within the Wilmington ROI, a moderate constraint within the Jacksonville and Berkeley-Charleston County ROIs, and a minor constraint within the remaining ROIs. Minor primary adverse impacts are anticipated as a result of port expansion for all ROIs except Wilmington, where moderate primary adverse impacts are anticipated. Substantial secondary adverse impacts are anticipated for the Wilmington ROI, moderate secondary adverse impacts are anticipated for the Jacksonville and Berkeley-Charleston County ROIs, and minor secondary adverse impacts are anticipated for the remaining ROIs.

IV. INSTITUTIONAL ANALYSIS

An Institutional Analysis (IA) was conducted as a third task of the RPA to identify other "critical factors" (in addition to the capacity analysis and the environmental survey) enabling or inhibiting development of a regional port. The IA was intended to concentrate on "deal makers and breakers" for particular ports and sites among other factors.

Because of a change in the way in which the scope of work was to be executed, the IA was developed from desktop materials and general familiarity with the ports as opposed to site visits and specific local assessments. Consequently, the focus of the IA is on general impediments to the efficient use of existing marine terminal capacity and the major considerations for new marine terminal development.

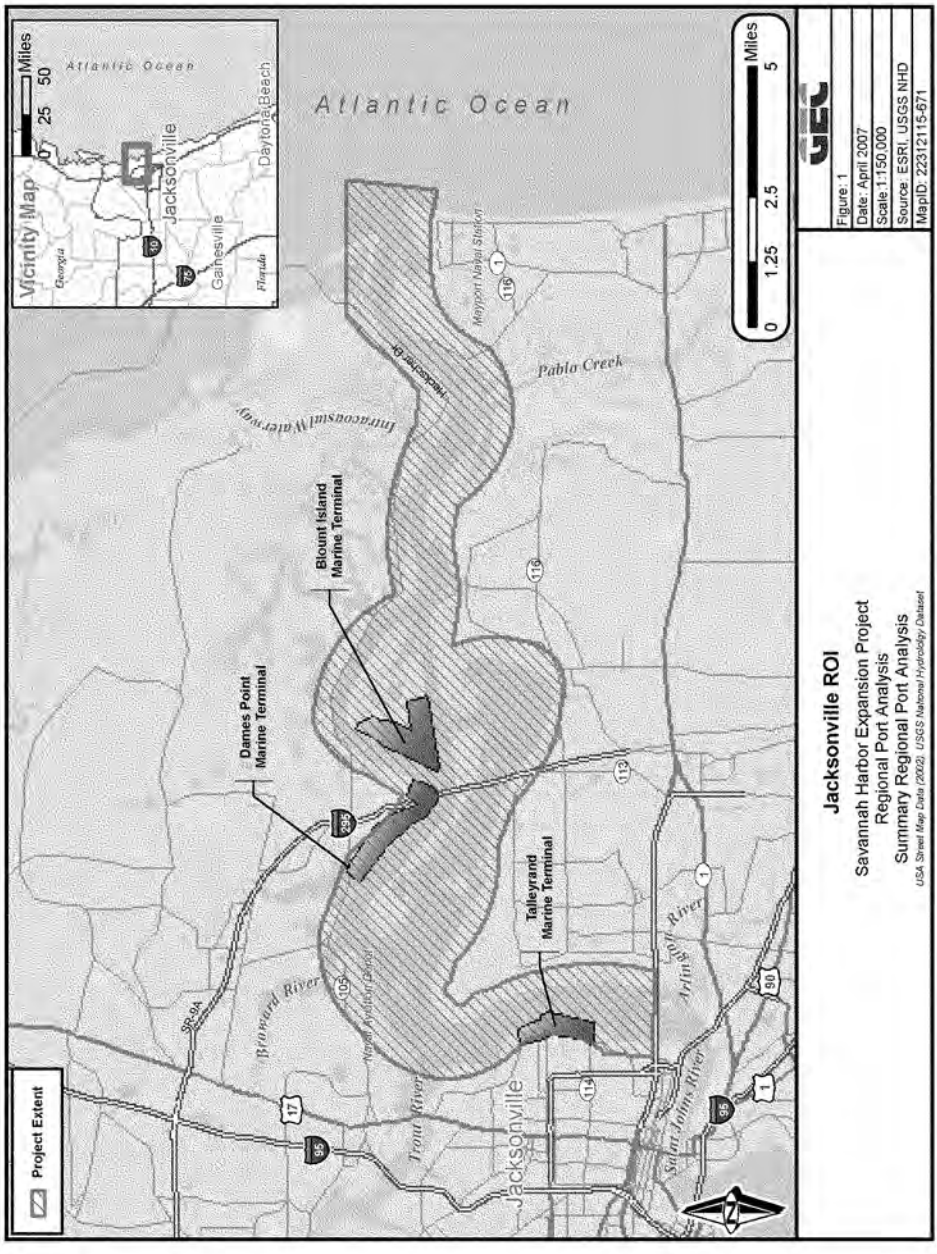
Among the general institutional impediments to efficient use of existing marine capacity are restricted hours and days of gate operations. Existing labor rules and practices require overtime payments for extended gate operations. This acts as a disincentive to expand marine terminal access to trucks, which handle over 80 percent of the U.S. east coast container port traffic. Also, many local businesses are not staffed to receive freight after an eight hour work day five days of the week, thus limiting the effectiveness of expanded marine terminal access hours.

Although much focus has been made on marine terminal storage of empty containers, the dwell times of loaded boxes are a more substantial determinant of throughput capabilities. Reductions in average dwell times of loaded boxes sitting in the terminal will have a proportional impact on increasing throughput. Consequently, it would appear that opportunity exists for a substantial increase in throughput for existing and proposed facilities, other things being equal.

Major new marine terminal capacity considerations include land, intermodal access, public/private partnerships, and community acceptance. Modern marine container terminal sites require a minimum of 200 acres preferably with room for expansion. Rail intermodal access is considered important, but a distinct minority of containers at South Atlantic ports currently move by rail (generally for niche markets with respect to longer distances, overweight and empty boxes). Truck and highway access continues to be predominant for ECUS ports because of the comparatively shorter distances and lower volumes served compared to West Coast U.S. ports.

There is evidence of a paradigm shift in financing and ownership of marine container terminals away from the traditional public port model and involving greater private sector investment and control. There is also a shift away from urban locations in favor of rural areas where the local economic impacts are likely to be greater and there is more community acceptance.

APPENDIX A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Pablo Creek
Blount Island Marine Terminal
Dames Point Marine Terminal
Talleyrand Marine Terminal
Broward River
Naval Aviation Depot
Arlington River
Front River
Jacksonville
SR-9A
Miles
0 1.25 2.5 5
Jacksonville ROI
Savannah Harbor Expansion Project
Regional Port Analysis
Summary Regional Port Analysis
USA Street Map Data (2002); USGS National Hydrology Dataset
GEC
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Source: ESRI, USGS NHD
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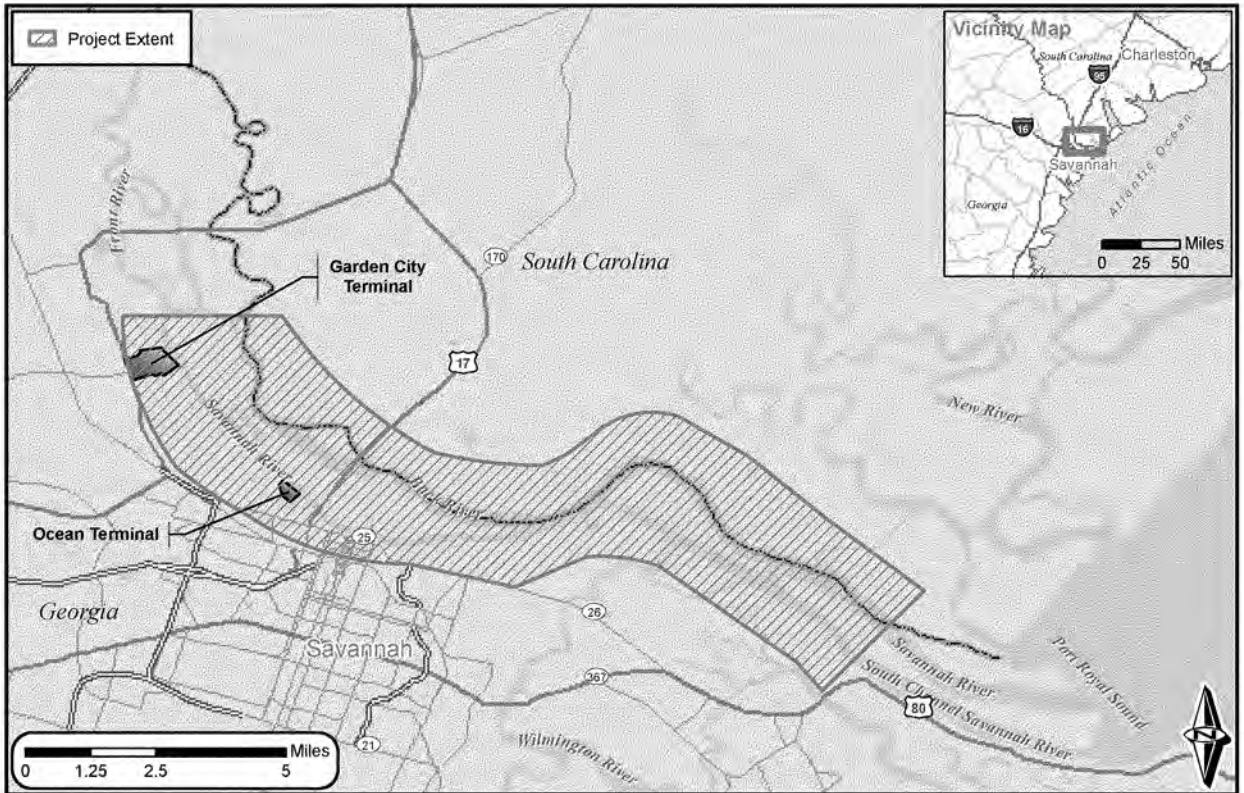

Savannah ROI

Savannah Harbor Expansion Project
Regional Port Analysis
Summary Regional Port Analysis

USA Street Map Data (2002), USGS National Hydrology Dataset

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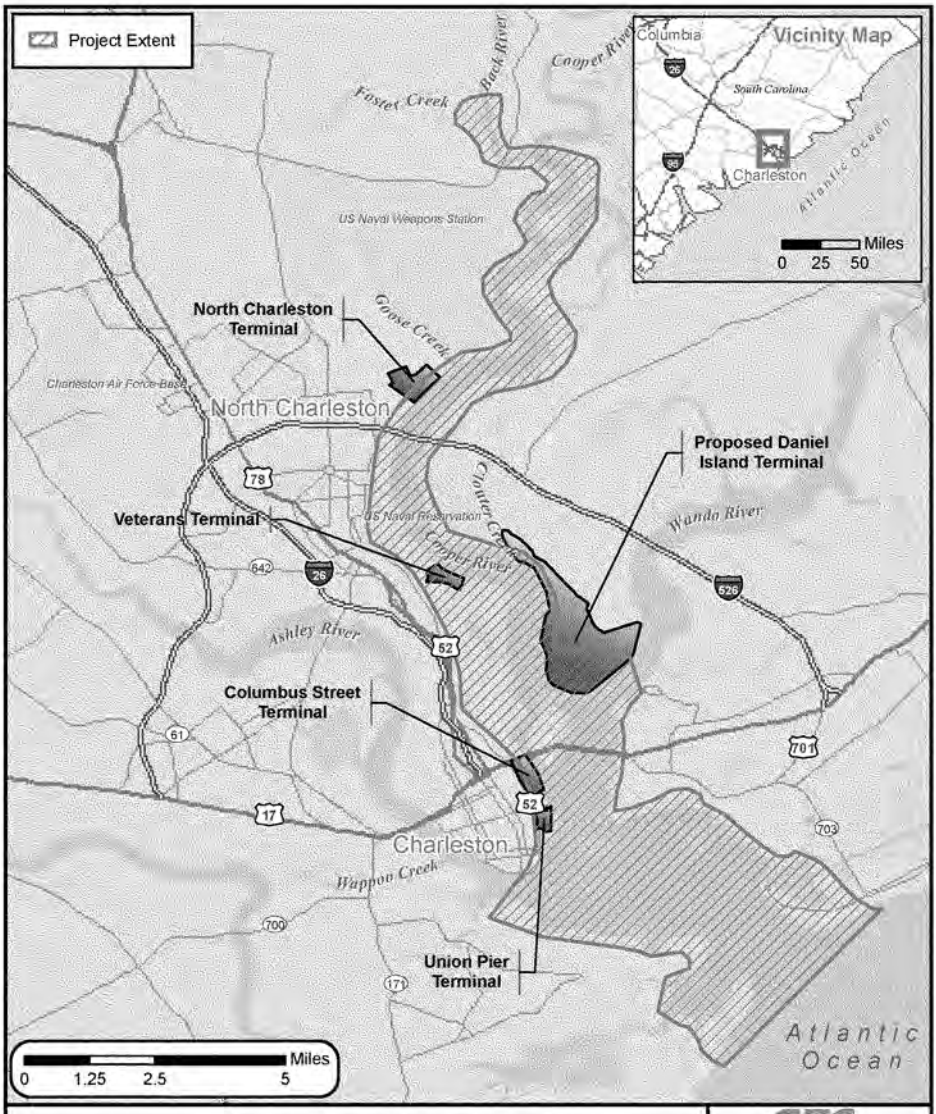

Berkeley - Charleston County ROI

Savannah Harbor Expansion Project
Regional Port Analysis
Summary Regional Port Analysis

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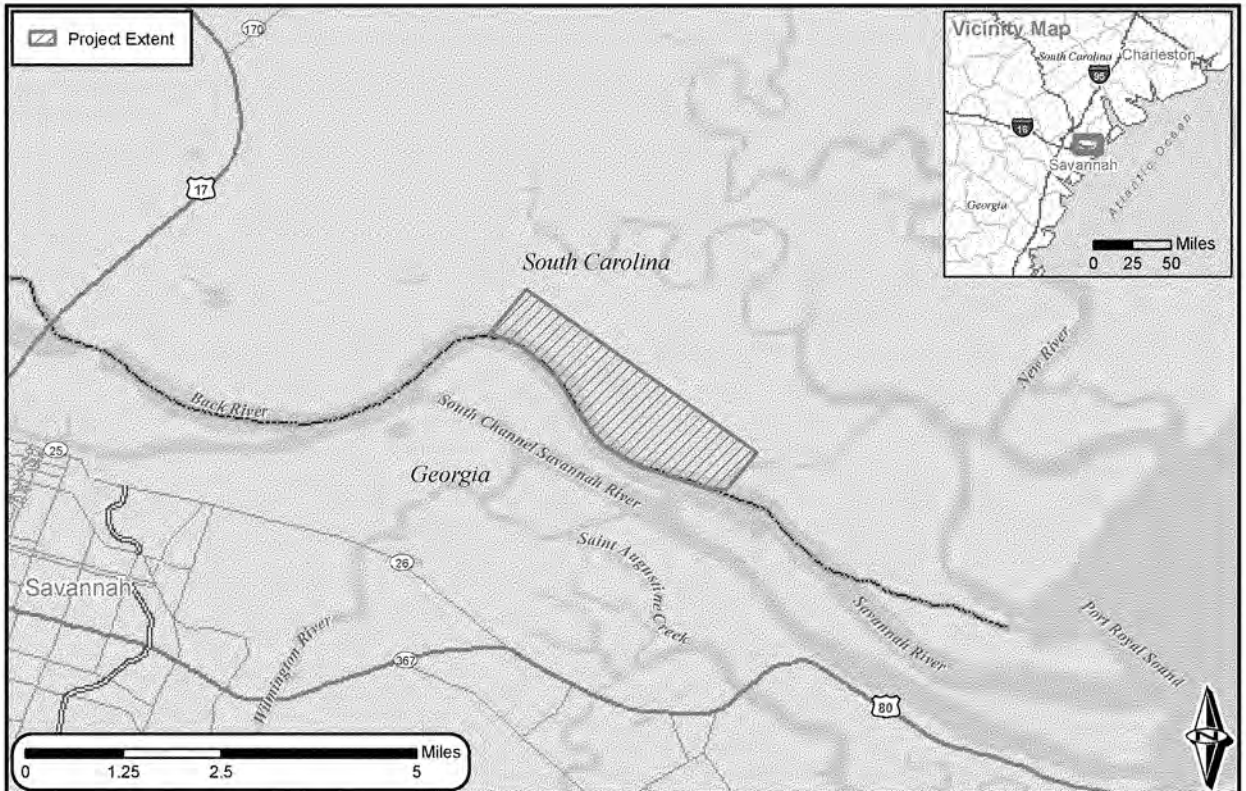

Jasper County ROI

Savannah Harbor Expansion Project
Regional Port Analysis
Summary Regional Port Analysis

USA Street Map Data (2002), USGS National Hydrology Dataset

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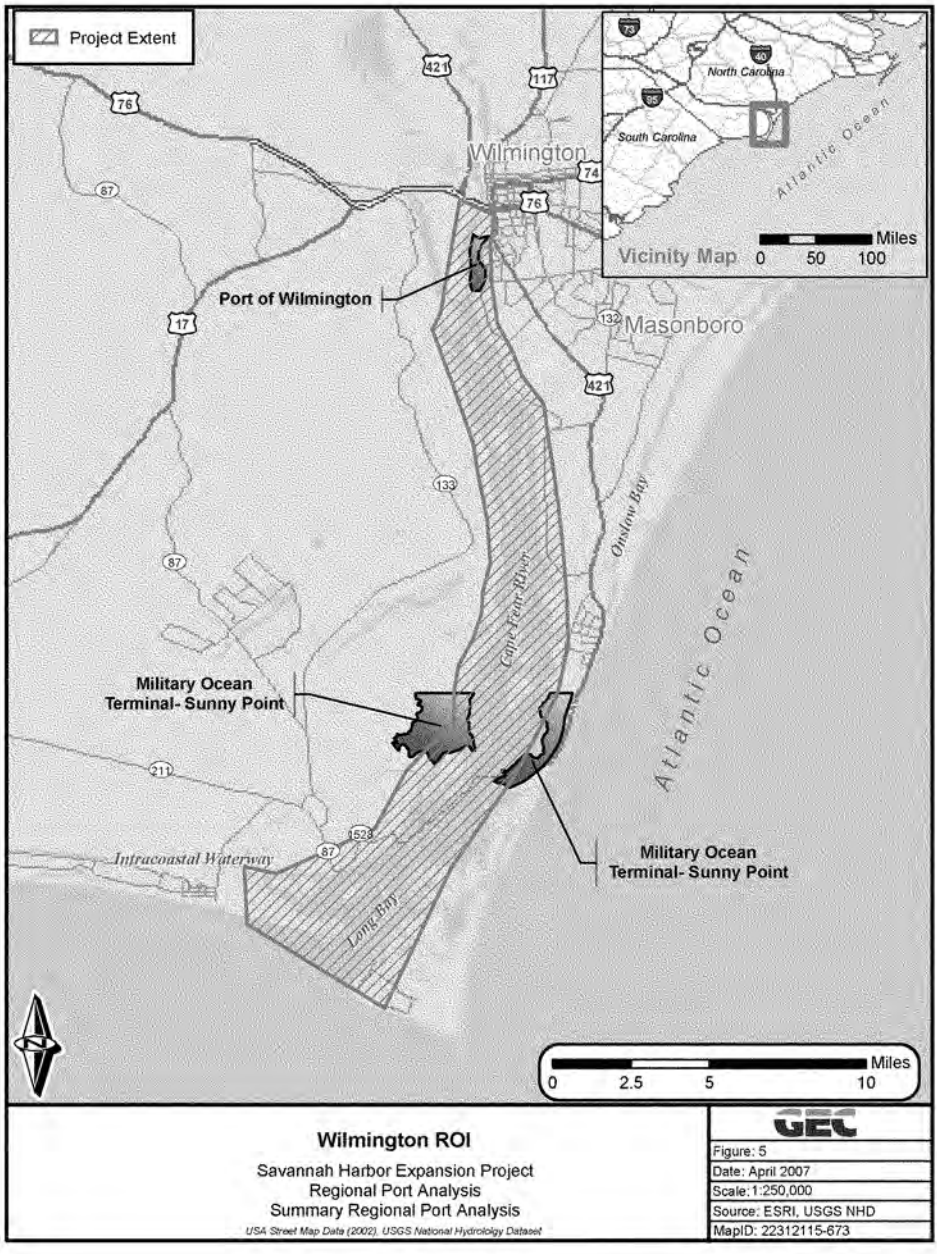
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Military Ocean Terminal- Sunny Point
Military Ocean Terminal- Sunny Point
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Long Bay
North Carolina
South Carolina
Atlantic Ocean
Vicinity Map
Miles
0 50 100
Miles
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Wilmington ROI
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Regional Port Analysis
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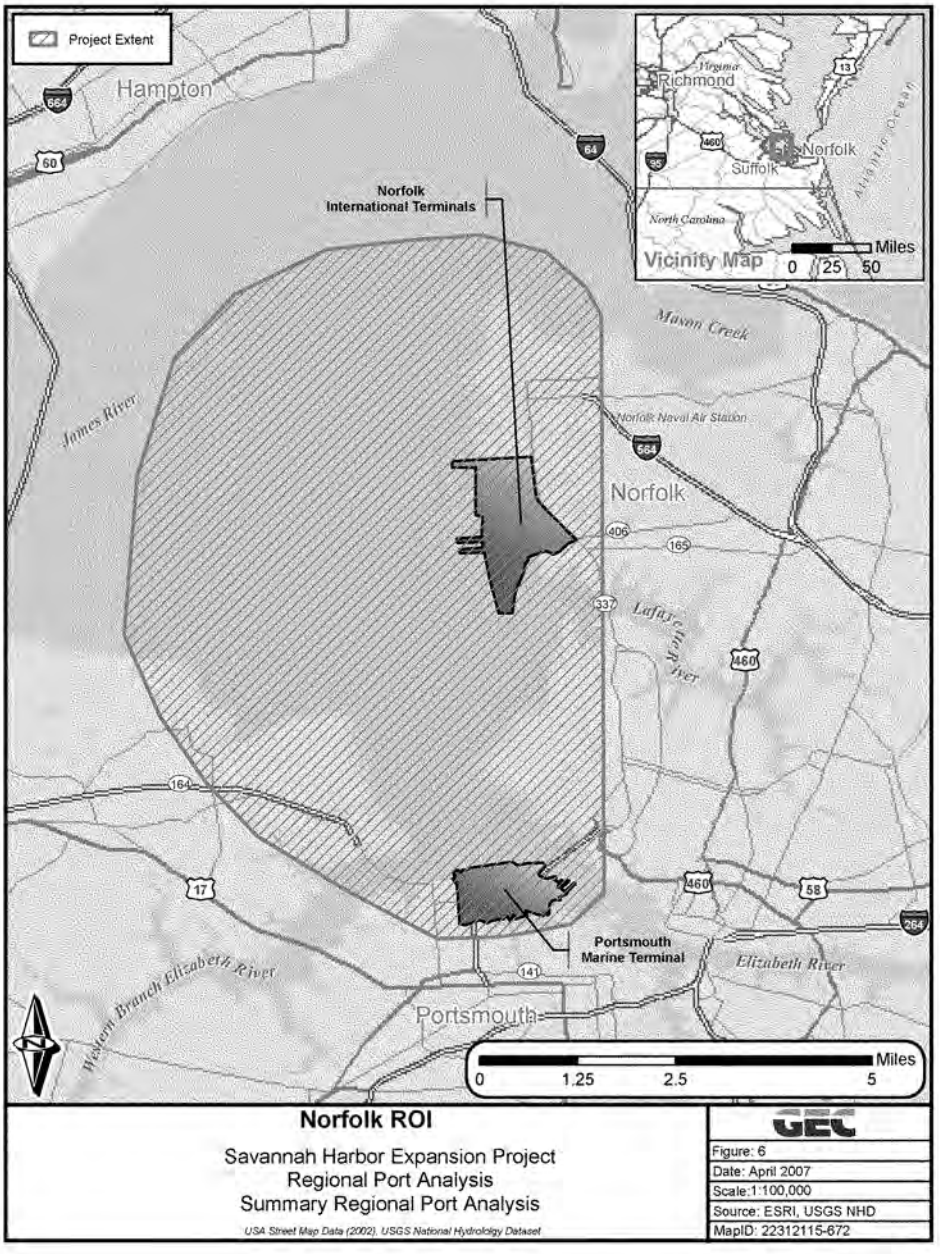

Norfolk ROI

Savannah Harbor Expansion Project
Regional Port Analysis
Summary Regional Port Analysis

USA Street Map Data (2002), USGS National Hydrology Dataset

Figure: 6
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Source: ESRI, USGS NHD
MapID: 22312115-672

ATTACHMENT 1

FIRST INTERIM REPORT
JULY 2006

First Interim Report

SAVANNAH HARBOR EXPANSION PROJECT

REGIONAL PORT ANALYSIS
PORT CAPACITY ANALYSIS

US Army Corps of Engineers
Savannah District
Savannah, Georgia

First Interim Report

SAVANNAH HARBOR EXPANSION PROJECT

REGIONAL PORT ANALYSIS
PORT CAPACITY ANALYSIS

Contract No. DACA-03-02-D-0003
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GEC Project No. 22312115

Prepared by
GEC
Gulf Engineers & Consultants
9357 Interline Avenue
Baton Rouge, Louisiana 70809
Phone – 225/612-3000

U.S. ARMY CORPS OF ENGINEERS
SAVANNAH DISTRICT
SAVANNAH, GEORGIA

July 26, 2006
(Revised September 20, 2006)

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

The Regional Port Analysis (RPA) reflects concerns of different stakeholders who indicated that there should be a study of allocating Federal improvement funds at one regional port in the South Atlantic region rather than deepening several competing ports with excess capacity. Accordingly, the RPA is being performed to address port capacity and related issues. This first interim report will address South Atlantic port marine container terminal capacity and demand.

Marine container terminal capacities were developed from secondary data for the ports between Norfolk and Jacksonville. Marine container terminal capacity is expressed in millions of 20 foot equivalent units (TEUs) that can be moved through each terminal during a year. Marine terminal annual TEUs of capacity were developed for existing, developing, and prospective terminals at each port (tables 1, 2, and 3). The first two categories are reasonably robust based on current and planned facilities. The prospective terminals are more conceptual in nature and not viewed as exhaustive of possible expansion capability at the different ports.

The projected loaded containers for each port developed in 2004 for the period 2004 to 2050 were adjusted to reflect 2005 total reported TEUs of throughput for loaded and empty containers at each port. The 2005 total TEU volumes were forecasted out to 2050 using the 2004 to 2050 projections of loaded containers (Table 4).

The capacity at each port among the existing, developing, and proposed terminals was compared to current and projected annual throughput TEUs (Table 5). The results indicate that there is substantial current capacity, but demand is projected to grow significantly in the near term, 2005 to 2020. By 2010 the existing terminal capacity at most ports will be nearly fully utilized. Developing terminals coming on line will be needed to meet demand after 2010 at most ports.

A regional port concept that concentrates existing capacity and/or future growth in demand was examined by shifts in port throughput (Table 6 and figures 3, 4, 5, 6, 7, and 8) and shifts in growth of container volumes among adjacent ports (Table 8 and figures 9, 10, 11, 12, 13, and 14). The South Atlantic port region, including Norfolk, is dominated by three large container ports (Norfolk, Charleston, and Savannah). Shifts in port throughput for Jacksonville and Wilmington are relatively inconsequential compared to Norfolk, Charleston, and Savannah. Similarly, shifts in future growth of container volume at Jacksonville and Wilmington can be more readily absorbed by existing and developing capacities at major ports compared to shifts of container volume growth away from the major ports.

The analysis confirms that the major ports are growing rapidly relative to existing terminal capacities and in substantial volumes compared to the capability of planned marine container terminals. For example, Charleston and Savannah together will experience nearly one million TEU growth between 2005 and 2010 and nearly two million TEU growth between 2005 and 2015 (Table 7). This kind of growth is indicative of a new Greenfield terminal site rather than employing a load center hub port that would concentrate containers at existing terminals or accelerate the full utilization of developing terminals.

TABLE OF CONTENTS

TABLE OF CONTENTS

Section			Page
I	INTRODUCTION		1
	A.	Purpose/Objectives	1
	B.	Organization	2
II	PORT INFRASTRUCTURE SURVEY: MARINE CONTAINER TERMINALS		2
III	CAPACITY METHODOLOGY		4
	A.	Static	4
	B.	Dynamic	6
IV	CAPACITY ESTIMATES		10
V	HUB/SPOKE ANALYSIS		20
	A.	Introduction	20
	B.	Assumptions	25
		1. Domestic Hub	26
		2. Foreign Hub	30
	C.	Performance of Hubs	30
		1. Cost	30
		2. Performance	30
Appendix:	THE REGIONAL PORTS		

LIST OF TABLES

Number		Page
1	Existing South Atlantic Marine Container Terminals-Norfolk to Jacksonville	3
2	Developing/Proposed South Atlantic Marine Containers Terminals – Norfolk to Jacksonville	4
3	Other Potential South Atlantic Marine Container Terminal Sites – Norfolk to Jacksonville	4
4	Projected TEUs for South Atlantic Ports, 2005-2050	13
5	Estimated TEU Annual Capacity of South Atlantic Ports, Existing, Developing, and Other Terminals (000,000)	15
6	Estimated TEU Annual Capacity of Total South Atlantic Ports, Existing, Developing, and Other Terminals, Excluding One Port (000,000)	21
7	Estimated TEU Annual Capacity and Throughput Growth at South Atlantic Ports (000,000)	27
8	Estimated TEU Annual Capacity and Shifting Throughput Growth at South Atlantic Ports (000,000)	28

LIST OF FIGURES

Number		Page
1	Port Marine Container Model Conceptual Logic of Input-Output Relationships	8
2	Model of Marine Container Terminal Systems	11
3	Existing TEUs Annual Capacity Compared to 2005 TEUs Throughput for Selected South Atlantic Ports	16
4	Total TEU Capacity Compared to Projected Demand for the Port of Jacksonville	17
5	Total TEU Capacity Compared to Projected Demand for the Port of Savannah	17
6	Total TEU Capacity Compared to Projected Demand for the Port of Charleston	18
7	Total TEU Capacity Compared to Projected Demand for the Port of Wilmington	18
8	Total TEU Capacity Compared to Projected Demand for the Port of Norfolk	19
9	Total Capacity Existing and Developing TEUs for All Selected South Atlantic Ports Compared to Estimated TEU Annual Throughput (2010-2050)	20
10	Existing and Developing TEU Capacity South Atlantic Ports Excluding Port of Norfolk Compared to Estimated TEU Annual Throughput – All Ports	22
11	Existing and Developing TEU Capacity South Atlantic Ports Excluding Port of Wilmington Compared to Estimated TEU Annual Throughput – All Ports	23
12	Existing and Developing TEU Capacity South Atlantic Ports Excluding Port of Charleston Compared to Estimated TEU Annual Throughput – All Ports	24
13	Existing and Developing TEU Capacity South Atlantic Ports Excluding Port of Savannah Compared to Estimated TEU Annual Throughput – All Ports	24

LIST OF FIGURES (cont'd)

Number **Page**

14 Existing and Developing TEU Capacity South Atlantic Ports Excluding Port of Jacksonville Compared to Estimated TEU Annual Throughput – All Ports 25

REGIONAL REPORT

REGIONAL PORT ANALYSIS
FIRST INTERIM REPORT: PORT CAPACITY ANALYSIS

I. INTRODUCTION

Public review comments and litigation-related issues resulting from the 1998 Savannah Harbor Expansion Feasibility Study by the Georgia Ports Authority (GPA) were highlighted by a request for a Regional Port Analysis (RPA) in the final analysis of the Savannah Harbor Expansion Project (SHEP) PED formulation. The RPA reflects concerns of different project stakeholders who indicated that there should be a study of allocating Federal improvement funds at one regional port in the South Atlantic region, rather than deepening several competing ports with excess capacity. Adherents to a regional approach to port capacity analyses and expansion believe that this would make sense economically (because fewer funds would be expended) and environmentally (because the impact of harbor improvements would be focused on one port rather than several).

The RPA is being performed in three segments as follows: (1) port capacity analyses; (2) environmental survey and institutional analysis; and (3) summary report. Accordingly, there will be an interim report for each segment followed by a Final Report. The RPA assumes that readers are familiar with the current status of development at the container ports (Norfolk to Jacksonville). Readers seeking more general information on the developments at these ports are referred to the appendix to this report.

A. PURPOSE/OBJECTIVES

The purpose of the port capacity analyses is to assess whether and to what extent there is sufficient marine terminal capacity in the region to absorb the projected cargo increases at a limited number of harbors. The capacity analysis is for the various container-capable ports in the South Atlantic, including Hampton Roads (Norfolk) to Jacksonville. South Florida container ports, notably Miami and Port Everglades, have been omitted because they normally service a regional domestic market for imports and foreign transshipment (Caribbean, Latin America, and South America) not otherwise competitive with the traditional South Atlantic container ports at Charleston and Savannah. Hampton Roads is traditionally regarded as a North Atlantic container port, competing primarily with New York and in a more marginal manner with the major South Atlantic container ports, Charleston and Savannah (refer to Section VIII of SHEP Multiport Analysis Final Report). The major reason for including Hampton Roads is that Maersk-SeaLand is building the first privately owned marine container terminal on the U.S. east coast, which may have implications for how this major container line will load center cargo relative to its services calling Charleston and Savannah. Other smaller South Atlantic container ports such as Wilmington and Jacksonville were included in the analysis for a comprehensive treatment of the major and minor ports with respect to container volumes.

Not only is the "South Atlantic" region interpreted broadly for capacity purposes to include Hampton Roads, but the capacity analysis is also intended to address "hub and spoke" operations with respect to domestic and foreign load centering container ports. Consequently, some

assessment will be made of the potential that a hub and spoke port system could take up capacity that would otherwise be distributed among the various ports and terminals.

B. ORGANIZATION

The RPA container ports and marine terminals capacity assessment and related survey of the environmental resources within the regions of port expansions were originally envisioned to be a product of site visits that would confirm and update existing secondary information with respect to container terminal capacity, expansion, and related environmental features. No new primary data were to be collected. The site visits were to familiarize the team with each of the marine terminals from an operations (capacity) assessment perspective, including expansion potential for existing, planned, and prospective sites and related environmental resources within the region of proposed port expansion.

Some of the various port interests expressed concerns about directly participating in a study that was related to SHEP.[1] As a result it appeared that port marine container terminal site visits for confirming and updating secondary information for capacity and related environmental surveys were not deemed practical. There was a reluctance among some of the public ports to discuss capacity, particularly related to planned and prospective expansions other than what was considered part of the public domain, such as existing environmental impact statements.[2] Rather than directly communicate with the ports, the different Corps districts (Norfolk, Wilmington, Charleston, Savannah, and Jacksonville) were contacted to serve as liaison to attempt to confirm or otherwise provide existing secondary information pertaining to port capacity, expansion, and related environmental features.

Rather than rely on data exchanged directly with ports, the capacity assessment and environmental review used other secondary sources, including port web sites, Corps districts, and related state and Federal agencies. The collected data have not been reviewed or otherwise approved by the ports or the Corps districts. All of the capacity and environmental survey related data have abundant source documentation, as will be evident in this report.

II. PORT INFRASTRUCTURE SURVEY: MARINE CONTAINER TERMINALS

The major marine container ports for the RPA, including existing, planned, and potential terminals, identified from secondary sources are presented for the ports from south to north as follows:

- Jacksonville – Talleyrand, Blount Island, and Dames Point terminals
- Savannah – Garden City Terminal, Ocean Terminal, Other
- Charleston – Wando Welch, North Charleston, Columbus Street, Charleston Navy Container Terminal, Jasper County, Other

[1] The major container ports view themselves as competitors and are reluctant to participate in a study that would ostensibly benefit Savannah Harbor from deepening.

[2] For example, concerns have been expressed that declaration of new marine terminal sites not otherwise identified in the existing public domain could become pre-judgmental from the perspective of other interested groups.

- Wilmington – Wilmington and North Carolina International Port (NCIP)
- Norfolk – Norfolk International Terminal, Portsmouth Marine Terminal, Newport News Marine Terminal, Maersk-SeaLand, and Craney Island

The structure of tables 1, 2 and 3 is similar in that the major physical elements that describe each port terminal are presented, subject to data availability, including distance from sea buoy, a proxy for sailing time and other harbor related variables such as pilotage and tug assistance, number of container berths, berth length, total terminal site space (acres), developed yard space for container storage (loads and empties) channel depth (MLLW) in feet, and rail accessibility to the container yard. Tables 1, 2, and 3 present a description of existing, developing/proposed, and other potential sites for marine container terminals at these ports, respectively.

Data compiled from secondary sources indicates that total annual marine container capacity for existing terminals (Table 1) is approximately between 11 and 13 million TEUs. For developing/proposed container terminals (Table 2), the total annual marine container capacity is approximately seven million TEU. For a sample of other indicated potential terminals (Table 3), total annual identified marine container capacity is approximately nine million TEUs.[3]

Table 1. Existing South Atlantic Marine Container Terminals – Norfolk to Jacksonville

Port/Terminal	Sea Buoy (miles)	Berth No.	Berth (feet)	Terminal (acres)	Container (storage acres)	Channel (feet)	Rail Access container	Annual Capacity Notes
Jacksonville								
Talleyrand	21	6	4,800	173	47	38	ND	(1) 0.258 million TEU based on 5500 TEU/acre
Blount Island	9	8	6,600	754	167	40	ND	(2) 0.920 million TEU based on 5500 TEU/acre
Total container storage					214			1.178 million TEU based on 5500 TEU/acre
Savannah								
Garden City	13	8	9,693	1208	407	500x42	ND	(3) currently 1.750 million TEU; planned 3.850 million TEU
Ocean Terminal	13	na	na	208	na	500x42		Not currently configured for containers
Charleston								
Wando Welch	16.4	4	3,800	na	194	400-600x45	No	(4) 1.584 million TEU
North Charleston	15	3	3,500	na	123	400-600x45	ND	(4) 0.713 million TEU
Columbus Street	6	2	na	na	78	400-600x45	ND	(4) 0.35 million TEU
Total container storage					456			(5) 2.646 million TEU
Wilmington								
Cape Fear River	26	na	6,768	na	na	500x42	No	(6) 0.250 to 1.0 million TEU
Norfolk								
Norfolk International	na	5	5,730	811	na	50	ND	
Portsmouth Marine	na	3	3,540	210	46.8	50	ND	
Newport News Marine	na	na	na	140	43	45	ND	
Total build out					664			(7) 3.20 million TEU (664 acres at 5000/TEU/acre)
Ports/Terminals								(8) 10.874 to 13.097 million TEU

Notes: Rail Access for containers "ND" = "near dock"; na = not available

(1) Jax Port container throughput based on "Business and Development Strategy Port of Jacksonville" (April 25, 2005).

(2) Blount Island berths 32, 34 and 35 feet (900, 1000 and 750 feet long, respectively) are used for container handling.

(3) "Planned Measures to Augment Capacity of Garden City Terminal" would increase throughput to 3.850 million TEU by 2015/2019.

GPA Facilities Master Planning indicate current capacity of GCT to be 2.652 million TEU which could be increased to 5.073 million TEU

Future capacity for Garden City increases to 5.07 million TEU per year based on maximum berth, reduced empty dwell time, RTG loads and 8000/TEU/acre stacking.

GPA berths include completion of CB 8 (2076 lineal feet).

(4) Maximum terminal throughput for SCSPA from "Updated Throughput Analysis" (November 13, 2004).

(5) Total storage at Charleston reflects incremental improvements at Wando, North Charleston and Columbus terminals.

(6) Wilmington terminal is common to bulk, general cargo and container cargoes.

No container yard size and capacity is available but likely not to exceed 0.250 million TEU as currently developed and 1.0 million "fully" developed.

(7) Maximum land use at the three existing VPA terminals is 664 acres. Current undeveloped area is 89 acres at NIT,

34.7 acres at PMT and 5.8 acres at NNMT. VPA 2040 Strategic Plan undeveloped area is 19.0, 0 and 5.8 acres for these facilities, respectively.

VPA efficient terminal capacity is capped at 5000 TEU per acre per year.

(8) Summation excluding Wilmington includes "planned" expansions at GPA (3.850 million TEU). Including GPA maximum of 5.07 million TEU would be 12.097 million TEU. Including Wilmington (estimated) and the full GPA planned development (5.073 million TEU) the total build-out annual capacity would be 13.097 million TEU.

Source: G.E.C., Inc.

[3] Table 3 serves as an example of other sites and should not be regarded as exhaustive or inclusive of all other possible sites for marine container terminal development at the different ports.

Table 2. Developing/Proposed South Atlantic Marine Containers Terminals – Norfolk to Jacksonville

Port/Terminal	Sea Buoy (miles)	Berth No.	Berth (feet)	Terminal (acres)	Container (storage acres)	Channel (feet)	Rail Access Container	Container Annual Capacity Notes
Jacksonville								
Dames Point	12	2	2,400	158		40	no	(1) 0.8 to 1.0 million TEU
Savannah								
Ocean Terminal						300x42		Not configured for container development
Charleston								
Charleston Navy		3	3,510	238.7	201.4	400-600x45	No	(2) 1.430 million TEU
Wilmington								
Norfolk								
Maersk-SeaLand			4,000	570	291	50	ND	(3) 1.0 million TEU Phase 1 and 2.16 million TEU final
Craney Island			8,400	580		50	ND	(4) 2.5 million TEU
Ports/Terminals								(5) 7.09 million TEU

Notes: Rail Access for containers "ND" = "near dock."
(1) Dames Point is stated to have expansion capability to 200 contiguous acres with limited expansion capability unless one or both of two other facilities for bulk cargo and cruise vessels are relocated. Accordingly, 158 and 200 acres will have capacities of 0.8 and 1.0 million TEUs respectively. Dames Point is a 585 acre site that handles dry bulk cargoes and a cruise facility. There are approximately 160 to 200 acres for new marine development. Relocating the cruise facility from Dames Point to increase cargo capacity does not appear likely at this time.
(2) Furnished by SCSPA.
(3) Various estimates have appeared for this private facility.
(4) VPA estimates.
(5) Summation of Dames Point (1.0 million), Charleston Navy (1.430 million), Maersk-SeaLand (2.16 million) and Craney Island (2.5 million).

Source: G.E.C., Inc.

Table 3. Other Potential South Atlantic Marine Container Terminal Sites – Norfolk to Jacksonville

Port/Terminal	Sea Buoy (miles)	Berth No.	Berth (feet)	Terminal (acres)	Container (storage acres)	Channel (feet)	Rail Access Container	Annual Capacity Notes
Jacksonville								
Other	21			120		38	ND	(1) Slated for auto processing
Savannah								
Site 1	?				212	42	?	(2) 1.7 million TEU
Site 2	?				200	42	?	(2) 1.6 million TEU
Charleston								
Jasper County	7			1,776	?	42	?	(3) 2.0 million
Other						400-600x45		(4) 2.0 million
Wilmington								
NCIP	9.5		4,000	600	?	42	?	(5) 2.0 million TEU
Norfolk								
Other								(6)
Ports/Terminals								(7) 9.3 million TEU

Notes: Rail Access for containers "ND" = "near dock," "?" indicates that rail near dock access unknown and/or non-existent at present but could be planned.
(1) Jax Port owns the Smartfitt Stone property (120) acres to the north of Talleyrand. The property is currently earmarked for automobile processing.
(2) Savannah site 1 based on 1.7 million TEU throughput. Savannah site 2 based on 1.6 million TEU throughput.
(3) Jasper County site size and development estimates likely to range above and below 2.0 million TEU per year.
(4) There are possibly other suitable properties such as Navy facilities that could be used at Charleston Harbor for further marine container development.
(5) NCIP capacity estimate likely to be "conceptual" along with the rest of the site development at this time.
(6) DEIS for the Craney Island Eastward Expansion indicates that other sites exist and were evaluated.
(7) Summation of Savannah Site 1 and Site 2, Charleston Jasper County and Other, and Wilmington NCIP.

Source: G.E.C., Inc.

III. CAPACITY METHODOLOGY

A. STATIC

Static measures of marine terminal capacity will use a critical component of throughput, usually berthage or yard area, and assume constant throughput factors for utilization. Marine container terminal capacity for containers, specified in TEUs, will typically use yard space (acres) and

assume an average number of TEU throughput per acre per year based on the following: (1) stack height; (2) stack configuration; and (3) box dwell time.

Stack height will vary for loads and empties and is affected by soil bearing strength. Most ECUS container yards can stack loaded containers at least four boxes high. Some facilities can stack loaded boxes five high. Stack configuration relates to the density of the clusters of boxes with respect to box handling systems. Box dwell time is the average duration that import and export boxes occupy yard space before discharge. Typically import boxes will average about four days of yard occupancy, and export boxes will average about three to five days of yard occupancy. Dwell times very widely by type of merchandise, steamship line, and service. Dwell time for empty boxes can be quite long, upwards of an average of thirty or more days.

Table 1 reflects prevailing static measures of marine container terminal capacity based on yard occupancy expressed as average annual throughput in TEUs. The data reflects port-specific capacity measures for container yard stowage that reflect assumptions about berth utilization and dwell time. Practically, maximum berth utilization is relatively unknown unless it is presumed as some ports do that it should be a minimum of 50 percent but not more than 75 percent of "berth occupancy." Berth congestion and delays to vessels rise exponentially above a threshold greater than 50 percent occupancy, sharply increasing beyond 75 percent occupancy. A distinction has to be made between productive berth occupancy, assuming that the vessel is working or actively preparing for working (loading/unloading cargo), and other berth occupancy characteristics not related to cargo handling such as standing by for labor, waiting for tide, and repairs.

Container yard dwell times are normally taken as a given in most trades, although there is discussion of their impact on marine container terminal capacity in the second interim report relating to institutional constraints. Traditionally, ports have focused on yard capacity as a critical measure of terminal capacity because the space of the yard and its occupancy under a set of operating circumstances (box layout, handling systems, and stacking) is much clearer to observe and measure than berth capacity or container dwell time.

For Jacksonville, the annual yard container throughput capacity was based on an average of 5,500 TEUs per acre per year.[4] The Virginia Ports Authority capped yard annual throughput capacity at 5,000 TEUs per acre per year to reflect efficient use of storage space relative to stacking density, etc. Savannah (GPA) indicates that future capacity ranges from 6,553 TEUs per acre per year to upwards of 11,115 TEUs per acre. The current maximum annual throughput capacity of the 407-acre Garden City site is said to be 2.6 million TEUs per year. This is planned to increase to 5.073 million TEUs by 2020 under three different scenarios: (1) maximum berth capacity, current dwell time, and pure Rubber Tired Gantry cranes (RTG) for loads – 639 acres and an average of 7,939 TEUs per acre per year; (2) maximum berth capacity, current dwell time, pure RTG for loads, and 50 percent of empty containers offsite – 477.5 acres and an average of 10,625 TEUs per acre; and (3) maximum berth capacity, reduced empty dwell time, pure RTG for loads – 456.4 acres and an average of 11,115 TEUs per acre.

[4] Business and Development Strategy Port of Jacksonville (April 25, 2005).

The lower TEU throughput per acre per year at Jacksonville and Norfolk, 5500 TEUs and 5,000 TEUs, respectively, compared to Savannah is in part a reflection of lower stacking capabilities resulting from soil weight bearing properties. This is a particular concern for Blount Island (dredge spoil). Also, it appears that both Norfolk and Jacksonville have used a desirable or practical working maximum stowage per acre based on a conventional forklift and top-pick box handling systems. Conversely, it appears that Savannah has sought to press toward the ultimate maximum stowage based on the use of a rubber tired gantry system (more capital intensive and slower but more intensive use of yard space), as well as some other noted measures (maximum berth capacity, reduced empty dwell time) that can increase marine terminal capacity. Because marine container terminal capacity is not absolute, higher capacities are possible, but they might not be as efficient or particularly practical other than for peak periods. Thus, at key points in a terminal operating cycle for any given stacking configuration, it may be that the stowage is over 100 percent of efficient "capacity," with boxes stacked all over (a condition that is not convenient or efficient, but may increase throughput for peak periods).

There have been gradual expansions at most of the major ports, depending on the site characteristics and options. Savannah is a good example of a single facility (Garden City Terminal) that has been progressively expanded by extending the berth and the container yard north for more space while at the same time strengthening the container yard for stacking boxes higher consistent with greater yard stowage capacity. Similarly, Norfolk has been progressively making improvements to Norfolk International Terminal for additional capacity. Other ports with older, smaller urban facilities with more limited expansion potential such as Jacksonville (Talleyrand) and Charleston have sought newer facilities (Blount Island and Wando Welch) for buildout purposes. As these newer sites have filled up, Jacksonville and Charleston have sought more space such as Dames Point and Charleston Navy Container Terminal, respectively.

Foreign ports, like domestic ports, have adjusted their capacity to meet the current demands and are concentrating their decision-making on ideas for expansion that will meet the future demand of globalization. Among the three current major benefiting vessel services at Savannah Harbor for deepening (AEX, PAX, and ZCS), such ports as Gioria Tauro, Rotterdam, and Barcelona are expanding their TEU capacity to become volume leaders among their respective services. In addition, the Port of Jeddah is aggressively expanding its volume of TEUs and experienced a 26 percent volume growth from 2003 to 2004.

B. DYNAMIC

Dynamic measures of marine container terminal capacity reflect the interaction of actual and projected box flows with the different interdependent capacity elements typically described in terms of berth, yard storage space, and gate operations. In practice, each terminal will have its own box input and output patterns relative to the capacity elements as determined by the vessel sailing schedules and associated volumes of box moves.

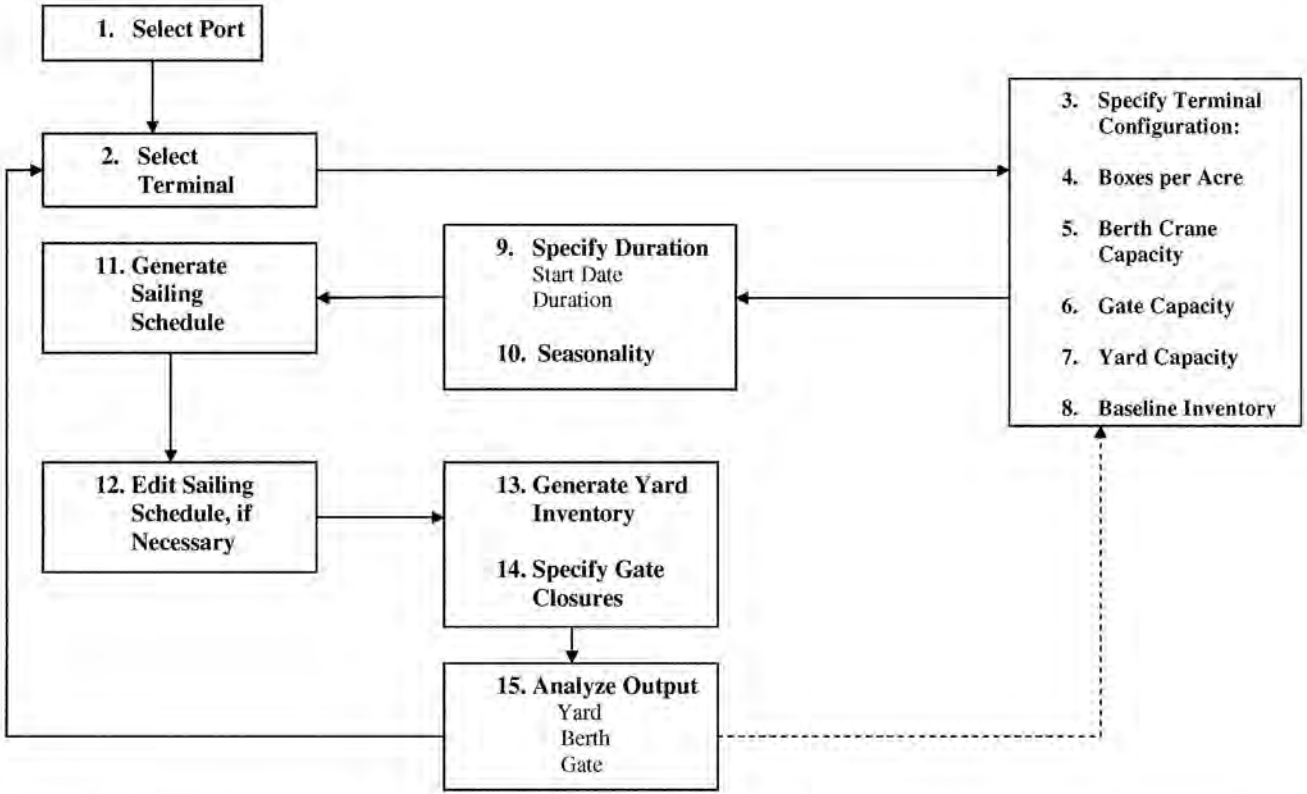
There are two general patterns of sailing schedules for marine container terminals with respect to the concentration of vessel calls and box movements during the week.[5] Sailing schedules that are clustered into part of the week will typically lead to sharply ascending and descending utilization of capacity elements. For example, a terminal with a "weekend" pattern of sailings will be nearly full shortly before and after as well as during the weekend and at a sharply lower level of capacity utilization by mid-week. Conversely, a container terminal with a more even pattern of vessel calls (and box moves) during the week will maintain a more constant level of capacity utilization.

Figures 1 and 2 display the conceptual logic of marine container terminal capacity elements. The diagrams refer to spreadsheet simulations of major U.S. marine container terminal capacities that were done nearly a decade ago to illustrate that "capacity" is not a nebulous issue or a simplistic rule of thumb but can be calculated quite carefully to reflect particular terminal characteristics and operations.

The logic and flow of Figure 1 is as follows:

1. Select Port – container capacity is estimated for particular ports and specific facilities within those ports.
2. Select Terminal – each terminal will usually have distinct physical and operating characteristics that will define the "capacity" for that facility.
3. Specify Terminal Configuration – the terminal capacity is a combination of interrelated factors as shown in items 4-8 as follows:
4. Boxes per Acre – is the facility storage capability that is determined by the stacking configurations for different sizes of boxes.
5. Berth Crane Capacity – refers to the number of cranes and effective average sustained box moves per hour for vessel loading/unloading that results in berth occupancy time by particular vessels.
6. Gate Capacity – the number of units that can pass through the gates in a defined period of working time for each day is a function of the number of gates, operating hours, and processing times for vehicles (which may be differentiated by whether the trucks have a chassis and the chassis is loaded or empty with respect to a container).
7. Yard Capacity – refers to the effective number of boxes that can be stored (as a function of box size, stack configuration, and other requirements for handling boxes) given a specified yard storage space (acres).
8. Baseline Inventory – is the effective on-hand yard inventory whenever any particular period of time is used to determine capacity and throughput (because the baseline inventory will include loaded import and export boxes on hand as well as empty containers).
9. Specify Duration – Marine terminals will reflect different levels of throughput and utilization depending on the time period relative to the vessels and cargo calling the facility. Because most major container vessel sailing schedule services are weekly, a seven-day period should reflect the general overall pattern of terminal activity with

[5] The week has been used since most major liner services are of this frequency. Therefore, other than some bi-monthly calls, the week is a typical pattern for the staging of container vessel calls and flows of import and export boxes in relation to the ship calls.



Source: "Response Model to Disruption of Maritime Transportation Systems" (Maritime Administration, U.S. Department of Transportation, August 1996).

Figure 1. Port Marine Container Model Conceptual Logic of Input-Output Relationships

10. respect to berth, yard, and gate utilization. However, when there are 10-day, bi-monthly, or monthly services (which are usually not major sources of volume), the duration of the time period used to determine terminal volumes should exceed one week.
11. Seasonality – many services have distinct seasonal patterns wherein the volume of cargo fluctuates during the year. Accordingly, seasonal adjustments to average cargo should be used to capture the throughput and utilization of the facility for peak and off-peak cargo flow periods for particular services.
12. Generate Sailing Schedule – the terminal throughput will vary based on the sailing schedule, which identifies the dates of vessel calls and departures, berth occupancy, and containers loaded and unloaded for loads and empties by box size and associated yard dwell times and stacking patterns preferred by the line, assuming not all containers are grounded but some may be left on chassis (which is declining in frequency because stacking of boxes affords more intensive use of yard storage space).
13. Edit Sailing Schedule if Necessary – allows the user to reflect any real world changes in the sailing schedule such as late or early vessel arrivals, chartered vessels (particularly at peak seasonal periods), or substitutions of larger or smaller vessels, changes in loaded or empty boxes, or associated dwell times.
14. Generate Yard Inventory – The spreadsheet will specify the number of containers, boxes by size, and type and yard storage pattern that are in the yard based on the sailing schedule information for each day assuming no gate constraints. This is an unconstrained yard inventory.
15. Specify Gate Closures – if gates are closed on a particular day(s), the yard inventory of boxes on hand will be adjusted to reflect that import boxes with predetermined dwell times (days) cannot exit the yard before the dwell time, and export boxes must enter the yard before the sailing time. Effectively, weekend or holiday gate closures will delay the exodus of import boxes and accelerate the arrival of export boxes in response to particular sailing schedules (arrivals and departures).
16. Analyze Output – the model will show the number of boxes in the yard and corresponding space utilization, berth occupancy by vessel, and gate utilization throughput for each day of the exercise.

The capacity logic reflects particular ports and terminals as a product of terminal characteristics (boxes per acre, berth crane capacity, gate capacity, yard capacity, and baseline box inventory) for a period of time (weeks and seasonal variations) in response to sailing schedules (days of the week of vessel and associated container arrivals and departures) that will result in box flows (imports, exports of loaded and empty boxes by size and associated yard dwell time distributions). The terminal configuration and the sailing schedules will determine the yard inventory of boxes at any particular time, exclusive of empty boxes.

Gate access between the terminal and public roads will affect the accumulation of boxes in the yard as a function of gate closures. Restricted gate hours, typically limited to a five-day week, excluding holidays, and open for eight to 10 hours a day means that all boxes must enter or exit the yard during these times (other than near dock rail intermodal, which does not typically rely on public streets or roads for box movements). Marine container terminal gates are typically closed during the weekends. Consequently, export boxes for Friday night, weekend sailings, and early Monday departures have to arrive at the terminal by close of business Friday. Similarly,

import boxes received late Friday through early Monday cannot be immediately discharged from the terminal until the gates open on Monday.[6]

Typically, most public marine terminals will work the berth seven days a week and upwards of twenty-four hours a day. Lines may have berthing preferences regarding the scheduling of labor shifts utilized due to overtime payments outside of the usual daylight time frame. However, berth vessel container cargo transfers will normally prevail any day of the week. Conversely, marine terminal gate operations that allow ingress and egress to the public roads, including off-dock rail intermodal, are normally closed during the weekends. Consequently, most container terminals tend to fill up during the weekends if there are related sailings.

Figure 2 represents a conceptual capacity model of a marine container terminal from the perspective of the interaction of various capacities of different elements (yard, berth, and gate) with the dynamics of the sailing schedules and services (box flows). The more or less static physical components of marine container terminal capacity in the traditional context of yard, berth, and gate elements are integrated with the dynamics of vessel sailing schedules and gate operations to compute yard inventory. The model results in calculating berth, gate, and yard utilization, integrating the physical elements with the flows of boxes from vessel schedules.

The dynamic model of container yard throughput reflects the integration of berth, yard, and gate characteristics with vessel schedules and box flows. Changes in gate operations and vessel schedules, including box dwell times, will effect capacity utilization of the marine terminal elements. For example, weekend gate operations can have a significant effect on yard capacity utilization, particularly if there are vessel calls and sailings during the weekend from late Friday until early Monday.[7] Changes in box dwell times for loads and empties also have a bearing on throughput capacity.

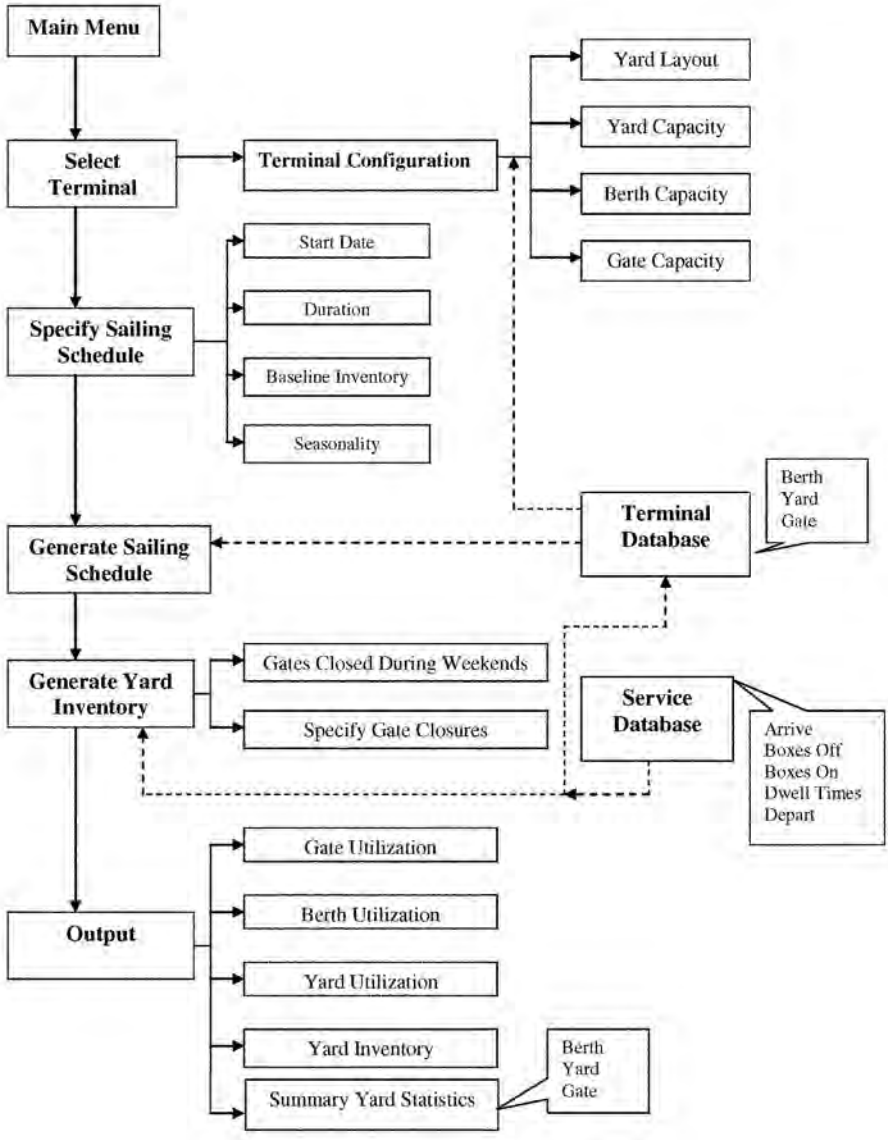
IV. CAPACITY ESTIMATES

The different approaches to marine terminal capacity described in the previous section can result in a range of estimates, depending on the methodology and the assumptions used. Because most of the public ports have "capacity" related information with regard to existing and planned container terminals, it was decided to use these public domain estimates rather than recreate them or otherwise come up with another set of estimates.

The projected number of containers (TEUs) for each port is shown in Table 4. Table 4 uses TEUs as a common measure of container volume, consistent with industry practices. However, TEU is really an artificial value because the predominant volume of containers at most U.S.

[6] There are instances in which lines will run a "late" gate on Friday or a weekend day gate. The Georgia Ports Authority runs gates on Saturday. Most public ports close gates on weekends and nights other than the exceptions noted.

[7] This assumes that local businesses would be able to make and accept deliveries of containers during the weekend, which has been problematic for marine terminals. More likely is that the distant shippers would be served by extended gate hours, allowing boxes to arrive and depart the terminal during the weekend when these businesses are typically closed for distribution operations.



Source: "Response Model to Disruption of Maritime Transportation Systems" (Maritime Administration, U.S. Department of Transportation, August 1996).

Figure 2. Model of Marine Container Terminal Systems

ports, including South Atlantic ports, is 40 to 45 foot length dimensions.[8] Consequently, converting from boxes (20-foot, 40-foot and 45-foot) to a common measure (20-foot) is an estimate. The conversion factors to translate containers of different lengths to an equivalent TEU vary among ports and industry groups, so resulting estimates of TEUs can also vary (refer to Table 4, year 2003 "loaded" versus WCSC reported TEUs).

There are also different measures of container (TEU) volume for the ports. Cargo forecasts will focus on loaded boxes, whereas port measures of throughput volume will focus on loaded and empty boxes because ports are commonly paid by lines for volumes of box throughput. Empty containers represent varying proportions of a port's total throughput, measured in TEUs or boxes. Empty containers as an institutional constraint to port capacity and throughput are discussed in greater detail in the institutional analysis component of the RPA.

Table 4 compiles the estimated number of loaded TEUs for foreign trade in 2003 from SHEP commodity projections (November 2004) and compares this with the number of loaded foreign trade TEUs reported by the Waterborne Commerce Statistics Center (WCSC).[9] Generally, the loaded TEUs for 2003 are less than the loaded TEUs of reported boxes from WCSC. For most of the ports, the fit between 2003 estimated loaded TEUs and WCSC reported loaded TEUs is close. For example, Savannah had an estimated 990,468 loaded foreign TEUs in 2003, whereas WCSC reported 1,120,839 (990,468/1,120,839 = 0.88). Charleston had 1,183,549 loaded foreign TEUs in 2003, whereas WCSC reported 1,244,587 (1,183,549/1,244,587 = 0.95). Wilmington had 65,274 loaded foreign TEUs in 2003 compared to WCSC 70,754 loaded foreign TEUs (65,274/70,754 = 0.92). Norfolk had 952,107 loaded TEUs in 2003 compared to WCSC 1,083,529 loaded TEUs (952,107/1,083,529 = 0.88).

Table 4 has a larger discrepancy between Jacksonville with 133,901 loaded foreign boxes in 2003 and the WCSC reported total of 107,871 TEUs for 2003. The Jacksonville container trade is dominated by Puerto Rico and consequently is predominantly domestic offshore. WCSC reports that the Jacksonville domestic TEU volume (loaded and empty boxes) was 463,500 in 2003.

Table 4 contains the 2004 SHEP port projections for loaded TEUs for the period 2005 through 2050. To normalize the container throughput in total TEUs, the most recent reported TEU volumes were used from the American Association of Port Authorities (AAPA) for 2005.[10] The difference between 2005 projected loaded TEUs and 2005 total reported TEUs of throughput was ascribed to "empty." Then, the total TEUs were projected using the growth of total forecasted loaded TEUs and estimated empty TEUs. For example, for Savannah Harbor the reported total TEUs of throughput in 2005 was 1.902 million. The projected loaded TEUs was 1.074 million, leaving 0.828 million as the estimated number of empty TEUs. The empty TEUs were then projected using the change in loaded TEUs for the period 2010 through 2050. The total TEUs for the period 2010 through 2050 is the sum of the projected loaded and empty TEUs

[8] 48-foot boxes are common at Jacksonville with the Puerto Rican trade.
[9] WCSC container TEUs for the port are reported to be compiled by PIERS, which has its own methodology for converting different sizes of boxes to a TEU equivalent.
[10] AAPA Advisory May 8, 2006, "North American Port Container Traffic 2005."

for this period, using 2005 reported total TEUs (loaded and empty) as the baseline for future projections.[11]

Table 4. Projected TEUs for South Atlantic Ports, 2005-2050

Port		2003	2005	2010	2015	2020	2030	2040	2050
Jacksonville	Imports	39,632	207,389	285,008	360,091	453,996	722,891	1,093,184	1,540,227
	Exports	94,269	99,299	112,183	122,307	135,491	181,511	285,999	500,993
	Loaded	133,901	306,688	397,191	482,398	589,487	904,402	1,379,183	2,041,220
	Empty		470,630	609,512	740,267	904,601	1,387,856	2,116,434	3,132,367
	Total		**777,318**	1,006,703	1,222,665	1,494,088	2,292,258	3,495,617	5,173,587
	WCSC	107,871							
Savannah	Imports	602,107	664,876	916,546	1,105,626	1,310,895	1,848,206	2,585,808	3,527,589
	Exports	388,361	408,991	420,447	442,855	488,149	637,739	945,571	1,543,369
	Loaded	990,468	1,073,867	1,336,993	1,548,481	1,799,044	2,485,945	3,531,379	5,070,958
	Empty		827,653	1,030,450	1,193,448	1,386,563	1,915,973	2,721,712	3,908,299
	Total		**1,901,520**	2,367,443	2,741,929	3,185,607	4,401,918	6,253,091	8,979,257
	WCSC	1,120,839							
Charleston	Imports	756,533	766,376	1,053,532	1,282,451	1,522,373	2,125,422	2,917,229	3,905,324
	Exports	427,016	449,301	505,916	567,983	648,299	895,918	1,364,276	2,196,283
	Loaded	1,183,549	1,215,677	1,559,448	1,850,434	2,170,672	3,021,340	4,281,505	6,101,607
	Empty		770,909	988,908	1,173,434	1,376,509	1,915,952	2,715,072	3,869,271
	Total		**1,986,586**	2,548,356	3,023,868	3,547,181	4,937,292	6,996,577	9,970,878
	WCSC	1,244,587							
Wilmington	Imports	45,717	92,810	139,503	182,438	230,356	357,183	533,105	770,210
	Exports	19,557	21,143	24,479	28,956	36,222	71,517	178,500	435,375
	Loaded	65,274	113,953	163,982	211,394	266,578	428,700	711,605	1,205,585
	Empty		34,831	50,123	64,615	81,483	131,037	217,510	368,500
	Total		**148,784**	214,105	276,009	348,061	559,737	929,115	1,574,085
	WCSC	70,754							
Norfolk	Imports	631,842	747,670	986,995	1,137,987	1,297,150	1,719,736	2,294,811	3,028,714
	Exports	320,265	391,428	419,754	447,059	488,878	640,788	993,433	1,720,759
	Loaded	952,107	1,139,098	1,406,749	1,585,046	1,786,028	2,360,524	3,288,244	4,749,473
	Empty		842,857	1,040,901	1,172,829	1,321,542	1,746,631	2,433,083	3,514,295
	Total		**1,981,955**	2,447,650	2,757,875	3,107,570	4,107,155	5,721,327	8,263,768
	WCSC	1,083,529							
Total			6,796,163	8,584,257	10,022,346	11,682,507	16,298,359	23,395,726	33,961,576

Notes: Imports and Exports are loaded TEUs from SHEP Commodity Projections.
"Loaded" is the sum of Import and Export TEUs from SHEP Commodity Projections.
"Total" is the number of TEUs (loaded and empty) reported by American Association Port Authorities (May 8, 2006).
"Empty" is the difference between "Total" and "Loaded" TEUs.
"WCSC" is the total number of loaded foreign import and export TEUs reported by Waterborne Commerce Statistics Center (2003).
Jacksonville TEUs for foreign and domestic were reported by WCSC to be 568,090.
Norfolk TEUs for foreign and domestic were reported by WCSC to be 1,211,332.

Source: Savannah Harbor Expansion Project Deep-Draft Channel Improvements Economic Analysis: Commodity Projections (Final Report, November 2004).

There is a discrepancy between the total projected TEUs (loaded) for Jacksonville for 2005 and the total reported TEUs handled by the port (loaded and empty) such that the estimated empty

[11] This assumes that empty TEUs will grow in proportion to loaded TEUs. In practice, empty TEUs may grow faster than loaded TEUs, particularly if imports are increasing faster than exports.

TEUs (0.471 million) is larger than the projected loaded TEUs. The Jacksonville discrepancy between lower projected number of loaded TEUs and actual TEUs seems to arise out of the port's dependence on domestic offshore TEUs as noted earlier. Although the adjustment for total TEUs of throughput for Jacksonville is regarded to be robust, the proportion of loaded and empty TEUs does not seem accurate owing to the large spread between projected foreign TEUs and actual foreign and domestic TEUs.

The capacity estimates in tables 1, 2, and 3 for the existing, planned, and other potential marine container terminal sites are compiled for each port in Table 5 with projected demand from Table 4. The capacity of existing marine terminals for all the ports is 10.176 million TEUs compared to 2005 existing throughput of 6.797 million TEUs. Figure 3 shows the annual capacity of existing marine container terminals and existing 2005 throughput for Jacksonville, Savannah, Charleston, Wilmington, and Norfolk. The average annual capacity utilization will mask seasonal fluctuations in volume for the ports. Ports will prefer a lower capacity utilization for yard space because stacking will be less dense, resulting in less costly box handling associated with gate and berth movements into and out of the yard.[12]

Table 5 shows the projected TEUs of throughput for the ports for the period 2010 through 2050. Figures 4, 5, 6, 7, and 8 show the total TEUs of port capacity (existing, developing, and other potential terminals) with projected growth in annual throughput demand from Table 5 for the ports of Jacksonville, Savannah, Charleston, Wilmington, and Norfolk, respectively. The 2004 SHEP projections for loaded TEUs for Norfolk and the South Atlantic ports (Wilmington through Jacksonville) were used to adjust the 2005 throughput of total TEUs to reflect actual volume of boxes. For the individual ports, the data indicates the buildup of forecasted throughput compared to the capacity from existing, developing, and other possible terminals.

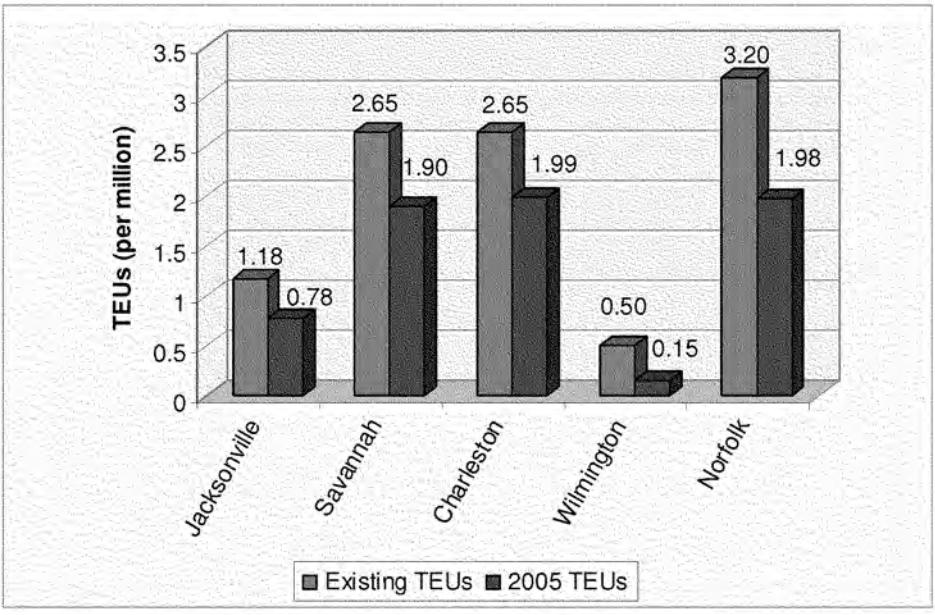
A more robust measure of existing and forthcoming port capacity is used to rely on existing and developing terminals, excluding other potential terminals. For Savannah, the existing and developing terminals will have a capacity of 5.073 million TEUs (2.652 + 2.421 = 5.073) compared to projected throughput of 4.402 million TEUs by 2030 and 6.253 million TEUs by 2040. Similarly, for Charleston the existing and developing (Charleston Navy Container Terminal) facilities will have a capacity of 4.076 million TEUs (2.646 + 1.430 = 4.076). This indicates that Charleston would have sufficient container capacity beyond 2020 when projected demand is 3.547 million TEUs. Norfolk would be comparatively well established for marine container terminal capacity, with the full buildout of three existing terminals (3.200 million TEUs) and the full buildout of the Maersk-SeaLand and Craney Island terminals (4.660 million TEUs), amounting to a total capacity of 7.860 million TEUs. This would be sufficient beyond 2040, with a projected throughput demand of 5.721 million TEUs.

[12] Marine container yards that operate at high levels of capacity (exceeding 90 percent) are regarded as congested and have higher box handling costs associated with nearly full stacks. From an operations efficiency perspective, container terminals prefer more space and less dense box stacking rather than full terminals as a measure of efficient use of space.

Table 5. Estimated TEU Annual Capacity of South Atlantic Ports, Existing, Developing, and Other Terminals (000,000)

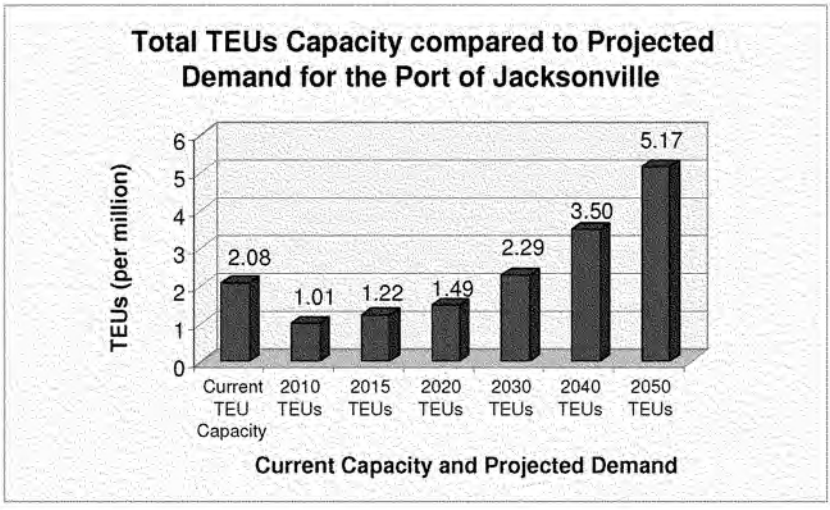
Ports	Terminals	TEUs	2005 TEUs	2010 TEUs	2015 TEUs	2020 TEUs	2030 TEUs	2040 TEUs	2050 TEUs
Jacksonville	Existing	1.178	0.777						
	Developing	0.900							
	Other								
	Total	2.078		1.007	1.223	1.494	2.292	3.496	5.174
Savannah	Existing	2.652	1.902						
	Developing	2.421							
	Other	3.300							
	Total	8.373		2.367	2.741	3.185	4.402	6.253	8.979
Charleston	Existing	2.646	1.987						
	Developing	1.430							
	Other	2.000							
	Total	6.076		2.548	3.023	3.547	4.937	6.997	9.971
Wilmington	Existing	0.500	0.149						
	Developing								
	Other	2.000							
	Total	2.500		0.214	0.276	0.348	0.560	0.929	1.574
Norfolk	Existing	3.200	1.982						
	Developing	4.660							
	Other								
	Total	7.860		2.448	2.758	3.108	4.107	5.721	8.264
Total	Existing	10.176	6.797						
	Developing	9.411							
	Other	7.300							
	Total	26.887		8.584	10.021	11.682	16.298	23.396	33.962

Source: G.E.C., Inc.



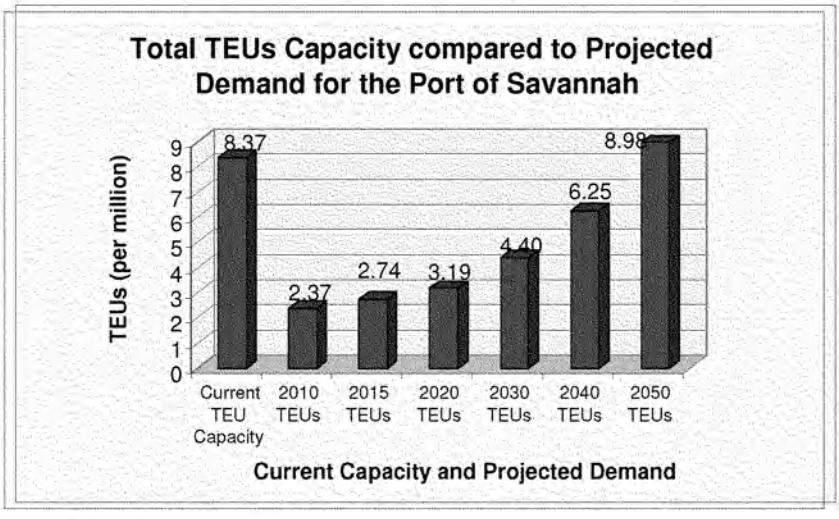
Source: Table 1.

Figure 3. Existing TEU Annual Capacity Compared to 2005 TEUs Throughput for Selected South Atlantic Ports



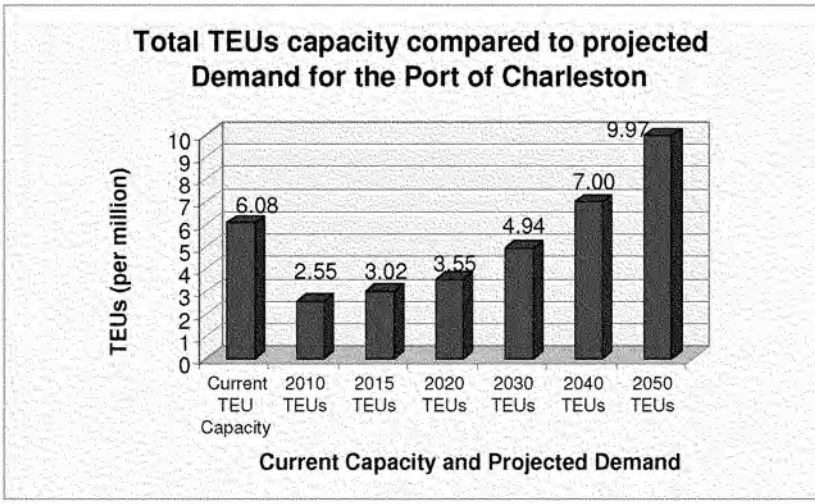
Source: Table 5.

Figure 4. Total TEU Capacity Compared to Projected Demand for the Port of Jacksonville



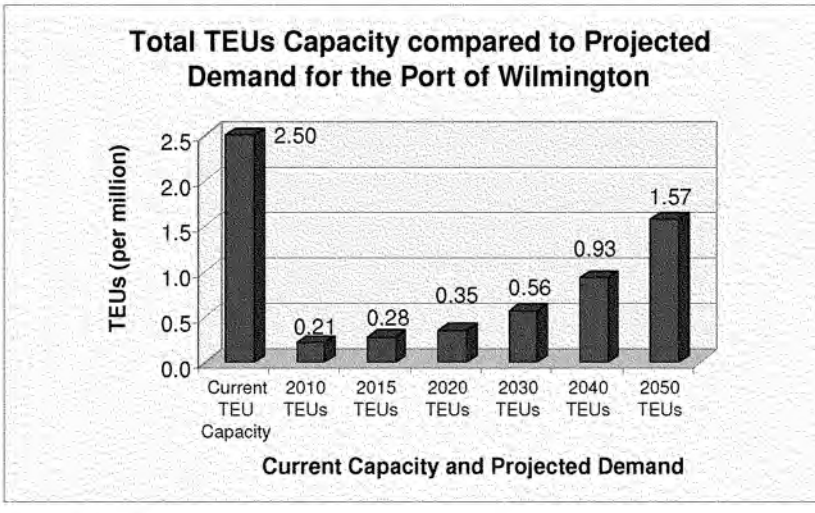
Source: Tables 1, 2, 3, and 4.

Figure 5. Total TEU Capacity Compared to Projected Demand for the Port of Savannah



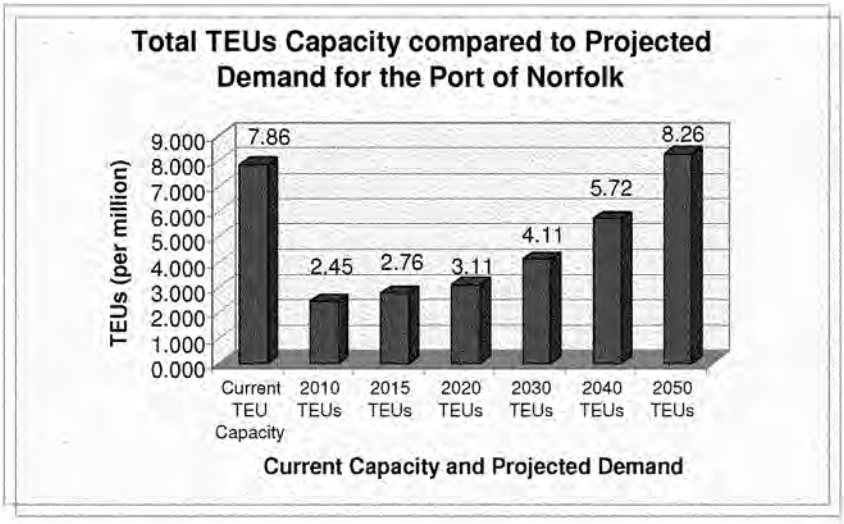
Source: Table 5.

Figure 6. Total TEU Capacity Compared to Projected Demand for the Port of Charleston



Source: Table 5.

Figure 7. Total TEU Capacity Compared to Projected Demand for the Port of Wilmington



Source: Table 5.

Figure 8. Total TEU Capacity Compared to Projected Demand for the Port of Norfolk

The smaller container ports in Table 5 (Jacksonville and Wilmington) have different settings for capacity utilization. Jacksonville has nearly fully developed existing marine terminals (Talleyrand and Blount Island) for 1.178 million TEUs and is developing Dames Point for 0.900 million TEUs, for a total of 2.078 million TEUs.[13] Projected growth for Jacksonville is 2.292 million TEUs by 2030.

Wilmington is very different from Jacksonville, with a largely underutilized existing facility (0.500 million TEUs) and a large potential facility, the NCIP (2.000 million TEUs). Unless Wilmington is able to wrestle market share away from other ports, the existing facility would be capable of handling projected TEUs of throughput outward to 2030 (0.560 million TEUs). Clearly, the potential for a NCIP would be to divert some of the projected growth at other South Atlantic ports to Wilmington.

Table 5 indicates that the annual capacity of the existing marine container terminals (10.176 million TEUs) would be sufficient until 2015 when throughput is projected to be 10.021 million TEUs. Excluding Norfolk and Wilmington, the capacity of the existing marine container terminals at Charleston, Savannah, and Jacksonville would be 6.476 million TEUs, compared to 5.922 million TEUs of demand throughput by 2010 (2.548 + 2.367 + 1.007 = 5.922). However,

[13] The three terminals at Jacksonville are all mixed with regard to significant space dedicated to containers and other cargoes.

full buildout of developing terminals at Charleston, Savannah, and Jacksonville will add 4.751 million TEUs of capacity (1.430 + 2.421 + 0.900 = 4.751).

Omitting Jacksonville, Charleston and Savannah as the main traditional South Atlantic container ports still have 5.298 million TEUs of capacity at existing marine terminals that would be sufficient to accommodate projected throughput demand in 2010 of 4.915 million TEUs (2.548 + 2.367 = 4.915), but not by 2015 with a projected throughput demand of 5.764 million TEUs (3.023 + 2.741 = 5.764). Moreover, Charleston and Savannah would have an additional 3.851 million TEUs of developing capacity from the Charleston Navy Container Terminal (1.430 million TEUs) and full buildout of the Garden City Terminal (2.421 million additional TEUs). The full buildout of existing and developing facilities at these ports would be an annual total capacity of 8.766 million TEUs, which would be sufficient for throughput demand beyond 2020 at 6.732 million TEUs (3.547 + 3.185 = 6.732), but not in 2030 when throughput is projected to be 9.339 million TEUs (4.937 + 4.402 = 9.339).

V. HUB/SPOKE ANALYSIS

A. INTRODUCTION

The purpose of a hub and spoke analysis is to assess the throughput of regional cargo from a load center port perspective analogous to an airline hub airport situation. The marine container literature has been replete with load center port references that would serve as hubs that consolidate cargo for smaller satellite ports. Analogous to airlines large capacity vessels with economies of scale would move substantial cargo volumes between hub ports while smaller capacity vessels would serve outlying ports that have lower volumes. The hub and spoke concept envisions a matching of capacity and costs among hubs and ports such that the economies of scale for services between hubs are combined with the economies of smaller better utilized vessels for the services between hubs and outlying (spoke) ports.

In the absence of a specific vessel operation plan the hub and spoke port development concept was analyzed by the capability of shifting existing capacity and or demand (TEUs) among the existing ports to a possible South Atlantic coast hub port. The concept was that the "hub" port would be sufficiently large to absorb the capacity of other ports or their future increases in TEUs as a result of regional port load centering.

Table 6 shows the capacity of existing, developing, and other potential terminals for the South Atlantic container ports. The data are depicted in Figure 9. The five ports have (as previously noted) 10.176 million TEUs of annual capacity for existing terminals and 9.411 million TEUs of annual capacity for developing terminals. Total existing and developing terminal annual capacity is 19.587 million TEUs. This would be sufficient for demand throughput beyond 2030 (roughly 2035).

The ports' annual capacity data in Table 6 is systematically recast, dropping one of the port's capacity but retaining its projected demand. The data depicted in figures 10, 11, 12, 13, and 14

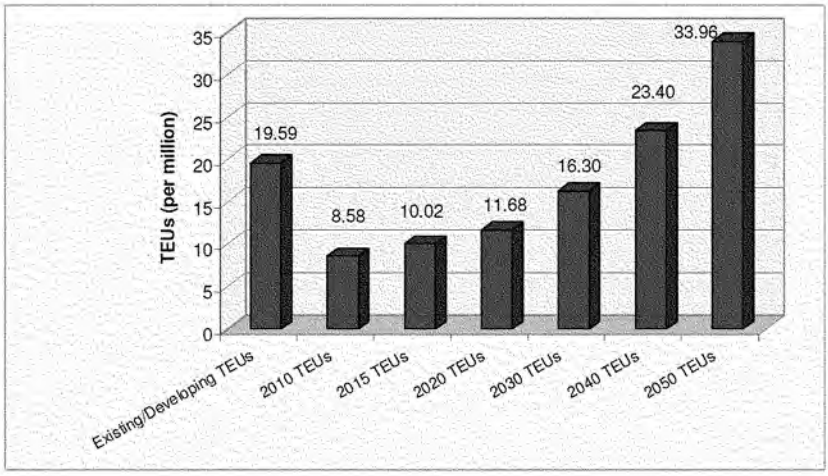
are for exclusions of capacity of Norfolk, Wilmington, Charleston, Savannah, and Jacksonville, respectively.

Table 6. Estimated TEU Annual Capacity of Total South Atlantic Ports, Existing, Developing, and Other Terminals, Excluding One Port (000,000)

Ports	Terminals	TEUs	2005 TEUs	2010 TEUs	2015 TEUs	2020 TEUs	2030 TEUs	2040 TEUs	2050 TEUs
	Capacity								
Total	Existing	10.176	6.797						
	Developing	9.411							
	Subtotal	**19.587**							
	Other	7.300							
	Total	26.887		8.584	10.021	11.682	16.298	23.396	33.962
Total, ex Norfolk	Existing	6.976	6.797						
	Developing	4.751							
	Subtotal	**11.727**							
	Other	7.300							
	Total	19.027		8.584	10.021	**11.682**	16.298	23.396	33.962
Total, ex Wilmington	Existing	9.676	6.797						
	Developing	9.411							
	Subtotal	**19.087**							
	Other	5.300							
	Total	24.387		8.584	10.021	11.682	**16.298**	23.396	33.962
Total, ex Charleston	Existing	7.530	6.797						
	Developing	7.981							
	Subtotal	**15.511**							
	Other	5.300							
	Total	20.811		8.584	10.021	11.682	**16.298**	23.396	33.962
Total, ex Savannah	Existing	7.524	6.797						
	Developing	6.990							
	Subtotal	**14.514**							
	Other	4.000							
	Total	18.514		8.584	10.021	**11.682**	16.298	23.396	33.962
Total, ex Jacksonville	Existing	8.998	6.797						
	Developing	8.511							
	Subtotal	**17.509**							
	Other	7.300							
	Total	24.809		8.584	10.021	11.682	**16.298**	23.396	33.962

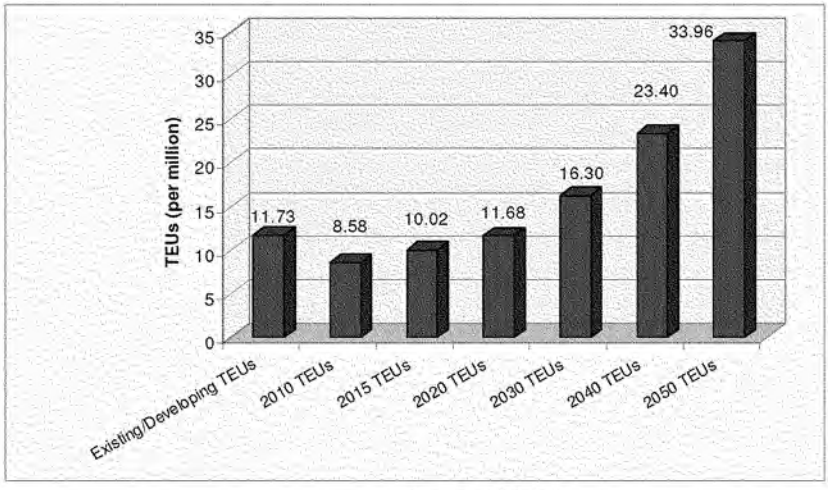
Notes: Growth TEUS represent the difference between projected TEUs (2010 - 2050) and 2005 actual TEUs.
Bold entries for existing and developing capacity (subtotal) correspond to nearest projected throughput demand, 2010 to 2050, in bold.

Source: G.E.C., Inc.



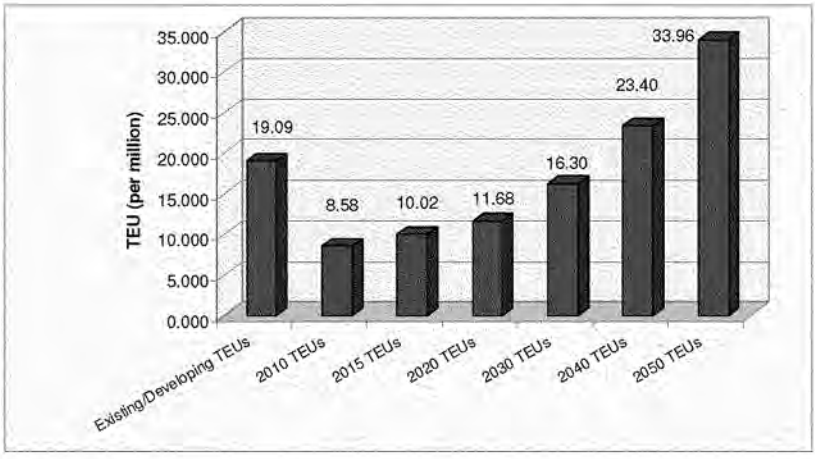
Source: Table 5.

Figure 9. Total Capacity Existing and Developing TEUs for All Selected South Atlantic Ports Compared to Estimated TEU Annual Throughput (2010-2050)



Source: Table 6

Figure 10. Existing and Developing TEU Capacity South Atlantic Ports Excluding Port of Norfolk Compared to Estimated TEU Annual Throughput – All Ports

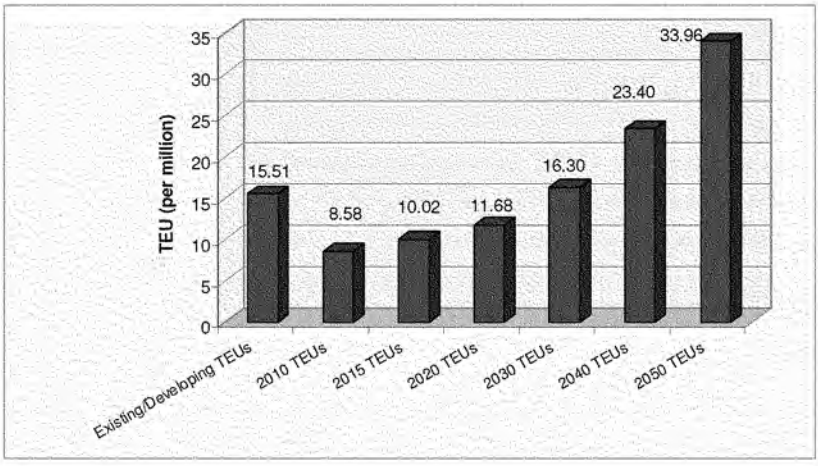


Source: Table 6.

Figure 11. Existing and Developing TEU Capacity South Atlantic Ports Excluding Port of Wilmington Compared to Estimated TEU Annual Throughput – All Ports

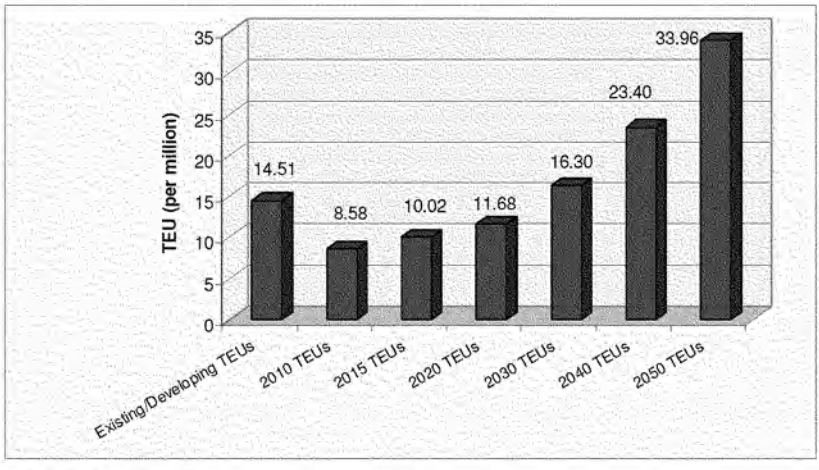
Excluding Norfolk (Figure 10), the existing and developing annual terminal capacity would be 11.727 million TEUs (6.976 + 4.751 = 11.727 million TEUs), which would be sufficient for all projected demand, including Norfolk, until 2020 (11.682 million TEUs). Excluding Wilmington (Figure 11), the existing and developing annual terminal capacity would be 19.087 million TEUs (9.676 + 9.411 = 19.087 million TEUs). This would be sufficient to serve total projected demand beyond 2030 (roughly 2035).

Excluding Charleston (Figure 12), the existing and developing annual terminal capacity would be 15.511 million TEUs (7.530 + 7.981 = 15.511 million TEUs), which would be sufficient for all projected demand, including Charleston, until nearly 2030 (16.298 million TEUs). Excluding Savannah (Figure 13), the existing and developing annual terminal capacity would be 14.514 million TEUs (7.524 + 6.990 = 14.514 million TEUs), which would be sufficient for all projected demand between 2020 and 2030. Finally, excluding Jacksonville (Figure 14), the existing and developing annual terminal capacity would be 17.509 million TEUs (8.998 + 8.511 = 17.509 million TEUs), which would be sufficient to meet projected demand past 2030.



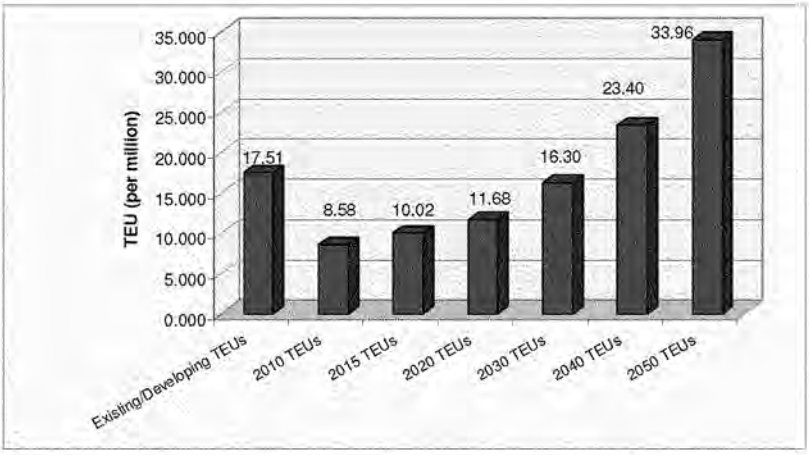
Source: Table 6.

Figure 12. Existing and Developing TEU Capacity South Atlantic Ports Excluding Port of Charleston Compared to Estimated TEU Annual Throughput – All Ports



Source: Table 6.

Figure 13. Existing and Developing TEU Capacity South Atlantic Ports Excluding Port of Savannah Compared to Estimated TEU Annual Throughput – All Ports



Source: Table 6.

Figure 14. Existing and Developing TEU Capacity South Atlantic Ports Excluding Port of Jacksonville Compared to Estimated TEU Annual Throughput – All Ports

Table 6 indicates that the two smallest ports relative to capacity of existing and developing terminals and demand (Wilmington and Jacksonville) have the least effect on capacity utilization at the major ports (Norfolk, Charleston, and Savannah). The most substantial effects on capacity utilization in the South Atlantic occur when shifts from the major ports (Norfolk, Charleston, and Savannah) are envisioned. The data indicate that the major ports all have substantial existing and projected container volumes as well as significant existing and developing marine terminal capacity. It is not readily apparent that selecting the best port for expansion purposes with the volumes currently handled and projected could be efficiently undertaken given the substantial existing and projected traffic at these ports.

B. ASSUMPTIONS

A hub and spoke port analysis requires a substantial number of assumptions related to but exceeding the framework described earlier for port capacity assessment. Foremost among the hub and spoke assumptions is whether the hub will be domestic or foreign with respect to location. A domestic hub would reflect the shift of cargo away from an existing port, effectively resembling a load centering of containers. Boxes would be moved between the load center port and the hinterland by alternative domestic land routes.[14] A foreign hub port would reflect an

[14] Alternatively, boxes could be moved by ocean barge between the load center port and other ports, incurring double handling at marine terminals.

offshore port that would require transshipment of boxes between itself and domestic ports. There is a limited model of this form of transfer already in place with some feeder service, for example between Freeport and Jacksonville.

1. Domestic Hub

Container ports are relatively seamless with respect to the ability to transfer cargo among them. This is particularly true for adjacent container ports on the same coast that share similar highway and rail networks (for example, Savannah and Charleston). Accordingly, it is not unusual for lines to issue shipper bill of ladings at a port but move the box through an adjacent container port. For example, a line might issue a Jacksonville bill of lading and then truck the box to Savannah for shipment.

One way to conceptually address load centering is to look at the effects on the port's capacity utilization of shifting growth cargo to adjacent ports. Growth cargo is a euphemism for new or expanded services that would be shifted to load center ports. Practically, existing cargo would remain at the "zero growth" port, although some might realign as part of shifts in lines' services that would accompany load centering. Overall, the effect would be to freeze existing cargo levels at particular ports and reallocate this growth in cargo volume to adjacent hub ports.

Table 7 presents the projected containerized cargo growth projected at the ports during the period 2005 to 2050. Total growth for the five ports is 1.787 million TEUs during the period 2005 to 2010, nearly doubling to 3.224 TEUs by 2015. The data indicate that the major ports (Norfolk, Charleston, and Savannah) will experience nearly 0.5 million growth in TEUs each during the period 2005 to 2010 and slightly less in the ensuing five-year periods of 2010 to 2015 and 2015 to 2020.

Table 8 shows shifting growth in projected total containers after 2005 among adjacent or otherwise close ports to simulate hub port alignments. In Table 8, Savannah growth is shifted to Jacksonville, Charleston, or Wilmington; Jacksonville growth is shifted to Savannah; Charleston growth is shifted to Savannah or Wilmington; Norfolk growth is shifted to Wilmington; and Wilmington growth is shifted to Charleston or Norfolk.

The key measure in Table 8 is the effect of the shifts in adjacent port container growth on hub port capacity utilization, particularly for the existing and developing terminal capacities that seem more certain than the other potential new terminal capacity. If the hub port throughput capacity utilization is likely to be substantially impacted by shifts in growth traffic from an adjacent port, it would not appear to be a feasible candidate as a hub, other things being equal. Conversely, if shifting of container growth traffic from adjacent ports to a hub port has no substantial impact on capacity utilization, it would appear to be a feasible candidate as a hub, other things being equal.

Table 7. Estimated TEU Annual Capacity and Throughput Growth at South Atlantic Ports (000,000)

Ports	Terminals	TEUs	2005 TEUs	2010 TEUs	2015 TEUs	2020 TEUs	2030 TEUs	2040 TEUs	2050 TEUs
Jacksonville	Existing	1.178	0.777						
	Developing	0.900							
	Other								
	Total	2.078		1.007	1.223	1.494	2.292	3.496	5.174
	Growth TEUs			0.230	0.446	0.717	1.515	2.719	4.397
Savannah	Existing	2.652	1.902						
	Developing	2.421							
	Other	3.300							
	Total	8.373		2.367	2.741	3.185	4.402	6.253	8.979
	Growth TEUs			0.465	0.839	1.283	2.500	4.351	7.077
Charleston	Existing	2.646	1.987						
	Developing	1.430							
	Other	2.000							
	Total	6.076		2.548	3.023	3.547	4.937	6.997	9.971
	Growth TEUs			0.561	1.036	1.560	2.950	5.010	7.984
Wilmington	Existing	0.500	0.149						
	Developing								
	Other	2.000							
	Total	2.500		0.214	0.276	0.348	0.560	0.929	1.574
	Growth TEUs			0.065	0.127	0.199	0.411	0.780	1.425
Norfolk	Existing	3.200	1.982						
	Developing	4.660							
	Other								
	Total	7.860		2.448	2.758	3.108	4.107	5.721	8.264
	Growth TEUs			0.466	0.776	1.126	2.125	3.739	6.282
Total	Existing	10.176	6.797						
	Developing	9.411							
	Other	7.300							
	Total	26.887		8.584	10.021	11.682	16.298	23.396	33.962
	Growth TEUs			1.787	3.224	4.885	9.501	16.599	27.165

Notes: Growth TEUS represent the difference between projected TEUs (2010 - 2050) and 2005 actual TEUs.

Source: G.E.C., Inc.

Table 8. Estimated TEU Annual Capacity and Shifting Throughput Growth at South Atlantic Ports (000,000)

Ports	Terminals	TEUs	2005 TEUs	2010 TEUs	2015 TEUs	2020 TEUs	2030 TEUs	2040 TEUs	2050 TEUs
Jacksonville	Existing	1.178	0.777						
	Developing	0.900							
	Other								
	Total	2.078		1.007	1.223	1.494	2.292	3.496	5.174
Savannah	Growth TEUs			0.465	0.839	1.283	2.500	4.351	7.077
Subtotal				1.472	2.062	2.777	4.792	7.847	12.251
Savannah	Existing	2.652	1.902						
	Developing	2.421							
	Other	3.300							
	Total	8.373		2.367	2.741	3.185	4.402	6.253	8.979
Jacksonville	Growth TEUs			0.230	0.446	0.717	1.515	2.719	4.397
Subtotal				2.597	3.187	3.902	5.917	8.972	13.376
Savannah	Existing	2.652	1.902						
	Developing	2.421							
	Other	3.300							
	Total	8.373		2.367	2.741	3.185	4.402	6.253	8.979
Charleston	Growth TEUs			0.561	1.036	1.56	2.95	5.01	7.984
Subtotal				2.928	3.777	4.745	7.352	11.263	16.963
Charleston	Existing	2.646	1.987						
	Developing	1.430							
	Other	2.000							
	Total	6.076		2.548	3.023	3.547	4.937	6.997	9.971
Savannah	Growth TEUs			0.465	0.839	1.283	2.500	4.351	7.077
Subtotal				3.013	3.862	4.830	7.437	11.348	17.048
Charleston	Existing	2.646	1.987						
	Developing	1.430							
	Other	2.000							
	Total	6.076		2.548	3.023	3.547	4.937	6.997	9.971
Wilmington	Growth TEUs			0.065	0.127	0.199	0.411	0.780	1.425
Subtotal				2.613	3.150	3.746	5.348	7.777	11.396
Wilmington	Existing	0.500	0.149						
	Developing								
	Other	2.000							
	Total	2.500		0.214	0.276	0.348	0.560	0.929	1.574
Savannah	Growth TEUs			0.465	0.839	1.283	2.500	4.351	7.077
Subtotal				0.679	1.115	1.631	3.060	5.280	8.651
Wilmington	Existing	0.500	0.149						
	Developing								
	Other	2.000							
	Total	2.500		0.214	0.276	0.348	0.560	0.929	1.574
Charleston	Growth TEUs			0.561	1.036	1.560	2.950	5.010	7.984
Subtotal				0.775	1.312	1.908	3.510	5.939	9.558
Wilmington	Existing	0.500	0.149						
	Developing								
	Other	2.000							
	Total	2.500		0.214	0.276	0.348	0.560	0.929	1.574
Norfolk	Growth TEUs			1.787	3.224	4.885	9.501	16.599	27.165
Subtotal				2.001	3.500	5.233	10.061	17.528	28.739
Norfolk	Existing	3.200	1.982						
	Developing	4.660							
	Other								
	Total	7.860		2.448	2.758	3.108	4.107	5.721	8.264
Wilmington	Growth TEUs			0.065	0.127	0.199	0.411	0.780	1.425
Subtotal				2.513	2.885	3.307	4.518	6.501	9.689
Total	Existing	10.176	6.797						
	Developing	9.411							
	Other	7.300							
	Total	26.887		8.584	10.021	11.682	16.298	23.396	33.962

Notes: Growth TEUS represent the difference between projected TEUs (2010 - 2050) and 2005 actual TEUs.

Source: G.E.C., Inc.

Shifting Savannah container growth to Jacksonville would essentially exhaust the port's existing and developing terminal container capacity by 2015 (2.062 million TEUs of throughput demand compared to 2.078 million TEUs of throughput capacity). Shifting Jacksonville container growth to Savannah would accelerate the port's full utilization of total capacity by nearly a decade, from approximately 2050 (8.979 million TEUs of Savannah throughput demand versus 8.373 million TEUs of throughput capacity) to 2040 (8.972 million TEUs of Savannah and Jacksonville growth throughput demand).

Shifting Charleston growth to Savannah would essentially fill existing and developing terminals (5.073 million TEUs of annual capacity) by 2020 with 4.745 million TEUs of throughput demand. If Savannah developed the other potential terminals for a total annual throughput capacity of 8.373 million TEUs, it would be fully occupied in the early part of the 2030 decade compared to nearly 2050 without Charleston growth.

Shifting Savannah growth to Charleston would quickly fill the 4.976 million TEUs of annual throughput capacity of the existing and developing terminals by 2020 compared to 2030 without Savannah growth shifted to Charleston. Possible other Charleston expansion (such as Jasper County) would accommodate Savannah growth until the mid-2020s (Charleston and Savannah growth throughput would be 4.830 million TEUs in 2020 and 7.437 million TEUs in 2030), unless the other potential terminal site had more than 2.0 million TEUs of annual throughput capacity.

Shifting Wilmington growth to Charleston would not present much of a problem relative to existing and developing container capacity. Charleston with just over 4.0 million TEUs of annual existing and developing terminal capacity would still have sufficient capacity into the early part of the 2020 decade.

Shifting Savannah or Charleston growth to Wilmington would engulf the port in TEUs. Capacity of the existing Wilmington facility, estimated to be fully developable to 0.5 million TEUs throughput annually, would be exceeded before 2010. Initial capacity estimates of the NCIP (2.0 million TEUs annually) would be exceeded early in the 2020 decade.

Shifting Wilmington growth to Norfolk would not present much of a problem relative to existing and developing container capacity. Norfolk would still have sufficient annual throughput capacity (7.860 million TEUs) into the decade of 2040.

The "growth TEUs" in Table 8 are quite large, starting at 1.787 million between 2005 and 2010 and increasing to 3.224 million by 2015 and 4.884 million by 2020. The developing Charleston Navy Container Terminal (CNCT), with 1.430 million TEUs of total annual throughput capacity, would need to be created to absorb most but not all of the five-year growth in South Atlantic TEUs from 2005 to 2010, 2010 to 2015, 2015 to 2020, and so on. Excluding Norfolk, the projected growth in TEUs at Charleston and Savannah is nearly 1.0 million between 2005 and 2010 (0.561 and 0.465 = 1.026 million TEUs) and 2.0 million TEUs between 2005 and 2015 (1.036 + 0.839 = 1.875 million TEUs). Effectively, a major new terminal with 2.0 million TEUs of capacity would have to be opened to handle the projected container growth traffic of Savannah and Charleston between 2005 and 2015.

2. Foreign Hub

Growth TEUs at one or more domestic ports could be handled offshore through a transshipment facility that would use smaller vessels for delivery to domestic ports. Previously, it was noted that the projected TEU growth at major South Atlantic ports such as Savannah and Charleston is a combined total of nearly 1.0 million TEUs for the five-year periods between 2005 and 2020. By 2020, growth TEUs from 2005 are projected to be 1.283 million at Savannah and 1.560 million at Charleston. Effectively, Savannah and Charleston would require an overseas marine container terminal with upwards of 2.0 million TEUs of throughput capacity annually by 2015 to accommodate their TEU growth traffic.

C. PERFORMANCE OF HUBS

To be effective, hub or load center ports must provide competitive cost and service characteristics. A qualitative discussion of these issues follows for domestic and foreign hubs.

1. Cost

Domestic hub ports from a cost perspective would perform similarly to spoke ports except for landside freight cost differences for longer routings. The multiport analysis demonstrates that there is a considerable degree of overlap between adjacent South Atlantic ports, particularly Savannah and Charleston, for a truck-served hinterland, with relatively small differences in least total delivered transportation cost. Port handling costs would be similar at the major ports in the absence of congestion.

A foreign hub port would have a considerable cost disadvantage from the perspective of double port handling of containers shuttled to domestic spoke ports. The double handling of containers could easily add another $150 to $250 per box associated with transshipment port costs. Unless the mother vessel calling at the foreign port had very substantial economies of scale compared to the use of distinctly smaller vessels (not regularly calling U.S. South Atlantic container ports) with direct services, the extra handling costs will increase the shippers' freight costs with no other benefits.

2. Performance

It is not likely that a domestic hub port would add appreciable transit time to domestic containers compared to spoke ports. It would appear that a domestic hub port might add up to a day of transit time to serve more distant hinterlands compared to spoke ports. Transit time differences less than one day can be ignored, and transit times of one day can be subsumed in supply chain procurement systems.

Offshore hub ports would likely add several days of transit time for domestic boxes. Although the time required for transshipment is not substantial, there will be schedule delays if the connecting services are weekly in frequency. Conceivably, foreign hub ports could add several days of average transit time for U.S. spoke ports. Shippers generally would not find this acceptable unless there were offsetting freight cost savings.

APPENDIX

Appendix

THE REGIONAL PORTS

OVERVIEW

What the various ports have in mind with respect to prospective container cargoes is not always clear because some of the ports lack comprehensive plans. When planning documents have been prepared, their contents are sometimes not readily available to the public. Of those that are available, some are not based on detailed commodity projections or an indication of how market share might be obtained. Many of the expansion plans appear to be predicated on an understanding of general trends, with assumptions about the capacity to acquire market share based on experience, opportunity, and intent. This has led to questions on the part of port analysts about potential overcapacity on the part of individual ports and the ports collectively. These questions are usually not raised in circumstances where expansion planning is based on private-sector initiatives.

NORFOLK

The Virginia Port Authority (VPA) owns the Norfolk International Terminals, the Newport News Marine Terminal, the Portsmouth Marine Terminal, and the Virginia Inland Port. These four facilities, which are operated by Virginia International Terminals, constitute the Port of Virginia. The three terminals are located along the Hampton Roads Harbor near the ocean with access to a 50-foot channel. Newport News handles breakbulk and RO-RO. Norfolk International is the largest of the terminals and handles containers, breakbulk, and RO-RO. Portsmouth Marine handles containers, breakbulk, and RO-RO. The Virginia Inland Port is located to the northwest far in the interior of the state and is the intermodal transfer point for the three harbor terminals.

The Port of Virginia is the eighth largest container port in the U.S. and the second largest port on the East Coast in terms of general cargo (container and breakbulk), with a stated intention to surpass the Port of New York/New Jersey. Major retailers have established nearby regional distribution centers. In May 2006, the port signed a cooperative agreement with the Suez Canal Authority to promote trade with Asia and the Indian subcontinent.

Ongoing renovations to Norfolk International totaling $280 million were begun in 2002 and are expected to be completed by 2012. Projects have included reconfiguration of the container yard, reconstruction of the wharf, installation of eight Post-Panamax cranes, and 70 straddle-carriers that will haul containers away from shipside. The improvements are intended to increase by 30 percent the storage and throughput capacity of Norfolk's South Terminal and make it a state-of-the-art facility capable of handling the heaviest cargo worldwide. The wharf reconstruction has been completed and the cranes are in operation. Dredging of the berths and access channels is expected to be completed this year.

The Port of Virginia is expected to experience further growth through the Heartland Corridor project, which will clear a route for double-stack trains directly from Portsmouth to Chicago, cutting a day off current transit times. In May 2006, the governor of Virginia and the CEO of Norfolk Southern signed a memorandum of understanding to finance the project, which will raise the clearance of train tunnels and bridges and eliminate 13 at-grade crossings. The project includes an $18 million intermodal shipping yard that will be built near Roanoke within three years. The project, which is scheduled for completion by 2010, will support operations at the proposed Craney Island and the emergent Maersk-Sealand facilities.

Craney Island and Maersk-Sealand are two terminal projects that will have a significant effect on the Port of Virginia's competitive position. A new Maersk-Sealand cargo terminal is under construction on VPA property on the Elizabeth River immediately below the Craney Island site. The project was announced in April 2004 and will involve a 280-acre facility that will cost $600 million. This is the first major privately developed terminal in the U.S. Phase I of the project is intended to open in July 2007 at one million TEUs, with 2.16 million TEUs projected at final buildout. When Maersk moves into the new facility, VPA will inherit its vacated 300,000 TEU capacity facility. The Corps of Engineers completed an Environmental Assessment on the project in 2003, concluding that it would have no significant impact to the environment. Environmental groups were not opposed to the project, but wanted the Corps to conduct a full-scale Environmental Impact Study of the cumulative impacts of proposed projects in the area, including Craney Island.

The need for the Craney Island project is established through VPA's 2040 Master Plan, which was based on a 1999 forecast of containerized cargo produced in conjunction with a reconnaissance report for the project that showed a growth rate between 3.5 and 4.7 percent. This analysis indicates that VPA will need 1,800 acres of new container cargo area by 2050, of which 664 will be supplied by improvements to existing facilities and 280 will be supplied by the Maersk-Sealand facility, leaving a deficit of 850 acres. The Port of Virginia was expected to run out of capacity in 2007 without the Maersk-Sealand project and in 2015 with the Maersk-Sealand project.

The Craney Island project involves a 580-acre eastward expansion of an existing dredged material disposal site adjacent to a federal navigation channel and subsequent development of the 580 acres for a container terminal complex, including an access channel, berths, wharves, container yards, cranes, gate facilities, intermodal yards, new access roads and ramps, a new rail track, cargo processing and support facilities, and stormwater management areas. The project is expected to cost $1.28 billion. VPA is serving as the local sponsor for the project, for which an Environmental Impact Statement was completed by the Corps in April 2006.

The project is intended to be built in four phases, with the first phase involving 220 acres. Major cumulative components of the four phases are 3,000 feet of wharf and eight 100-foot (Suez Class) cranes in Phase I, 4,800 feet of wharf and 12 100-foot cranes in Phase II, 6,600 feet of wharf and 16 100-foot cranes in Phase III, and 8,400 feet of wharf and 20 100-foot cranes in Phase IV. Phase I operations are expected to be underway by 2018, with a throughput of 600,000 TEUs. Full buildout conditions are projected for 2032, with a throughput of 2.5 million TEUs.

The Corps had considered the Craney Island project to be merely speculative from a federal perspective because of the high cost, assumed navigational safety problems, and environmental harm. However, in May 2006 the Corps granted a policy exemption indicating that it does not have to recommend an alternative. The Corps is now in a position to recommend federal participation in the project. Issues remain with respect to VPA's request that the Corps split the $600 million cost of building the eastward expansion.

WILMINGTON

The Port of Wilmington is located on the Cape Fear River in Wilmington, North Carolina, and is operated by the North Carolina State Ports Authority. The port is located 26 miles from the ocean on a new 42-foot channel and is considered a niche port handling containerized, bulk, and breakbulk cargoes. Exports include chemicals, food, phosphate, and general merchandise; and imports include animal feeds, chemicals, fertilizers, metal products, lumber, rubber, steel, furniture, and general merchandise. The port stresses its eastern seaboard location and the availability of sites for distribution centers.

Although the existing container yard was operating at only half capacity in late 2005, a $130 million enhancement program is underway that is intended to double the container capacity at the port to meet demand during the next 10 years. These efforts include four new 100-foot gauge container cranes, new container handling equipment, a new terminal operating system, and berth, dock, and paving improvements. Phase 1 is to be completed in 2007 and the whole effort in five years. This effort is intended as an interim measure before the construction of the North Carolina International Port (NCIP), which would be the primary container port, with Wilmington's existing facilities continuing to serve the general cargo business.

Conceptual plans for the NCIP envision it as a major international port terminal that would place North Carolina in the ranks of major U.S. ports. The idea of such a port did not emerge until fairly recently and was apparently based on the projected doubling of the East Coast container market by 2015. In April 2006, the Ports Authority closed on the purchase of a 600-acre undeveloped industrial site on the Cape Fear River 9.5 miles from the ocean and with nearby highway and rail access. The facility would have a minimum annual capacity of 1.5 million TEUs, 4,000 linear feet of berthing space, and an industrial park on site for distribution centers or related operations. About 75 percent of the facility's container traffic would be moved by rail. Planning and construction is expected to take about 10 years, with a current projected opening in 2015.

The project is expected to cost $1 billion, including $300 million that would be needed from Congress for channel dredging. The Ports Authority plans to seek a private-sector partner to invest in the development of the port facility. Some preliminary interest has been shown by Seattle-based SSA, South Korea's Hanjin Shipping, and Denmark's A.P. Moeller-Maersk.

The Authority is moving forward quickly to plan development of the new terminal. Among the tasks required before the new port could open are dredging the navigation channel, design and

construction of terminal facilities, and working with state and federal authorities to ensure highway and rail access. The project has Congressional delegation support. The Corps of Engineers will soon be undertaking a reconnaissance study to deepen the navigation channel to 50 feet. Authority representatives have met with the North Carolina Department of Transportation and state and local officials to discuss highway and rail access, and a working group has been established to coordinate the effort. CH2M Hill was selected in May to manage the port development process, including project management, planning and design of port and intermodal facilities, investigation of environmental issues, and conduct of public outreach efforts.

Contacts by the Port Authority with persons in the area that would be impacted by the project indicate that transportation is a key concern. Among the transportation concerns are proximity of the proposed highway to residential streets, rail traffic hindering access to a neighborhood, and implications for the proposed Cape Fear Skyway Bridge. An alternative to NC 87 has already been proposed that would involve access from US 17 and points north and west. The proposed Skyway Bridge was designed to move port-generated highway traffic off Wilmington's streets while providing 225 feet of clearance for the passage of large ships to the existing port, which may no longer be necessary.

Critics question whether a third major port in roughly 300 miles of coastline could compete. The location of the site in a coastal environment raises issues about the potential impacts to water quality, fisheries, and other natural resources. Environmentalists expressed concerns about the prior deepening of the channel from 38 to 42 feet and are expected to express even greater concern about the increased depths.

CHARLESTON

The Port of Charleston is located in Charleston, South Carolina, and is operated by the South Carolina State Ports Authority (SPSCA). The port contains five terminals: (1) Columbus Street, which handles breakbulk and containers; (2) North Charleston, which handles containers; (3) Wando Welch, which handles containers and is the largest terminal in size and volume; (4) Union Pier, which handles breakbulk and RO-RO; and (5) Veterans, which handles bulk, breakbulk, RO-RO, and project cargo. All of the terminals are located on the Cooper River, with the exception of Wando Welch, which is located on the Wando River. The North Charleston Terminal is two hours sailing time to the ocean, and the Wando Welch Terminal is 1.5 hours sailing time to the ocean. The channels to all of the terminals have been deepened to 45 feet, and the entrance channel has been deepened to 47 feet. The new Ravenel Bridge over the Cooper River provides 186 feet of vertical clearance.

The port ranks fourth nationally in container movements, is the busiest container port on the Southeast and Gulf coasts, and is exceeded on the entire East Coast only by the Port of New York/New Jersey. To handle near-term growth and improve utilization of existing terminals, the port has a two-year $159 million capital plan to provide new container stacking equipment, container cranes, and other capacity enhancements. The cranes include four new Super Post-Panamax container cranes, with North Charleston and Wando Welch expected to receive two each by 2007. The near-term plan translates into 400,000 TEUs of additional capacity.

The port has been interested in capacity expansion through new terminal development since the late 1980s. Attention was first focused on Daniel Island, a dredge fill area at the junction of the Cooper and Wando rivers. Attention shifted to the Charleston Naval Complex when its impending closure was announced. The Naval Complex project was abandoned when it was opposed by the residents of North Charleston, a largely black low-income community. Attention shifted back to Daniel Island, but the project was opposed by the residents of Mount Pleasant (a wealthy suburb across the Wando) and new residents of Daniel Island. Although a Draft Environmental Impact Statement was completed in 1999, a compromise plan failed, the SCSPA withdrew its permit application in 2000, and the land is presently being offered for sale.

Efforts are presently directed toward development of a 280-acre site in the Naval Complex, with a cost estimate of $600 million. The need for the project is established by a 2002 update by SCSPA of a 1999 container cargo projections analysis. The update utilized trade lane data compiled by PIERS, macroeconomic growth drivers and annual growth rates by trade lane projected by Wharton Econometric Forecasting Associates, and customer-specific information. Based on this analysis, SCSPA estimates that the maximum practical capacity of its nine berths at its three existing container terminals will be exceeded by 2008.

The purpose of the proposed project is to accommodate Post-Panamax class ships. The project will have a maximum practical capacity of 1.4 million TEUs, is expected to be operational in 2012, and is expected by SCSPA to meet their needs through 2025. The project will not involve channel dredging. The project includes:

1. Three berths with a total length of 3,510 feet.
2. A berth area 50 feet deep and 150 feet wide.
3. A turning basin at least 1,500 feet square and 50 feet deep.
4. Six container cranes with a minimum outreach of 200 feet.
5. A 203-acre paved area for container processing and storage.
6. A 40-acre paved area and buildings for support gate structures and other operations and facilities.
7. A dedicated access road.

A $10 million federal earmark was obtained in August 2005 to plan for the access road to the south, which has broad community support. In December, SCSPA received three proposals for development of the terminal, two of which were disclosed: Hanjin Shipping and OOCL (USA).

A Draft Environmental Impact Statement on the project was completed by the Corps of Engineers in October 2005. Comments on the project have not yet been summarized by the Corps. SCSPA has offered North Charleston $4 million for social programs to help neighborhoods affected by the development. In May 2006, the North Charleston City Council voted nine to two to accept the offer and direct the money toward affordable housing, educational opportunities, health care, and landscaping between the proposed project and nearby communities.

SCSPA is pursuing a parallel terminal project in Jasper County that would provide three container berths. In January 2005, SCSPA's Board voted unanimously to begin the necessary

steps to acquire 1,800 acres on the South Carolina side of the Savannah River. The land, which is a dredged material disposal area, is presently owned by the Georgia Department of Transportation. Jasper County had wanted its own container terminal and had reached an agreement with the Seattle-based Stevedoring Services of America to build and operate the port when SCSPA intervened. A dispute over condemnation rights is presently in litigation, with the most recent court case finding in favor of SCSPA.

SAVANNAH

The Port of Savannah is located on the Savannah River in Savannah, Georgia, about 13 miles from the ocean and is owned by the Georgia Ports Authority (GPA). The port contains two terminals: the Garden City Terminal and the Ocean City Terminal. The Garden City Terminal is among the top five container handling facilities in the U.S. and is the largest of its kind on the East and Gulf coasts. The Ocean Terminal slightly downstream handles breakbulk and RO-RO. The channel is 42 feet deep and is under investigation by the Corps of Engineers for deepening to 48 feet.

The port is considered one of the fastest growing ports on the East Coast[15]. Major retailers have established nearby regional distribution centers. In 2003, *Expansion Management* magazine ranked Savannah as the Number 1 distribution and logistics location in the U.S. The ports of Savannah and New York/New Jersey are the only East Coast ports cited in national publications for port-related traffic congestion. However, the interstate highway system in Savannah is considered congestion-free.

GPA will invest $700 million over the next ten years at the Port of Savannah. In June 2006, GPA's Board approved $83 million in capital improvements, including four Super Post-Panamax cranes, 15 rubber-tired Gantry cranes, and container yard improvements. The most important element of the investment is the completion of Container Berth 8. The first phase of the Container Berth 8 project involved the completion of 1,200 feet of berth space in April 2006. An additional 1,000 feet is now under construction. By mid-2007, there will be an additional 100 acres of paved storage area. The improvements will increase the port's capacity to 4.37 million TEUs in 2015.

The deepening project is opposed by various environmental groups, citing saltwater intrusion and the proposed new port in Jasper County, South Carolina, which would be on the north side of the Savannah River downstream from the Port of Savannah.

JACKSONVILLE

The Port of Jacksonville is located in Jacksonville, Florida, on the St. Johns River and is operated by the Jacksonville Port Authority (JAXPORT). The port operates three public marine terminals (Blount Island, Talleyrand, and Dames Point) and one temporary passenger cruise terminal. The port handles dry and liquid bulk, breakbulk, vehicle (RO-RO), and containerized

[15] "How Savannah Revised Its Aging Cargo Port," The Wall Street Journal Online (www.Realestatejournal.com/propertyreport/industrial/20050823-machalaba.html)

cargoes, as well as oversized specialty cargoes. It is known as one of the largest vehicle-handling ports in the country.
The St. Johns River harbor deepening project began in 2002. Thus far, the main shipping channel has been deepened from 38 feet to 40 feet from the mouth of the river to Drummond Point. A proposal to extend the harbor deepening from Drummond Point to the Talleyrand terminal was authorized in late 2005 and is being constructed. The U.S. Army Corps of Engineers is also studying the impact of deepening the St. Johns River main channel to 45 feet.

The port indicates that it has committed more than $200 million to capital projects during the past decade to improve the three marine terminals and Jacksonville's harbor. Expansion plans are concentrating on a new container terminal at Dames Point. The need for the Dames Point facility is supported by a 1986 JAXPORT master plan, which projects cargo tonnage (including containers) through 2000 based on historic trends for the port.

In August 2005, Mitsui O.S.K. Lines (MOL), a Tokyo-based logistics and ocean transportation company, signed a 30-year lease agreement with JAXPORT for the construction of a 158-acre container-handling facility on an undeveloped portion of the Dames Point terminal about 10 miles from the ocean. Additional phases of the project could expand MOL's container facility to more than 200 acres.

Ships will sail directly between the facility and ports in Asia, as well as Latin America. This agreement marks the first time a company will regularly ship containers directly between Jacksonville and Asia, which is in keeping with JAXPORT'S efforts to diversify beyond its historic trading partners in Latin America and the Caribbean.

Facility construction (including equipment) is expected to cost approximately $200 million, with facility opening expected in late 2007 or early 2008. The underlying purpose of the project is to create a terminal that can accommodate two Panamax-class container ships. The project includes:

1. Construction of a 3,000-foot steel sheetpile bulkhead, a utility trench, and pile-supported crane rails to provide two 1,200-foot berths for containerized cargo ships.
2. Installation of six electric-powered, Post-Panamax container cranes.
3. Construction of a 158-acre paved container yard.
4. Construction of an access road and improvements to offsite roads to provide safe access for trucks and other vehicles.
5. Construction of infrastructure and utilities to accommodate a planned throughput of approximately 400,000 container units annually.
6. Construction of maintenance and administrative buildings.
7. Dredging of the St. Johns River to 42 feet from the bulkhead line to the limits of the federally maintained navigation channel.

According to the March 2006 Environmental Assessment by the Corps of Engineers, the project is expected to have no significant negative environmental effects. The existing road system is not sufficient to accommodate the projected truck traffic. Needed road improvements would

include widening the New Berlin Road and modifying Heckscher Drive and the northbound SR 9A ramp.

Initial plans call for the new facility to handle 360,000 TEUs annually, with an expectation of growth to 800,000 TEUs annually by 2011. When added to existing container activity, this would push Jacksonville beyond 1.5 million TEUs, making it one of only a dozen U.S. ports to handle more than one million containers annually. The port has stated a goal to become one of the three largest ports on the East Coast.

ATTACHMENT 2

SECOND INTERIM REPORT REVISED MARCH 8, 2007

Volume I

Second Interim Report
(Revised March 8, 2007)

SAVANNAH HARBOR EXPANSION PROJECT

REGIONAL PORT ANALYSIS
ENVIRONMENTAL ISSUES SURVEY
INSTITUTIONAL ANALYSIS

US Army Corps of Engineers
Savannah District
Savannah, Georgia

Volume I

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Prepared by
GEC
Gulf Engineers & Consultants
9357 Interline Avenue
Baton Rouge, Louisiana 70809
Phone – 225/612-3000

U.S. ARMY CORPS OF ENGINEERS
SAVANNAH DISTRICT
SAVANNAH, GEORGIA

March 8, 2007

ORGANIZATION OF REPORT

This report contains the following sections, published in two volumes:

Volume I

Executive Summary
Table of Contents
I. Introduction
II. Environmental Issues Survey Overview
III. Institutional Analysis
Appendix A: Savannah District Letter to Ports
Appendix B: Savannah District Communication to Other Districts
Appendix C: Memorandum Concerning Secondary Information Sought

Volume II

Attachment: Environmental Issues Survey

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

The Regional Port Analysis (RPA) reflects concerns of different stakeholders who indicated that there should be a study of allocating Federal improvement funds at one regional port in the South Atlantic region rather than deepening several competing ports with excess capacity. Accordingly, the RPA is being performed to address port capacity and related issues such as environmental resources and institutional factors affecting port expansion and development. The first interim report (July 2006) addressed South Atlantic port marine container terminal capacity and demand. This second interim report addresses environmental resources and institutional factors pertaining to port expansion and development. This volume presents the constraint determination and anticipated impact level evaluation for environmental resources in the areas of potential port expansion based on the data presented in Volume II of the Second Interim Report.

ENVIRONMENTAL ISSUES SURVEY

An Environmental Issues Survey was prepared in accordance with the February 2004 scope of work and superseding guidance provided by the Savannah and Mobile districts. The work plan envisioned selection of discrete expansion alternative sites and associated intermodal access points and hinterland corridors for each candidate site, site reconnaissance and primary data collection, and interviews with personnel at pertinent ports. Concern was raised by the Mobile District that an environmental survey of discrete sites prior to a full National Environmental Policy Act analysis would constitute a "pre-decisional" action. Consequently, new guidelines were issued specifying that the survey would evaluate environmental resources that could potentially be impacted during any planned port or deep-draft channel expansion. The survey would utilize publicly available information, and no new data would be collected.

The July 2006 Multiport Analysis identified five ports as candidates for the proposed Regional Port: Jacksonville, Savannah, Charleston, Wilmington, and Hampton Roads (Norfolk). To prevent concerns over pre-decisional expansion site selection(s), a Region of Interest (ROI) was selected for each port that was broad in extent and generally included both coastal and inland areas (in the case of Charleston, two ROIs were selected). The following environmental resources were identified for evaluation: geology and soils; air quality; water quality; sediment quality; Coastal Zone Management Act (CZMA) resources; noise environment; wetlands; wildlife resources (including invasive species, threatened and endangered species, unique or unusual habitats, and Essential Fish Habitat [EFH]); cultural resources; hazardous, toxic, and radioactive waste (HTRW); socioeconomic profile (including environmental justice); transportation; and recreation. Data on these environmental resources were collected for each ROI from environmental agencies as well as independent research. Level of constraint and degree of impact were assessed. These data are summarized in Chapter II and included fully in the attachment to this report. A synopsis of determinations by environmental resource is presented below.

Geology and soils are not believed to constitute a constraint to port expansion within any ROI. No appreciable primary or secondary impacts are anticipated to this resource as a result of port expansion activities or consequences.

Air quality has been assessed as a moderate constraint for all ROIs except Savannah and Norfolk, where it has been assessed as a substantial constraint. Minor primary adverse impacts are anticipated for all ROIs, and moderate secondary adverse impacts are anticipated for the Jacksonville, Charleston, and Wilmington ROIs. Substantial secondary adverse impacts are anticipated for the Savannah and Norfolk ROIs.

Water quality has been assessed as a moderate constraint for all ROIs except Savannah, Wilmington, and Norfolk, where it has been assessed as a substantial constraint. Minor primary adverse impacts are anticipated for all ROIs, and moderate secondary adverse impacts are anticipated for the Jacksonville and Charleston ROIs. Substantial secondary adverse impacts are anticipated for the Savannah, Wilmington, and Norfolk ROIs.

Sediment quality has been assessed as a substantial constraint for the Savannah, Wilmington, and Norfolk ROIs and a moderate constraint for the remaining ROIs. Minor primary adverse impacts are anticipated for all ROIs, and moderate secondary adverse impacts are anticipated for the Jacksonville and Charleston ROIs. Substantial secondary adverse impacts are anticipated for the Savannah, Wilmington, and Norfolk ROIs.

CZMA resources have been assessed as a substantial constraint to port expansion within all ROIs. Moderate primary and secondary adverse impacts are anticipated as a result of port expansion activities or consequences within all ROIs.

Noise environment has been assessed as a moderate constraint for all ports except the Charleston ROIs. Noise environment has been assessed as a substantial constraint for the Berkeley-Charleston County ROI and is not believed to constitute a constraint for the Jasper County ROI. Moderate primary adverse impacts to noise are anticipated for all ROIs except the Jasper County ROI, where no appreciable primary adverse impacts are anticipated. Moderate secondary adverse impacts are anticipated for all ROIs except the Charleston ROIs, where substantial secondary adverse impacts are anticipated for the Berkeley-Charleston County ROI, and no appreciable secondary adverse impacts are anticipated for the Jasper County ROI.

Wetlands have been assessed as a moderate constraint to port expansion for all ROIs. Minor primary adverse impacts and moderate secondary adverse impacts are anticipated as a result of potential port expansion actions or consequences.

Invasive species have been assessed as a moderate constraint to port expansion within all ROIs. Minor primary adverse impacts and moderate secondary adverse impacts are anticipated as a result of port expansion activities or consequences within all ROIs.

Natural areas have been assessed as a minor constraint for all ROIs except the Jacksonville and Wilmington ROIs, where it has been assessed as a moderate and significant constraint, respectively. Minor primary adverse impacts are anticipated for all ROIs except the Jacksonville and Wilmington ROIs, where moderate primary adverse impacts are anticipated. Minor secondary adverse impacts are anticipated for all ROIs except Jacksonville and Wilmington, where moderate and significant secondary adverse impacts are anticipated, respectively.

Threatened and endangered species has been assessed as a substantial constraint to port expansion at all ROIs. Substantial primary and secondary adverse impacts are anticipated for this resource at all ROIs as a result of port expansion activities or consequences. The National Marine Fisheries Service (NMFS) Southeast Regional Office (SERO) has stated that the species of greatest concern with regard to port expansion in the South Atlantic region is the North Atlantic right whale (*Eubalaena glacialis*), which is particularly vulnerable to secondary impacts such as increased vessel traffic. The SERO indicated that in order for port expansion actions in or near right whale critical habitat to proceed, NMFS may impose reasonable and prudent alternatives on the federal action agency to prevent the expansion project(s) from putting the right whales in a "jeopardy" situation.

Critical habitat has been assessed as a substantial constraint to port expansion within the Jacksonville and Wilmington ROIs. Substantial primary adverse impacts to critical habitat are anticipated for the Jacksonville ROI, and minor primary adverse impacts to critical habitat are anticipated for the Wilmington ROI. Substantial secondary adverse impacts are anticipated for both ROIs. No designated critical habitat exists in the other ROIs, and critical habitat is not believed to constitute a constraint to port expansion within these ROIs at this time. No appreciable primary or secondary adverse impacts are anticipated to this resource at the remaining ROIs as a result of port expansion actions or consequences.

Unique or unusual habitat has been assessed as a minor constraint to port expansion within the Jacksonville, Savannah, and Norfolk ROIs and as a moderate constraint for the Charleston and Wilmington ROIs. Minor primary and secondary adverse impacts are anticipated as a result of port expansion within the Jacksonville, Savannah, and Norfolk ROIs, and moderate primary and secondary adverse impacts are anticipated for the Charleston and Wilmington ROIs.

EFH has been assessed as a substantial constraint to port expansion at all ROIs. Substantial primary and secondary adverse impacts are anticipated for EFH at all ROIs as a result of port expansion activities or consequences.

Cultural resources have been assessed as a substantial constraint to port expansion within the Wilmington and Norfolk ROIs, a moderate constraint within the Jacksonville and Berkeley-Charleston County ROIs, and a minor constraint within the Savannah ROI. The resource is not believed to constitute a constraint within the Jasper County ROI at this time. Minor primary adverse impacts are anticipated for all ROIs except Jasper County (where no adverse impacts are anticipated) and Norfolk (where substantial impacts are anticipated). Moderate secondary adverse impacts are anticipated for all ROIs except Jasper County, where no such impacts are anticipated, and the Wilmington and Norfolk ROIs, where substantial secondary adverse impacts are anticipated.

HTRW has been assessed as a substantial constraint to port expansion within the Norfolk ROI, a moderate constraint within the Jacksonville ROI, and a minor constraint within the Savannah, Berkeley-Charleston County, and Wilmington ROIs and is not believed to constitute a constraint within the Jasper County ROI at this time. Minor primary adverse impacts are anticipated as a result of port expansion for all ROIs except Norfolk, where substantial primary adverse impacts are anticipated. Substantial secondary adverse impacts are anticipated for all ROIs.

Socioeconomic conditions are not believed to constitute a constraint to port expansion within any ROI. Port expansion would likely constitute a net benefit to socioeconomic conditions within all ROIs, and no net primary or secondary adverse impacts are anticipated as a result of port expansion actions or consequences.

Environmental justice has been assessed as a minor constraint to port expansion within all ROIs. Minor primary adverse impacts are anticipated for all ROIs, and no net secondary adverse impacts are anticipated for any ROI as a result of port expansion actions or consequences.

Transportation has been assessed as a substantial constraint to port expansion within all ROIs. Minor primary adverse impacts and substantial secondary adverse impacts are anticipated as a result of port expansion activities or consequences within all ROIs.

Recreation has been assessed as a substantial constraint to port expansion within the Wilmington ROI, a moderate constraint within the Jacksonville and Berkeley-Charleston County ROIs, and a minor constraint within the remaining ROIs. Minor primary adverse impacts are anticipated as a result of port expansion for all ROIs except Wilmington, where moderate primary adverse impacts are anticipated. Substantial secondary adverse impacts are anticipated for the Wilmington ROI, moderate secondary adverse impacts are anticipated for the Jacksonville and Berkeley-Charleston County ROIs, and minor secondary adverse impacts are anticipated for the remaining ROIs.

INSTITUTIONAL ANALYSIS

An Institutional Analysis (IA) was conducted as a third task of the RPA to identify other "critical factors" (in addition to the capacity analysis and the environmental survey) enabling or inhibiting development of a regional port. The IA was intended to concentrate on "deal makers and breakers" for particular ports and sites among other factors.

Because of a change in the way in which the scope of work was to be executed, the IA was developed from desktop materials and general familiarity with the ports, as opposed to site visits and specific local assessments. Consequently, the focus of the IA is on general impediments to the efficient use of existing marine terminal capacity and the major considerations for new marine terminal development.

Among the general institutional impediments to efficient use of existing marine capacity are restricted hours and days of gate operations. Labor rules and practices require overtime payments for extended gate operations. This acts as a disincentive to expand marine terminal access to trucks, which handle over 80 percent of the U.S. East Coast container port traffic. Also, many local businesses are not staffed to receive freight after an eight-hour workday five days of the week, thus limiting the effectiveness of expanded marine terminal access hours.

Although much attention has been paid to marine terminal storage of empty containers, the dwell times of loaded boxes are a more substantial determinant of throughput capabilities. Reductions in average dwell times of loaded boxes sitting in the terminal will have a proportional impact on

increasing throughput. Consequently, it would appear that there are opportunities for substantial increases in throughput for existing and proposed facilities, other things being equal.

Major new marine terminal capacity considerations include land, intermodal access, public/ private partnerships, and community acceptance. Modern marine container terminal sites require a minimum of 200 acres, preferably with room for expansion. Rail intermodal access is considered important, but a distinct minority of containers move by rail (generally for niche markets with respect to longer distances and overweight and empty boxes). Truck and highway access continues to be predominant for ECUS ports because of the comparatively shorter distances and volumes served.

There is evidence of a paradigm shift in financing and ownership of marine container terminals away from the traditional public port model and involving greater private sector investment and control. There is also a shift away from urban locations in favor of rural areas where the local economic impacts are likely to be greater and there is more community acceptance.

TABLE OF CONTENTS

TABLE OF CONTENTS

Section		Page
I	INTRODUCTION	1
	Objectives	1
	Execution	1
II	ENVIRONMENTAL ISSUES SURVEY OVERVIEW	3
	Introduction	3
	Jacksonville Region of Interest	4
	Geology and Soils	4
	Air Quality	4
	Water Quality	4
	Sediment Quality	7
	Noise Environment	7
	Coastal Zone Management Act Resources	8
	Wetlands	8
	Wildlife Resources	8
	Invasive Species	8
	Natural Areas	9
	Threatened and Endangered Species	9
	Critical Habitat	10
	Unique or Unusual Habitats	10
	Essential Fish Habitat	11
	Cultural Resources	11
	Hazardous, Toxic, and Radioactive Waste	11
	Socioeconomic Profile	12
	Environmental Justice	12
	Transportation	12
	Recreation	13
	Savannah Region of Interest	13
	Geology and Soils	13
	Air Quality	15
	Water Quality	15
	Sediment Quality	15
	Noise Environment	16

TABLE OF CONTENTS (cont'd)

Section **Page**

Coastal Zone Management Act Resources 16
Wetlands 17
Wildlife Resources 17

Invasive Species 17
Natural Areas 17
Threatened and Endangered Species 18
Critical Habitat 18
Unique or Unusual Habitats 19
Essential Fish Habitat 19

Cultural Resources 19
Hazardous, Toxic, and Radioactive Waste 20
Socioeconomic Profile 20

Environmental Justice 20

Transportation 21
Recreation 21

Charleston Regions of Interest 22

Geology and Soils 22
Air Quality 22
Water Quality 22
Sediment Quality 25
Noise Environment 26
Coastal Zone Management Act Resources 26
Wetlands 26
Wildlife Resources 27

Invasive Species 27
Natural Areas 27
Threatened and Endangered Species 28
Critical Habitat 29
Unique or Unusual Habitats 29
Essential Fish Habitat 29

Cultural Resources 30
Hazardous, Toxic, and Radioactive Waste 30
Socioeconomic Profile 31

TABLE OF CONTENTS (cont'd)

Section		Page
	Environmental Justice	31
	Transportation	32
	Recreation	32
	Wilmington Region of Interest	33
	Geology and Soils	33
	Air Quality	33
	Water Quality	33
	Sediment Quality	35
	Noise Environment	35
	Coastal Zone Management Act Resources	36
	Wetlands	36
	Wildlife Resources	36
	Invasive Species	36
	Natural Areas	37
	Threatened and Endangered Species	37
	Critical Habitat	38
	Unique or Unusual Habitats	38
	Essential Fish Habitat	39
	Cultural Resources	39
	Hazardous, Toxic, and Radioactive Waste	40
	Socioeconomic Profile	40
	Environmental Justice	40
	Transportation	41
	Recreation	41
	Norfolk Region of Interest	42
	Geology and Soils	42
	Air Quality	42
	Water Quality	42
	Sediment Quality	44
	Noise Environment	44
	Coastal Zone Management Act Resources	45
	Wetlands	45
	Wildlife Resources	45

TABLE OF CONTENTS (cont'd)

Section **Page**

Invasive Species 45
Natural Areas 46
Threatened and Endangered Species 46
Critical Habitat 47
Unique or Unusual Habitats 47
Essential Fish Habitat 47

Cultural Resources 47
Hazardous, Toxic, and Radioactive Waste 48
Socioeconomic Profile 48

Environmental Justice 48

Transportation 49
Recreation 49

III INSTITUTIONAL ANALYSIS 51

Objectives 51
Methodology 51
Existing Capacity 51

Gate Access 51
Labor Flexibility 53
Empty Containers 55
Dwell Time 56
Chassis Supply 58

Critical Factors Affecting Expansions and New Capacity for Marine Container Terminals 58

Land 59
Marine Terminal Landside Access 59
Financing 61
Community Acceptance 64

Appendix A: SAVANNAH DISTRICT LETTER TO PORTS
Appendix B: SAVANNAH DISTRICT COMMUNICATION TO OTHER DISTRICTS
Appendix C: MEMORANDUM CONCERNING SECONDARY INFORMATION SOUGHT

LIST OF TABLES

Number		Page
1	Constraint Determination and Anticipated Impact Levels for Regional Port Expansion ROIs	5
2	Effect of Container Dwell Time Distribution on Average Total Dwell Time (Days)	57

LIST OF FIGURES

Number		Page
1	Jacksonville ROI	6
2	Savannah ROI	14
3	Berkeley-Charleston County ROI	23
4	Jasper County ROI	24
5	Wilmington ROI	34
6	Norfolk ROI	43

SAVANNAH HARBOR EXPANSION PROJECT (SHEP) REGIONAL PORT ANALYSIS (RPA)

I. INTRODUCTION

OBJECTIVES

The Savannah Harbor Expansion Project (SHEP) Regional Port Analysis (RPA) technical scope was designed to address public review comments and items of litigation interest resulting from the 1998 Feasibility Study by the Georgia Ports Authority (GPA). At that time some project stakeholders expressed that there should be a study of allocating Federal improvement funds at one regional port in the South Atlantic range, rather than deepening several ports. They believed that this would make sense economically (since fewer funds would be expended) and environmentally (since the impact of dredging would only occur at one port rather than at several). The regional port concept was envisioned as a separate task in the overall economic analysis with an approach that would likely require extensive discussion with port authorities and shipping lines, as well as with the environmental interests in order to present a balanced view of the concept. It was also presumed that it might also be necessary to include economic development specialists and other local government authorities in these discussions.

The RPA scope of work developed in 2004 identified five tasks as follows: (1) Port Capacity Analysis; (2) Port Infrastructure Survey; (3) Hub and Spoke Analysis; (4) Environmental Survey; and (5) Institutional Analysis. The port capacity analysis would pertain to the various container ports and existing and developing terminals in the South Atlantic (Jacksonville to Norfolk). The port infrastructure survey would be an inventory of port capacity inputs and the ability to increase throughput volumes of container traffic. The hub and spoke analysis would evaluate the feasibility of regional load center ports that would feed container traffic to other ports.

The RPA scope for the environmental survey would compile existing secondary information on environmental resources and would require evaluation for each port and related site under consideration for expansion or development. Also, landside potentials for intermodal operations would be inventoried and arrayed. Finally, an assessment would be made of the secondary environmental impacts.

The RPA included an institutional analysis component that would focus on other "critical factors" (in addition to the capacity analysis and the environmental survey) enabling or inhibiting a port to expand, including such things as legal authority, non-federal sponsorship, and community acceptance. The institutional analysis was intended to concentrate on "deal makers and breakers" for particular ports and sites, such as intermodal access, dredge disposal, and bridge clearances. It was also envisioned that the institutional analysis would address whether the states under consideration would be both able and willing to fund a regional port. Similarly, the institutional analysis presumed that the shipping industry would need to be persuaded that designation of regional port improvements would better serve their needs.

EXECUTION

Data collection on marine container terminal infrastructure for the South Atlantic ports, including Norfolk, commenced through website searches in June 2005 in preparation for subsequent port site visits for confirming capacity inputs and documenting secondary data

related to the survey of environmental resources. In preparation for meetings with the ports and site visits, letters were sent in late August 2005 from the Savannah District (see Appendix A) to the senior executives, including port directors, assistant directors, and executives related to operations, engineering and planning, etc., at adjacent public ports (Norfolk, Wilmington, Charleston, and Jacksonville) explaining the purpose of the RPA and advising that G.E.C., Inc. (GEC) would be contacting them concerning matters related to port capacity and expansion.

In September, all further work on the RPA was put on hold until further notice, with no outside contacts to be made pending Corps resolution of issues raised about the scope with regard to inclusion of ports other than Savannah Harbor. Late November communications were sent from the Savannah District Commander to the respective Commanders of districts covered by the RPA ports, including Norfolk, Wilmington, Charleston, and Jacksonville (see Appendix B) requesting district assistance with the RPA in lieu of direct contact with the ports. The status of the execution of the moribund RPA was discussed at the Mobile District at a December 7 progress report meeting and presentation. As of late December 2005, there was still no closure on how to begin the execution of the RPA in terms of direct interaction with different Corps districts and possible local port participation through districts to document the capacity and related environmental secondary information available or otherwise sought for these tasks.

At the request of the Savannah District, a description of the secondary information sought for the RPA tasks was prepared January 6, 2006 (see Appendix C). A January 10 conference call among the Corps districts resulted in agreement that the Planning Chiefs in the various districts would be the initial points of contact for any possible interaction with the ports. In a followup conference call on January 12, members of the GEC team for capacity analysis and the environmental survey were introduced to the district points of contact. The districts were requested to assist GEC to compile existing secondary data and perform port liaison to the extent that this was possible with the resources available. Subsequently, GEC met with the districts as follows: (1) Jacksonville – February 28; (2) Charleston – March 1; and (3) Wilmington – May 16. No meetings or communications were held with the public ports other than GPA on February 27. Some port capacity information other than website related was received (from the Jacksonville District). No further meetings or contacts were held with the districts related to port capacity information. The districts and ports have not received or reviewed the information in this report.

Based on initial port capacity assessments, a geographic Region of Interest (ROI) was defined for each port with regard to capacity expansion. This allowed the environmental survey to be initiated March 2006. A draft letter for the District to sign for GEC to send to Federal and state agencies for secondary data collection was developed for District approval. The letter was reviewed, but no further action was taken pending response from the District. During April, GEC independently initiated environmental agency contacts and pursued related secondary data collection. Subsequently, the institutional analysis was initiated. Similar to the port capacity analysis and environmental survey, the institutional analysis was performed with no contacts with the public ports. This Second Interim Report contains the results of the environmental survey and institutional analysis. This volume presents the constraint determination and anticipated impact level evaluation for environmental resources in the areas of potential port expansion based on the data presented in Volume II of the Second Interim Report.

II. ENVIRONMENTAL ISSUES SURVEY OVERVIEW

INTRODUCTION

The Environmental Issues Survey was prepared in accordance with the February 2004 *Economic Analysis Work Plan for the Savannah Harbor Expansion Project* and superseding guidance provided by the Savannah and Mobile districts.

The development of the Environmental Issues Survey as described in the 2004 work plan relied on the selection of discrete expansion alternative sites and associated intermodal access points and hinterland corridors for each candidate site, site reconnaissance and primary data collection, and interviews with personnel at pertinent ports. Concern was raised by the Mobile District that an environmental survey of discrete sites prior to a full National Environmental Policy Act (NEPA) analysis would constitute a "pre-decisional" action. In November 2005, the Savannah District issued new guidelines for the preparation of the Environmental Issues Survey. The new guidelines specified that the survey would evaluate environmental resources that could potentially be impacted during any planned port or deep-draft channel expansion. No new data would be collected, but rather the survey would utilize publicly available information that would then be used to create a matrix characterizing the level of constraint posed by each environmental resource and the severity of the anticipated impacts resulting from potential port expansion activities. The guidance provided by the Savannah District was determined to supersede the 2004 work plan, and the methodology for the preparation of the Environmental Issues Survey was based on these latter directives where appropriate.

The July 2006 Multiport Analysis identified five ports as candidates for the proposed Regional Port: Jacksonville, Savannah, Charleston, Wilmington, and Hampton Roads (Norfolk). To prevent concerns over pre-decisional expansion site selection(s), a Region of Interest (ROI) was selected for each port that was broad in extent and generally included both coastal and inland areas (in the case of Charleston, two ROIs were selected). The following environmental resources were identified for evaluation: geology and soils; air quality; water quality; sediment quality; Coastal Zone Management Act (CZMA) resources; noise environment; wetlands; wildlife resources (including invasive species, threatened and endangered species, unique or unusual habitats, and Essential Fish Habitat [EFH]); cultural resources; hazardous, toxic, and radioactive waste (HTRW); socioeconomic profile (including environmental justice); transportation; and recreation. Data on these environmental resources were collected for each ROI from environmental agencies as well as independent research for each environmental resource category and compiled for analysis.

The complete environmental analysis is presented as an attachment to this report. This chapter of the report presents a qualitative summary of the environmental resources within the ROIs that are described fully within the attachment. The chapter characterizes the level of constraint posed by each environmental resource for each ROI and the anticipated level of adverse impacts to each environmental resource resulting from port expansion or the development of a regional port at each ROI. Constraints posed by the environmental resources were assessed and assigned to one of the following categories: (1) not a constraint at this time; (2) minor constraint;

(3) moderate constraint; and (4) substantial constraint. Anticipated adverse impacts to these environmental resources from potential port expansion activities at each ROI were assessed and assigned to one of the following categories: (1) no appreciable adverse impacts anticipated at this time; (2) minor adverse impacts anticipated; (3) moderate adverse impacts anticipated; and (4) substantial adverse impacts anticipated. Separate assessments are provided for primary impacts (i.e., those impacts resulting from construction of any facilities or projects associated with port expansion) and secondary impacts (i.e., those impacts resulting from the subsequent operations of port expansion facilities). A matrix presenting these determinations is presented in Table 1. The justification for these determinations is presented for each ROI in the following sections of this chapter.

JACKSONVILLE REGION OF INTEREST

There is one ROI in the Jacksonville area (Figure 1). Potential impacts to each environmental resource in the ROI are summarized in the following subsections.

Geology and Soils

No rare or environmentally sensitive geologic features are present within the Jacksonville ROI. No prime or unique farmland soils are present within the ROI. Consequently, geology and soils are not believed to pose an environmental constraint for potential expansion activities within the Jacksonville ROI, and no appreciable primary or secondary adverse environmental impacts to these resources are anticipated as a result of any expansion activities.

Air Quality

The ROI is within an attainment zone for all six air criteria pollutants identified by the National Ambient Air Quality Standards (NAAQS). Criteria pollutant concentrations are significantly below NAAQS values for all pollutants except ozone, concentrations of which are moderately below NAAQS values. Air quality in the ROI is generally good, with minimal periods in which air quality is classified as unhealthy for the general public or for sensitive groups. Potential primary impacts to air quality that could result from port expansion within the Jacksonville ROI include temporary increases in emissions from construction equipment during the construction of new port facilities and adjacent intermodal rail and surface road accesses and from dredging vessels during dredging operations. These impacts would be temporary in nature. Potential secondary impacts to air quality resulting from potential port expansion activities within the ROI include air quality degradation from emissions caused by an increase in cargo vessel traffic and transportation vehicles at adjacent intermodal rail and surface road accesses. Air quality has been assessed as a moderate constraint for port expansion within the Jacksonville ROI. Minor primary adverse impacts and moderate secondary adverse impacts to air quality are anticipated as a result of potential expansion activities or consequences.

Water Quality

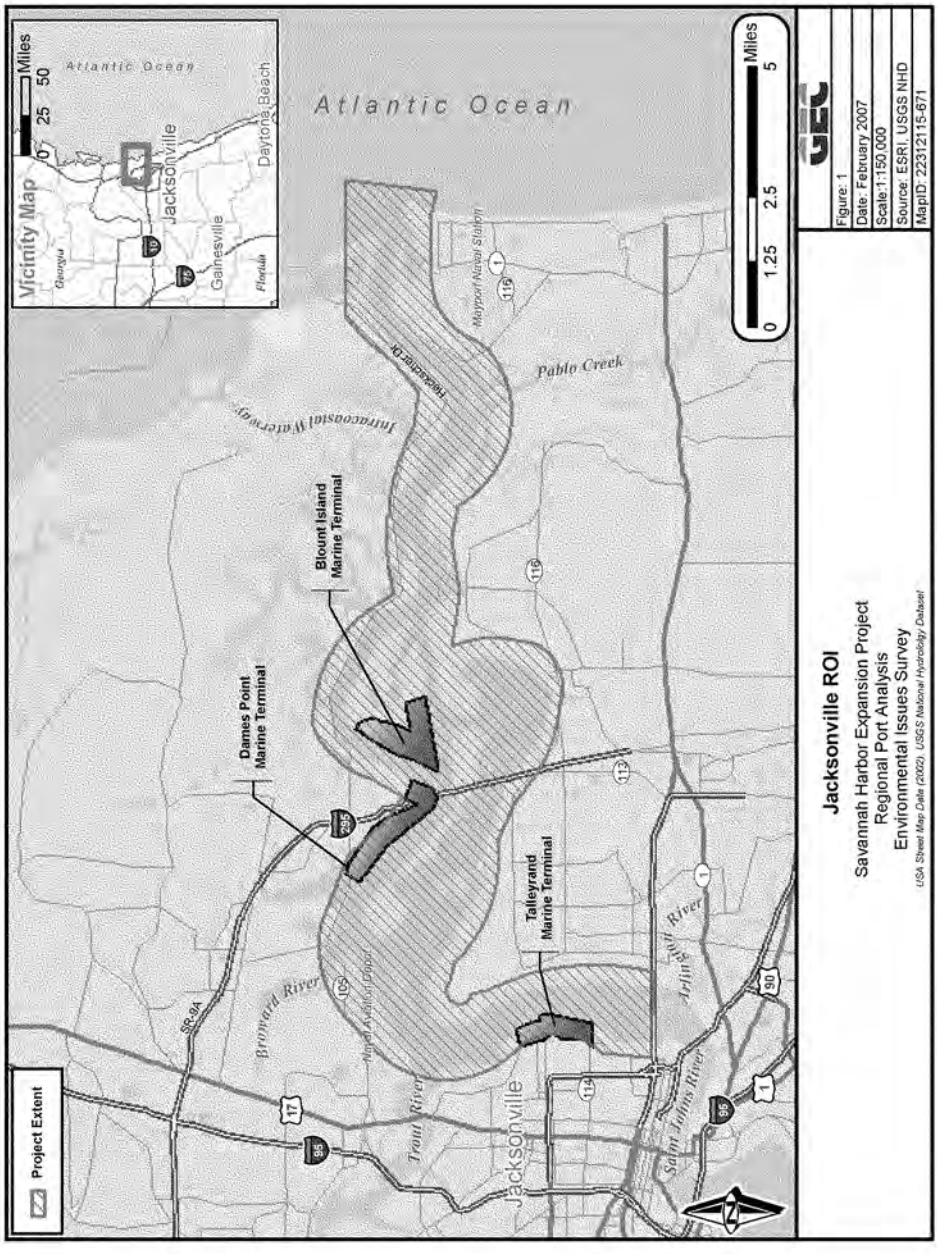
Portions of the St. Johns River within the Jacksonville ROI are currently listed as impaired because of metals contamination. Potential primary impacts to water quality within the

Table 1. Constraint Determination and Anticipated Impact Levels for Regional Port Expansion ROIs

Parameter	Port Expansion Region of Interest																	
	Jacksonville			Savannah			Charleston						Wilmington			Norfolk		
							Berkeley-Charleston County			Jasper County								
	Constraint Determination	Anticipated Impact Level		Constraint Determination	Anticipated Impact Level		Constraint Determination	Anticipated Impact Level		Constraint Determination	Anticipated Impact Level		Constraint Determination	Anticipated Impact Level		Constraint Determination	Anticipated Impact Level	
		Primary	Secondary		Primary	Secondary		Primary	Secondary		Primary	Secondary		Primary	Secondary		Primary	Secondary
Geology and Soils	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Air Quality	M2	M1	M2	S	M1	S	M2	M1	M2	M1	M1	M2	M2	M1	M2	S	M1	S
Water Quality	M2	M1	M2	S	M1	S	M2	M1	M2	M2	M1	M2	S	M1	S	S	M1	S
Sediment Quality	M2	M1	M2	S	M1	S	M2	M1	M2	M2	M1	M2	M2	M1	M2	S	M1	S
Noise Environment	M2	M2	M2	M2	M2	M2	S	M2	S	N	N	N	M2	M2	M2	M2	M2	M2
Coastal Zone Management Act Resources	S	M2	M2	S	M2	M2	S	M2	M2	S	M2	M2	S	M2	M2	S	M2	M2
Wetlands	M2	M1	M2	M2	M1	M2	M2	M1	M2	M2	M1	M2	M2	M1	M2	M2	M1	M2
Wildlife Resources																		
Invasive Species	M2	M1	M2	M2	M1	M2	M2	M1	M2	M2	M1	M2	M2	M1	M2	M2	M1	M2
Natural Areas	M2	M2	M2	M1	M1	M1	M1	M1	M1	M1	M1	M1	S	M2	S	M1	M1	M1
Threatened and Endangered Species	S	S	S	S	S	S	S	S	S	S	M	S	S	S	S	S	S	S
Critical Habitat	S	S	S	N	N	N	N	N	N	N	N	N	S	M1	S	N	N	N
Unique or Unusual Habitats	M1	M1	M1	M1	M1	M1	M2	M2	M2	M2	M2	M2	M2	M2	M2	M1	M1	M1
Essential Fish Habitat	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Cultural Resources	M2	M1	M2	M1	M1	M2	M2	M1	M2	N	N	N	S	M1	S	S	S	S
Hazardous, Toxic, and Radioactive Waste	M2	M1	S	M1	M1	S	M1	M1	S	N	M1	S	M1	M1	S	S	S	S
Socioeconomic Profile	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Environmental Justice	M1	M1	N	M1	M1	N	M1	M1	N	M1	M1	N	M1	M1	N	M1	M1	N
Transportation	S	M1	S	S	M1	S	S	M1	S	S	M1	S	S	M1	S	S	M1	S
Recreation	M2	M1	M2	M1	M1	M1	M2	M1	M2	M1	M1	M1	S	M2	S	M1	M1	M1

Notes.
For Constraint Determination:
S = Substantial Constraint
M2 = Moderate Constraint
M1 = Minor Constraint
N = Not a Constraint at Present
For Anticipated Impact Level:
S = Substantial Adverse Impacts Anticipated
M2 = Moderate Adverse Impacts Anticipated
M1 = Minor Adverse Impacts Anticipated
N = No Appreciable Adverse Impacts Anticipated at Present

Source: GEC, 2006.


Project Extent
Vicinity Map
Miles
0 25 50
Atlantic Ocean
Jacksonville
Gainesville
Daytona Beach
Georgia
Florida
Atlantic Ocean
Pablo Creek
Intracoastal Waterway
Blount Island Marine Terminal
Dames Point Marine Terminal
Talleyrand Marine Terminal
Broward River
Trout River
Arlington River
Saint Johns River
Jacksonville
Mayport Naval Station
Hecksher Dr
SR-9A
Naval Aviation Depot
Miles
0 1.25 2.5 5
Jacksonville ROI
Savannah Harbor Expansion Project
Regional Port Analysis
Environmental Issues Survey
USA Street Map Date (2002), USGS National Hydrology Dataset
Figure: 1
Date: February 2007
Scale:1:150,000
Source: ESRI, USGS NHD
MapID: 22312115-671

Jacksonville ROI that could result from port expansion activities include emissions from construction and dredging equipment, impairment from runoff at port facility or adjacent intermodal accesses, and temporary impairment from sediment disturbance during dredging operations. Actions or consequences associated with port expansion within the Jacksonville ROI that could result in secondary adverse impacts to water quality include increases in cargo vessel traffic and associated emissions, increases in point and nonpoint pollution sources associated with the construction of new port facilities and adjacent intermodal rail and surface road accesses, and increases in salinity in coastal river systems associated with channel deepening. Water quality has been assessed as a moderate environmental constraint to port expansion within the Jacksonville ROI; minor primary adverse environmental impacts and moderate secondary adverse impacts are anticipated for this resource as a result of potential port expansion.

Sediment Quality

Sediment quality may pose a potential constraint to some port expansion activities, particularly dredging operations. Significantly contaminated sediments may pose a concern for disposal, and dredging operations may resuspend and redistribute contaminated sediments that were previously restricted in areal extent. Primary adverse impacts to sediment quality within the ROI that could result from potential port expansion activities include emissions and discharges from construction equipment during the construction of new port facilities and associated intermodal rail and surface road accesses and disturbance and redistribution of any contaminated sediments during dredging operations. Potential secondary adverse impacts to water quality from port expansion activities include increases in emissions and discharges associated with increased cargo vessel traffic and increases in point and nonpoint pollution sources associated with the operation of new port facilities and adjacent intermodal accesses.

Sediment quality in the lower St. Johns River is generally good according to recent studies performed by the USACE Jacksonville District. Polychlorinated biphenyl (PCB) and polynuclear aromatic hydrocarbon (PAH) concentrations were below detection limits in virtually all sediments sampled, with the exception of the areas around Dames Point and the Talleyrand Terminal, which exhibited low concentrations of both contaminant types. Metals concentrations were below minimum sediment quality guidelines (SQGs) for all sediments sampled. Sediment quality has been assessed as a moderate constraint to potential port expansion. Minor primary adverse impacts and moderate secondary adverse impacts are anticipated as a result of potential expansion activities or consequences.

Noise Environment

Few noise data are available for the Jacksonville ROI. Ambient noise levels appear to be within U.S. Environmental Protection Agency (EPA) and U.S. Department of Housing and Urban Development (HUD) recommended standards. Noise-sensitive areas within the ROI include natural areas such as the Timucuan National Ecological and Historic Preserve and populated places such as the Town of Mayport and City of Jacksonville. Actions associated with port expansion within the Jacksonville ROI that could result in primary adverse impacts to the noise environment include construction of new port facilities and adjacent intermodal rail or surface road accesses; these impacts would be temporary in nature. Secondary adverse impacts

to the noise environment associated with potential port expansion within the ROI could include increases in noise levels from equipment and facility operations at new port facilities and adjacent intermodal accesses and from an increase in cargo vessel traffic. Noise environment has been assessed as a moderate constraint to port expansion within the Jacksonville ROI, and moderate primary and secondary adverse impacts to this resource are anticipated as a result of potential expansion activities or consequences.

Coastal Zone Management Act Resources

The ROI is located entirely within the designated coastal zone for the state of Florida. Potential primary adverse impacts to CZMA resources within the ROI resulting from port expansion activities include the loss of CZMA resources within the construction footprints of new or expanded port facilities and associated intermodal rail and surface road accesses. Potential secondary impacts to CZMA resources associated with port expansion include the degradation or loss of CZMA resources in the ROI from wave erosion associated with increased commercial vessel traffic and from increased emissions associated with increased vessel and surface vehicle traffic. Such impacts could be minimized by adhering to state coastal management policies as mandated by the Federal consistency provision (Section 307) of the CZMA. CZMA resources have been assessed as a substantial constraint to port expansion activities within the ROI. With adherence to state coastal management policies, moderate primary and secondary adverse impacts are anticipated as a result of potential expansion activities or consequences.

Wetlands

Wetlands comprise a significant percentage of land surfaces within the Jacksonville ROI. Primary impacts to wetlands that could result from potential port expansion include wetland loss from the construction of new port facilities and adjacent intermodal rail or surface road accesses. However, opportunities exist to mitigate these primary wetland impacts by wetland creation on upland or submerged lands in or adjacent to the ROI. Potential secondary impacts to wetlands resulting from port expansion could include erosion of wetlands from increased wake action caused by an increase in cargo vessel traffic. Wetlands have been assessed as a moderate constraint to port expansion within the Jacksonville ROI. Minor primary adverse impacts and moderate secondary adverse impacts are anticipated as a result of potential expansion activities or consequences.

Wildlife Resources

Invasive Species

At least 99 invasive species may be present within the Jacksonville ROI. Potential primary adverse impacts associated with invasive species resulting from port expansion activities within the ROI include the introduction of new species to the ROI from fill material used in construction of new port facilities and adjacent intermodal rail and surface road accesses. Additionally, disposal of dredged material from channel deepening operations could result in the introduction of invasive species already present within the ROI to new areas. Secondary impacts

associated with invasive species within the ROI resulting from port expansion activities could include the introduction of new species as a result of ballast water dumping from commercial vessels utilizing the new or expanded port facilities. Primary impacts associated with invasive species could be reduced or eliminated by using fill material already located within the ROI and disposing of any dredged material at locations within the ROI, preventing the offsite spread of invasive species. Secondary impacts associated with invasive species could be reduced by the enforcement of U.S. Coast Guard (USCG) ballast water management guidelines established in 33 CFR 151. Invasive species have been assessed as a moderate constraint to port expansion activities within the Jacksonville ROI. Minor primary adverse impacts and moderate secondary adverse impacts are anticipated as a result of potential expansion activities or consequences.

Natural Areas

The ROI contains portions of a number of managed conservation areas, including the Timucuan National Ecological and Historic Preserve and the Machaba Balu Preserve. Most of these managed lands occur in the eastern portion of the ROI. Additionally, numerous areas within the ROI have been designated by the Florida Fish and Wildlife Conservation Commission (FFWCC) as Strategic Habitat Conservation Areas (SHCAs). Potential primary adverse impacts to natural areas resulting from port expansion activities include loss of natural areas from construction of new port facilities and adjacent intermodal rail and surface road accesses. Secondary impacts to natural areas resulting from potential port expansion within the ROI include erosion of nearshore natural areas from increased wake action resulting from an increase in cargo vessel traffic and disturbance of natural areas caused by increases in cargo vessel traffic and surface transport vehicles at intermodal accesses. While it is unlikely that port expansion would occur within any designated preserves, the increase in cargo vessel traffic and surface transport vehicles associated with port expansion could result in adverse impacts to these resources. Additionally, because SHCA designation does not necessarily indicate any legal protection status, these natural areas could be adversely impacted by the construction of new port facilities and adjacent intermodal rail and surface road accesses. Natural areas have been assessed as a moderate constraint to port expansion within the Jacksonville ROI, and moderate primary and secondary adverse impacts to this resource are anticipated as a result of potential expansion activities or consequences.

Threatened and Endangered Species

Numerous Federal and state listed species are present in the ROI. Potential primary impacts to listed species that could result from port expansion within the ROI include loss of terrestrial and nearshore habitat from construction of new port facilities and adjacent intermodal rail or surface road accesses, disturbance of benthic habitat from dredging operations, and incidental or accidental takes of listed species during construction activities. Potential secondary adverse impacts include disturbance of terrestrial habitat from transport vehicles at adjacent intermodal accesses and disturbance of terrestrial, nearshore, benthic, and pelagic habitat from increased cargo vessel traffic. Species of particular concern for the Jacksonville ROI include the North Atlantic right whale (*Eubalaena glacialis*), West Indian manatee (*Trichechus manatus latirostris*), piping plover (*Charadrius melodus*), sea turtles, and Atlantic sturgeon (*Acipenser oxyrhynchus oxyrhynchus*).

The National Marine Fisheries Service (NMFS) Southeast Regional Office (SERO) has stated that the species of greatest concern with regard to port expansion in the South Atlantic is the North Atlantic right whale (Habitat Conservation Division, personal communication). The SERO further stated that port expansion projects that result in increased vessel traffic threats to North Atlantic right whales will be subject to intense scrutiny by NMFS. The SERO explained that, because takes of this species cannot be authorized (due to small population size), for some port expansion actions (in or near right whale critical habitat) to proceed, it may be necessary for NMFS to impose reasonable and prudent alternatives on the Federal action agency to prevent the expansion project(s) from putting the right whales in a "jeopardy" situation.

Because of concerns raised by environmental agencies over potential impacts to threatened and endangered species resulting from port expansion operations, threatened and endangered species have been assessed as a substantial constraint to port expansion within the Jacksonville ROI. Substantial primary and secondary adverse impacts are anticipated for this resource as a result of potential expansion activities or consequences.

Critical Habitat

Critical habitat is present within the Jacksonville ROI for three federally listed species. Critical habitat for the North Atlantic right whale and piping plover is present at or near the mouth of the St. Johns River, and critical habitat for the West Indian manatee is present for the entire extent of the St. Johns River within the ROI. Potential primary impacts to critical habitat resulting from port expansion within the ROI include loss of critical habitat from construction of new port facilities and adjacent intermodal rail and surface road accesses and disturbance of nearshore and aquatic critical habitat from dredging operations. Secondary impacts to critical habitat resulting from potential port expansion within the ROI include erosion of nearshore critical habitat from increased wake action resulting from an increase in cargo vessel traffic and disturbance of nearshore, upland, and aquatic critical habitat caused by increases in cargo vessel traffic and surface transport vehicles at intermodal accesses. Although it is unlikely that the construction of new port facilities and adjacent intermodal accesses would occur within a designated critical habitat area, potential secondary impacts from wave erosion and noise disturbance associated with vessel traffic increases are possible. Because critical habitat is present throughout the ROI, this resource has been assessed as a substantial constraint; substantial primary and secondary adverse impacts are anticipated as a result of potential expansion activities or consequences.

Unique or Unusual Habitats

Small discontinuous populations of submerged aquatic vegetation (SAV) and oysters are present within the ROI. No significant natural hardbottoms have been identified within the ROI. Because these resources are not present in significant quantities within the ROI, unique or unusual habitats have been assessed as a minor constraint, and minor primary and secondary environmental impacts are anticipated as a result of potential expansion activities or consequences.

Essential Fish Habitat

Essential Fish Habitat (EFH) is found throughout the Jacksonville ROI for a large assemblage of managed marine fishes and invertebrates, including various shrimp species, red drum (*Scianeops ocellatus*), members of the snapper-grouper complex, and highly migratory managed species. Potential primary adverse impacts to EFH that could result from port expansion activities within the ROI include loss of nearshore EFH from construction of new port facilities and adjacent intermodal rail and surface road accesses and loss or disturbance of benthic EFH from dredging operations. Potential secondary adverse impacts from port expansion include disturbance of nearshore, benthic, and pelagic EFH from increased cargo vessel traffic and degradation or loss of EFH from increased point and nonpoint pollution sources associated with port operations. Because of the widespread nature of EFH within the ROI, this resource has been assessed as a substantial environmental constraint, and substantial primary and secondary adverse impacts are anticipated to EFH as a result of potential expansion activities or consequences.

Cultural Resources

The ROI contains an abundance of cultural resource sites. Despite the large number of sites within the ROI, many of these sites are concentrated in the central and western portions of the ROI, near the south shore of Mill Cove and on the right descending riverbank in the vicinity of Reddie Point, respectively. Potential primary adverse impacts to cultural resources from port expansion activities within the ROI include destruction of cultural resource sites from the construction of new port facilities and adjacent intermodal rail and surface road accesses. Potential secondary impacts include the damage or loss of nearshore cultural resources from wave action associated with increased commercial vessel traffic. Significant areas with low densities of cultural resource sites are present within the ROI, indicating that construction of new facilities may not pose a significant threat to cultural resources; however, the potential loss of nearshore sites from wave action remains a possibility. Consequently, cultural resources have been assessed as a moderate constraint to port expansion within the Jacksonville ROI; minor primary adverse impacts and moderate secondary adverse impacts are anticipated for cultural resources as a result of potential expansion activities or consequences.

Hazardous, Toxic, and Radioactive Waste

Hazardous, toxic, and radioactive waste (HTRW) may pose a constraint to port expansion activities. The presence of significant recognized environmental conditions (REC) sites in a given area may render the given area infeasible for port expansion because of HTRW concerns. Additionally, potential port expansion may pose an HTRW concern to the surrounding environment. Potential primary impacts associated with port expansion activities include discharges from construction or dredging equipment during the construction of new port facilities and adjacent intermodal rail and surface road accesses or dredging operations. Potential secondary impacts include increases in point and nonpoint pollution sources associated with the construction of new port facilities and adjacent intermodal accesses, as well as the potential increase in pollutant or contaminant discharges from accidents involving cargo vessels.

Significant concentrations of potential REC sites in the ROI are present in the vicinity of the Mayport Naval Station, on Blount Island, and on the left descending river bank in the vicinity of Blount Island; particularly high concentrations of potential REC sites are present on the left descending river bank in the vicinity of the existing Talleyrand terminal. Much of the remainder of the ROI, however, exhibits a low density of potential REC sites. Considerable potential for the avoidance of existing HTRW sites exists, and the likelihood of substantial primary adverse impacts resulting from port expansion activities is believed to be minimal. Secondary HTRW impacts are a substantial concern, however. HTRW has been assessed as a moderate environmental constraint to port expansion within the Jacksonville ROI. Minor primary adverse impacts and substantial secondary adverse impacts are anticipated as a result of potential port expansion.

Socioeconomic Profile

Expansion of port facilities in the Jacksonville ROI would likely result in the creation of new jobs and new infrastructure within the ROI. Potential primary impacts to socioeconomic conditions within the Jacksonville ROI include the acquisition of property from residents or landowners for the construction of new port facilities and adjacent intermodal rail and surface road accesses. It is anticipated that compensation would be provided to any impacted residents or socioeconomic groups impacted by property acquisition, offsetting or mitigating the impacts. No secondary adverse impacts to socioeconomic conditions are anticipated as a result of port expansion activities. Port expansion would likely constitute a net benefit to socioeconomic conditions within the ROI. Overall socioeconomic conditions are not believed to constitute a constraint to potential port expansion within the Jacksonville ROI at this time, and no net primary or secondary adverse impacts to this resource are anticipated as a result of potential port expansion.

Environmental Justice

Areas with significant minority and/or poverty levels within the ROI include the vicinity of the Mayport Naval Station and the area from the Trout River to the Talleyrand Terminal on the left descending riverbank and adjacent property on the right descending bank. Construction of new port facilities and adjacent intermodal rail and surface road accesses in these areas could result in primary adverse impacts to minority or disadvantaged populations. However, ample areas exist within the ROI for port expansion that would not result in disproportionate impacts to such groups, and the construction of new port facilities and the associated increase in jobs and infrastructure could result in a net benefit to minority and disadvantaged populations within the ROI. Environmental justice has been assessed as a minor constraint. Minor primary adverse impacts are anticipated as a result of potential port expansion. No net secondary adverse impacts are anticipated as a result of potential port expansion.

Transportation

The Jacksonville ROI contains an extensive network of surface roads, railroads, and waterways with shipping channels that support residential and commercial traffic activity in the area. Potential primary adverse impacts to transportation resulting from port expansion activities

include the temporary disruption of traffic on surface roads and railways in construction areas for expanded port facilities or adjacent intermodal rail and surface road accesses, and temporary disruption of vessel traffic in areas selected for channel modification. Additionally, the construction of landside features could result in the permanent loss of portions of surface roads or railroads within the construction footprint of the expanded facilities. Traffic disruptions from construction activities would likely be temporary in nature, however, and any permanent surface route closures from construction activities could be offset by construction of new nearby routes to replace the closed routes. Potential secondary impacts to transportation resulting from port expansion activities within the ROI include increased use of transportation routes from commercial vehicle, train, and vessel traffic associated with expanded port facilities. Such increases in traffic could require substantial additions to or modifications of the existing transportation infrastructures. Consequently, transportation has been assessed as a substantial constraint to port expansion within the Jacksonville ROI. Minor primary adverse impacts and substantial adverse secondary impacts are anticipated as a result of potential port expansion within the ROI.

Recreation

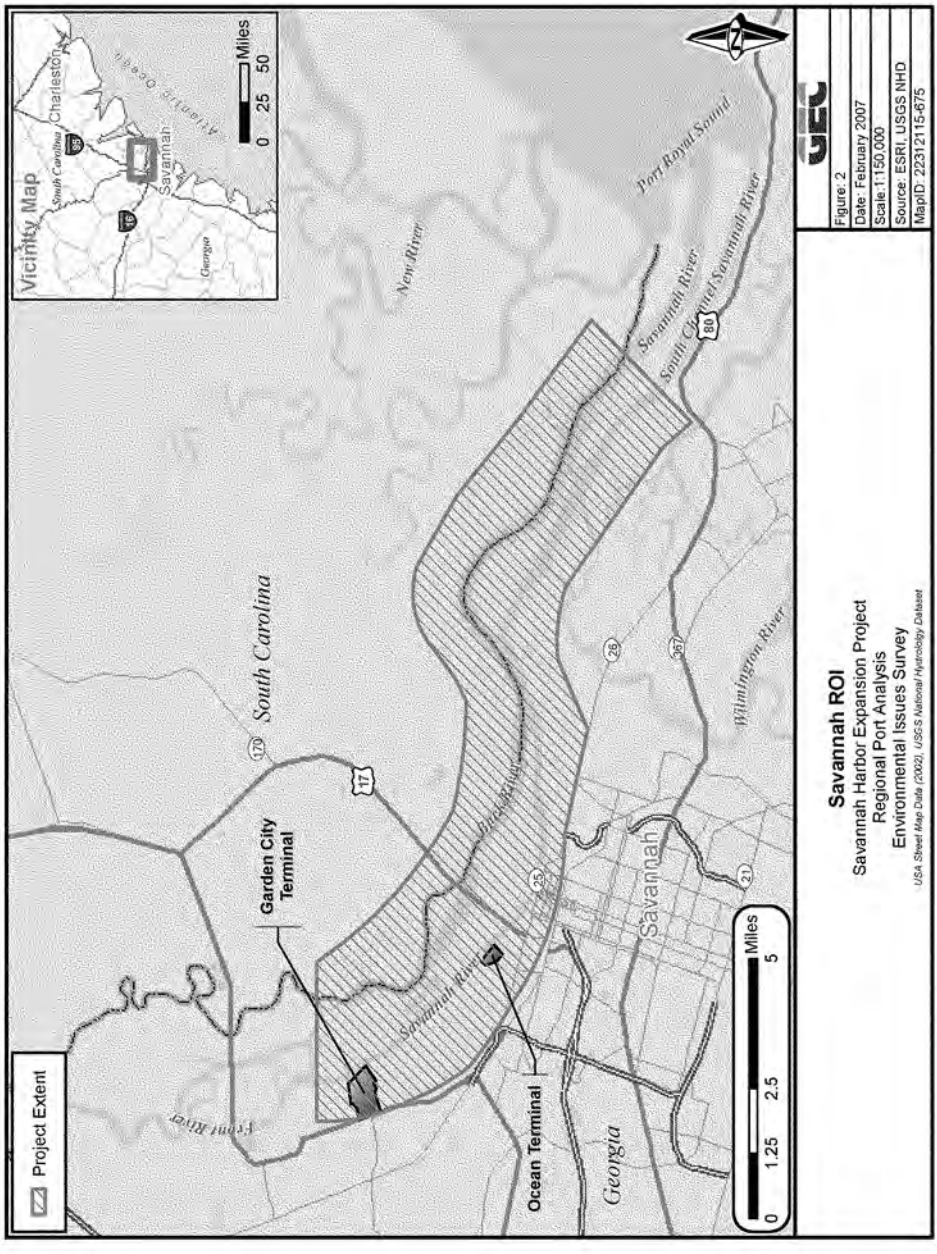
Common recreational activities on the lower St. Johns River include boating, fishing, birding, and visiting the area's parks, preserves, and natural areas. Potential primary adverse impacts to recreation within the ROI resulting from port expansion include loss of nearshore recreational space from the construction of new port facilities and adjacent intermodal rail and surface road accesses; secondary adverse impacts include the disturbance of waterborne and ecotourist recreation activities from increased cargo vessel traffic. Recreational fishing, one of the predominant recreational activities on the lower St. Johns River, may be less affected than other activities, because the large number of inlets and bays off the main river channel would likely still provide significant recreational fishing opportunities despite any additional cargo vessel traffic associated with port expansion. Consequently, recreation has been assessed as a moderate constraint to port expansion within the Jacksonville ROI. Minor primary adverse impacts and moderate secondary adverse impacts are anticipated for the resource as a result of potential port expansion.

SAVANNAH REGION OF INTEREST

There is one ROI in the Savannah area (Figure 2). Potential impacts to each environmental resource in the ROI are summarized in the following subsections.

Geology and Soils

No rare or environmentally sensitive geologic features are present within the ROI. No prime or unique farmland soils are present within the ROI. Consequently, geology and soils do not pose an environmental constraint for potential expansion activities within the Savannah ROI, and no appreciable adverse primary or secondary environmental impacts to these resources are anticipated as a result of any expansion activities.


Project Extent
Vicinity Map
Charleston
Savannah
Atlantic Ocean
South Carolina
Georgia
Miles
0 25 50
Garden City Terminal
Ocean Terminal
South Carolina
Georgia
Savannah
New River
Savannah River
Port Royal Sound
Wilmington River
Miles
0 1.25 2.5 5
Savannah ROI
Savannah Harbor Expansion Project
Regional Port Analysis
Environmental Issues Survey
USA Street Map Data (2002), USGS National Hydrology Dataset
Figure: 2
Date: February 2007
Scale: 1:150,000
Source: ESRI, USGS, NHD
MapID: 22312115-675

Air Quality

The ROI is within an attainment zone for all six air criteria pollutants identified by the NAAQS. Concentrations of ozone and particulate matter in the ROI are near the NAAQS limit, however. Air quality in the ROI is generally good to moderate, with minimal periods in which air quality is classified as unhealthy for the general public or for sensitive groups. Potential primary impacts to air quality from port expansion within the Savannah ROI that could adversely impact air quality include temporary increases in emissions from construction equipment during the construction of new port facilities and adjacent intermodal rail and surface road accesses and from dredging vessels during dredging operations. Potential secondary impacts to air quality resulting from potential port expansion activities within the ROI include air quality degradation from emissions caused by an increase in cargo vessel traffic and transportation vehicles at adjacent intermodal rail and surface road accesses. Because the ROI is currently near nonattainment status with regard to air quality, this resource has been assessed as a substantial constraint for port expansion within the Savannah ROI. Primary adverse impacts to air quality from potential port expansion are anticipated to be minor and temporary in nature; however, substantial secondary adverse impacts to air quality are anticipated as a result of potential expansion activities or consequences.

Water Quality

Waterbodies within the Savannah ROI are currently listed as only partially supporting their designated uses because of low dissolved oxygen, fecal coliform, and metals contamination. Potential primary impacts to water quality within the Savannah ROI that could result from port expansion activities include emissions from construction and dredging equipment, impairment from runoff at port facility or adjacent intermodal accesses, and temporary impairment from sediment disturbance during dredging operations. Actions or consequences associated with port expansion within the ROI that could result in secondary adverse impacts to water quality include increases in cargo vessel traffic and associated emissions, increases in point and nonpoint pollution sources associated with the construction of new port facilities and adjacent intermodal rail and surface road accesses, and increases in salinity in coastal river systems associated with channel deepening. Water quality has been assessed as a substantial environmental constraint within the Savannah ROI. Minor temporary primary adverse impacts and substantial secondary adverse environmental impacts are anticipated for this resource as a result of potential port expansion.

Sediment Quality

Sediment quality may pose a potential constraint to some port expansion activities, particularly dredging operations. Significantly contaminated sediments may pose a concern for disposal, and dredging operations may resuspend and redistribute contaminated sediments that were previously restricted in areal extent. Primary adverse impacts to sediment quality within the Savannah ROI that could result from potential port expansion activities include emissions and discharges from construction equipment during the construction of new port facilities and associated intermodal rail and surface road accesses and disturbance and redistribution of any contaminated sediments during dredging operations. Potential secondary adverse impacts to

water quality from port expansion activities include increases in emissions and discharges associated with increased cargo vessel traffic and increases in point and nonpoint pollution sources associated with the operation of new port facilities and adjacent intermodal accesses.

Recent sediment quality studies in Savannah Harbor indicate that metals contamination is a concern for sediments within the ROI. PCB and PAH concentrations were below detection limits in virtually all sediments sampled, with the exception of the areas around the Ocean Terminal, which exhibited significant exceedences of PAH SQGs. SQG exceedences for arsenic, cadminum, and magnesium were documented in a number of sediment samples collected from the harbor. Sediment quality has been assessed as a substantial constraint to potential port expansion within the Savannah ROI. Minor primary adverse impacts and substantial secondary adverse impacts are anticipated as a result of potential expansion activities or consequences.

Noise Environment

No noise data are available for the Savannah ROI. Noise-sensitive areas within the ROI include the Savannah Wildlife Refuge and the City of Savannah. Actions associated with port expansion within the Savannah ROI that could result in primary adverse impacts to the noise environment include construction of new port facilities and adjacent intermodal rail or surface road accesses; these impacts would be temporary in nature. Secondary adverse impacts to the noise environment associated with potential port expansion within the ROI could include increases in noise levels from equipment and facility operations at new port facilities and adjacent intermodal accesses and from an increase in cargo vessel traffic. Noise environment has been assessed as a moderate constraint to port expansion within the Savannah ROI, and moderate primary and secondary adverse impacts to this resource are anticipated as a result of potential expansion activities or consequences.

Coastal Zone Management Act Resources

The ROI is located entirely within the designated coastal zones for the states of Georgia and South Carolina. Additionally, the portion of the ROI located in South Carolina is within a designated critical area. Potential primary adverse impacts to CZMA resources within the ROI resulting from port expansion activities include the loss of CZMA resources within the construction footprints of new or expanded port facilities and associated intermodal rail and surface road accesses. Potential secondary impacts to CZMA resources associated with port expansion include the degradation or loss of CZMA resources in the ROI from wave erosion associated with increased commercial vessel traffic and from increased emissions associated with increased vessel and surface vehicle traffic. Such impacts could be minimized by adhering to state coastal management policies as mandated by the Federal consistency provision (Section 307) of the CZMA. Because the ROI is located entirely within the designated coastal zones, CZMA resources have been assessed as a substantial constraint to port expansion activities within the ROI. With adherence to state coastal management policies, moderate primary and secondary adverse impacts are anticipated as a result of potential expansion activities or consequences.

Wetlands

Wetlands comprise a significant percentage of land surfaces within the Savannah ROI. Primary impacts to wetlands that could result from potential port expansion include wetland loss from the construction of new port facilities and adjacent intermodal rail or surface road accesses. However, opportunities exist to mitigate these primary wetland impacts by wetland creation on upland or submerged lands in or adjacent to the ROI. Potential secondary impacts to wetlands resulting from port expansion could include erosion of wetlands from increased wake action caused by an increase in cargo vessel traffic. Wetlands have been assessed as a moderate constraint to port expansion within the Savannah ROI. Minor primary adverse impacts and moderate secondary adverse impacts are anticipated as a result of potential expansion activities or consequences.

Wildlife Resources

Invasive Species

At least 75 invasive species may be present within the Savannah ROI. Potential primary adverse impacts associated with invasive species resulting from port expansion activities within the ROI include the introduction of new species to the ROI from fill material used in construction of new port facilities and adjacent intermodal rail and surface road accesses. Additionally, disposal of dredged material from channel deepening operations could result in the introduction of invasive species already present within the ROI to new areas. Secondary impacts associated with invasive species within the ROI resulting from port expansion activities could include the introduction of new species as a result of ballast water dumping from commercial vessels utilizing the new or expanded port facilities. Primary impacts associated with invasive species could be reduced or eliminated by using fill material already located within the ROI and disposing of any dredged material at locations within the ROI, preventing the offsite spread of invasive species. Secondary impacts associated with invasive species could be reduced by the enforcement of USCG ballast water management guidelines established in 33 CFR 151. Invasive species have been assessed as a moderate constraint to port expansion activities within the Savannah ROI. Minor primary adverse impacts and moderate secondary adverse impacts are anticipated as a result of potential expansion activities or consequences.

Natural Areas

Natural areas are not widespread throughout the Savannah ROI. Managed conservation areas within the ROI include the Savannah National Wildlife Refuge and Fort Pulaski National Monument, located near the northwestern and southeastern termini of the ROI, respectively. Potential primary adverse impacts to natural areas resulting from port expansion within the ROI include loss of natural areas from construction of new port facilities and adjacent intermodal rail and surface road accesses. Secondary impacts to natural areas include erosion of nearshore natural areas from increased wake action resulting from an increase in cargo vessel traffic and disturbance of natural areas caused by increases in cargo vessel traffic and surface transport vehicles at intermodal accesses. While it is unlikely that port expansion would occur in either of the designated preserves, the increase in cargo vessel traffic and surface transport

vehicles associated with port expansion could result in adverse impacts to these resources. Natural areas have been assessed as a minor constraint to potential port expansion within the Savannah ROI, and minor primary and secondary adverse impacts to this resource are anticipated as a result of potential expansion activities or consequences.

Threatened and Endangered Species

Numerous Federal and state listed species are present in the Savannah ROI. Potential primary adverse impacts to listed species from port expansion within the ROI include loss of terrestrial and nearshore habitat from construction of new port facilities and adjacent intermodal rail or surface road accesses and incidental or accidental takes of listed species during construction activities. Potential secondary adverse impacts include disturbance of terrestrial habitat from transport vehicles at adjacent intermodal accesses, disturbance of benthic habitat from dredging operations, and disturbance of terrestrial, nearshore, benthic, and pelagic habitat from increased cargo vessel traffic. Species of particular concern for the Savannah ROI include the North Atlantic right whale, piping plover, sea turtles, shortnose sturgeon (*Acipenser brevirostrum*), eastern Indigo snake (*Drymarchon corais couperi*), and gopher tortoise (*Gopherus polyphemus*).

The NMFS SERO has stated that the species of greatest concern with regard to port expansion in the South Atlantic is the North Atlantic right whale (Habitat Conservation Division, personal communication). The SERO further stated that port expansion projects that result in increased vessel traffic threats to North Atlantic right whales will be subject to intense scrutiny by NMFS. The SERO explained that, because takes of this species cannot be authorized (due to small population size), for some port expansion actions (in or near right whale critical habitat) to proceed, it may be necessary for NMFS to impose reasonable and prudent alternatives on the Federal action agency to prevent the expansion project(s) from putting the right whales in a "jeopardy" situation. Although no critical habitat for the North Atlantic right whale is present within the ROI, the ROI is located in close proximity to such critical habitat. Additionally, the ROI is located immediately west of South Atlantic coastal waters that are used as a migration corridor by the species.

Because of concerns raised by environmental agencies over potential impacts to threatened and endangered species resulting from port expansion operations, threatened and endangered species have been assessed as a substantial constraint to port expansion within the Savannah ROI, and substantial primary and secondary adverse environmental impacts are anticipated for this resource as a result of potential expansion activities or consequences.

Critical Habitat

No critical habitat is present within the ROI. Consequently, critical habitat is not considered to be a constraint for potential port expansion at this time, and no appreciable adverse environmental impacts to critical habitat are anticipated as a result of potential expansion activities or consequences.

Unique or Unusual Habitats

Small discontinuous populations of oysters are present within the ROI. No significant SAV communities or natural hardbottoms have been identified within the ROI. Because these resources are not present in significant quantities within the ROI, unique or unusual habitats have been assessed as a minor constraint, and minor primary and secondary adverse impacts are anticipated as a result of potential expansion activities or consequences within the ROI.

Essential Fish Habitat

EFH is found throughout the Savannah ROI for a large assemblage of managed marine fishes and invertebrates, including various shrimp species, red drum, members of the snapper-grouper complex, and highly migratory managed species. Potential primary adverse impacts to EFH that could result from port expansion activities within the ROI include loss of nearshore EFH from construction of new port facilities and adjacent intermodal rail and surface road accesses and loss or disturbance of benthic EFH from dredging operations. Potential secondary adverse impacts from port expansion include disturbance of nearshore, benthic, and pelagic EFH from increased cargo vessel traffic and degradation or loss of EFH from increased point and nonpoint pollution sources associated with port operations. Because of the widespread nature of EFH within the Savannah ROI, this resource has been assessed as a substantial environmental constraint, and substantial primary and secondary adverse impacts are anticipated to EFH as a result of potential expansion activities.

Cultural Resources

The ROI contains an abundance of cultural resource sites. Despite the large number of sites within the ROI, however, many of these sites are concentrated in downtown Savannah or along the right descending riverbank in the vicinity of Hutchinsons Island. Much of the Jasper County portion of the ROI is comprised of dredged material disposal areas that were selected because of minimal impacts to environmental resources, including cultural resources. The likelihood of significant cultural resources occurring within this portion of the ROI is believed to be minimal. Potential primary adverse impacts to cultural resources from port expansion activities within the ROI include destruction of cultural resource sites from the construction of new port facilities and adjacent intermodal rail and surface road accesses. Potential secondary impacts include the damage or loss of nearshore cultural resources from wave action associated with increased commercial vessel traffic. Significant areas with low densities of cultural resource sites are present within the ROI, indicating that construction of new facilities may not pose a significant threat to cultural resources; however, the potential loss of nearshore sites from wave action remains a possibility. Because significant opportunities for avoidance of sensitive areas are possible, cultural resources have been assessed as a minor constraint to port expansion within the Savannah ROI. Minor primary adverse impacts and moderate secondary adverse impacts are anticipated for cultural resources as a result of potential expansion activities or consequences.

Hazardous, Toxic, and Radioactive Waste

HTRW may pose a constraint to port expansion activities. The presence of significant REC sites in a given area may render the given area infeasible for port expansion because of HTRW concerns. Additionally, potential port expansion may pose an HTRW concern to the surrounding environment. Potential primary impacts associated with port expansion activities include discharges from construction or dredging equipment during the construction of new port facilities and adjacent intermodal rail and surface road accesses or dredging operations. Potential secondary impacts include increases in point and nonpoint pollution sources associated with the construction of new port facilities and adjacent intermodal accesses, as well as the potential increase in pollutant or contaminant discharges from accidents involving cargo vessels.

Significant concentrations of potential REC sites in the ROI are present on the right descending riverbank in the vicinity of the historic Fort Jackson area east of Savannah and downtown Savannah; particularly high concentrations of potential REC sites are present on the right descending bank in the vicinity of the existing Garden City and Talleyrand terminals. Much of the remainder of the ROI, however, exhibits a low density of potential REC sites. No REC sites were identified within the Jasper County portion of the ROI. Considerable potential for the avoidance of existing HTRW sites exists, and the likelihood of substantial primary adverse impacts resulting from port expansion activities is believed to be minimal. Secondary HTRW impacts are a substantial concern, however. Consequently, HTRW has been assessed as a minor constraint to port expansion within the Savannah ROI at this time. Minor primary adverse impacts and substantial secondary adverse impacts are anticipated as a result of potential port expansion.

Socioeconomic Profile

Expansion of port facilities in the Savannah ROI would likely result in the creation of new jobs and new infrastructure within the ROI. Potential primary impacts to socioeconomic conditions within the Savannah ROI include the acquisition of property from residents for the construction of new port facilities and adjacent intermodal rail and surface road accesses. It is anticipated that compensation would be provided to any impacted residents or socioeconomic groups impacted by property acquisition, offsetting or mitigating the impacts. No secondary adverse impacts to socioeconomic conditions are anticipated as a result of port expansion activities. Port expansion would likely constitute a net benefit to socioeconomic conditions within the ROI. Overall socioeconomic conditions are not believed to constitute a constraint to potential port expansion within the Savannah ROI at this time, and no net primary or secondary adverse impacts to this resource are anticipated as a result of potential port expansion.

Environmental Justice

Areas with significant minority and/or poverty levels within the ROI include the right descending riverbank from the historic Fort Jackson area west to the vicinity of the Ocean Terminal. The Jasper County portion of the ROI is included within a U.S. Census block characterized as having a high percentage of minority and disadvantaged residents; however, this area is virtually unpopulated, and population demographics are not applicable to this portion of

the ROI. Construction of new port facilities and adjacent intermodal rail and surface road accesses in these areas could result in primary adverse impacts to minority or disadvantaged populations. However, ample areas exist within the ROI for port expansion that would not result in disproportionate impacts to such groups, and the construction of new port facilities and the associated increase in jobs and infrastructure could result in a net benefit to minority and disadvantaged populations within the ROI. Environmental justice has been assessed as a minor constraint to port expansion within the Savannah ROI. Minor primary adverse impacts are anticipated as a result of potential port expansion. No net secondary adverse impacts are anticipated as a result of potential port expansion.

Transportation

The Georgia portion of the Savannah ROI contains an extensive network of surface roads, railroads, and waterways with shipping channels that support residential and commercial traffic activity in the area. Potential primary adverse impacts to transportation resulting from port expansion activities include the temporary disruption of traffic on surface roads and railways in construction areas for expanded port facilities or adjacent intermodal rail and surface road accesses, and temporary disruption of vessel traffic in areas selected for channel modification. Additionally, the construction of landside features could result in the permanent loss of portions of surface roads or railroads within the construction footprint of the expanded facilities. Traffic disruptions from construction activities would likely be temporary in nature, however, and any permanent surface route closures from construction activities could be offset by construction of new nearby routes to replace the closed routes. Potential secondary impacts to transportation resulting from port expansion activities within the ROI include increased use of transportation routes from commercial vehicle, train, and vessel traffic associated with expanded port facilities. Such increases in traffic could require substantial additions to or modifications of the existing transportation infrastructures. Consequently, transportation has been assessed as a substantial constraint to port expansion within the Savannah ROI. Minor primary adverse impacts and substantial adverse secondary impacts are anticipated as a result of potential port expansion within the ROI.

Recreation

Recreational activities in the vicinity of the Savannah ROI include boating, fishing, birding, and visiting the area's historic sites. Actions or consequences of potential port expansion that could result in primary adverse impacts to recreation within the ROI include loss of nearshore recreational space from the construction of new port facilities and adjacent intermodal rail and surface road accesses; secondary impacts include the disturbance of waterborne and ecotourist recreation activities from increased cargo vessel traffic. Recreational boating and fishing in the ROI are currently not prominent activities because of the high volume of cargo vessel traffic associated with port operations. Landside recreational activities appear to have adjusted to any disturbances caused by high cargo traffic volumes and would likely adjust to any increases without substantial impairment. Consequently, recreation has been assessed as a minor constraint to port expansion within the Savannah ROI, and minor primary and secondary adverse impacts are anticipated for the resource as a result of potential port expansion.

CHARLESTON REGIONS OF INTEREST

There are two ROIs (Berkeley-Charleston County and Jasper County) in the Charleston area (figures 3 and 4). Potential impacts to each environmental resource in the ROIs are summarized in the following subsections.

Geology and Soils

No rare or environmentally sensitive geologic features are present within either ROI. No prime or unique farmland soils are present within either ROI. Consequently, geology and soils do not pose an environmental constraint for potential expansion activities within the Charleston ROIs, and no appreciable adverse environmental impacts to these resources are anticipated as a result of any expansion activities.

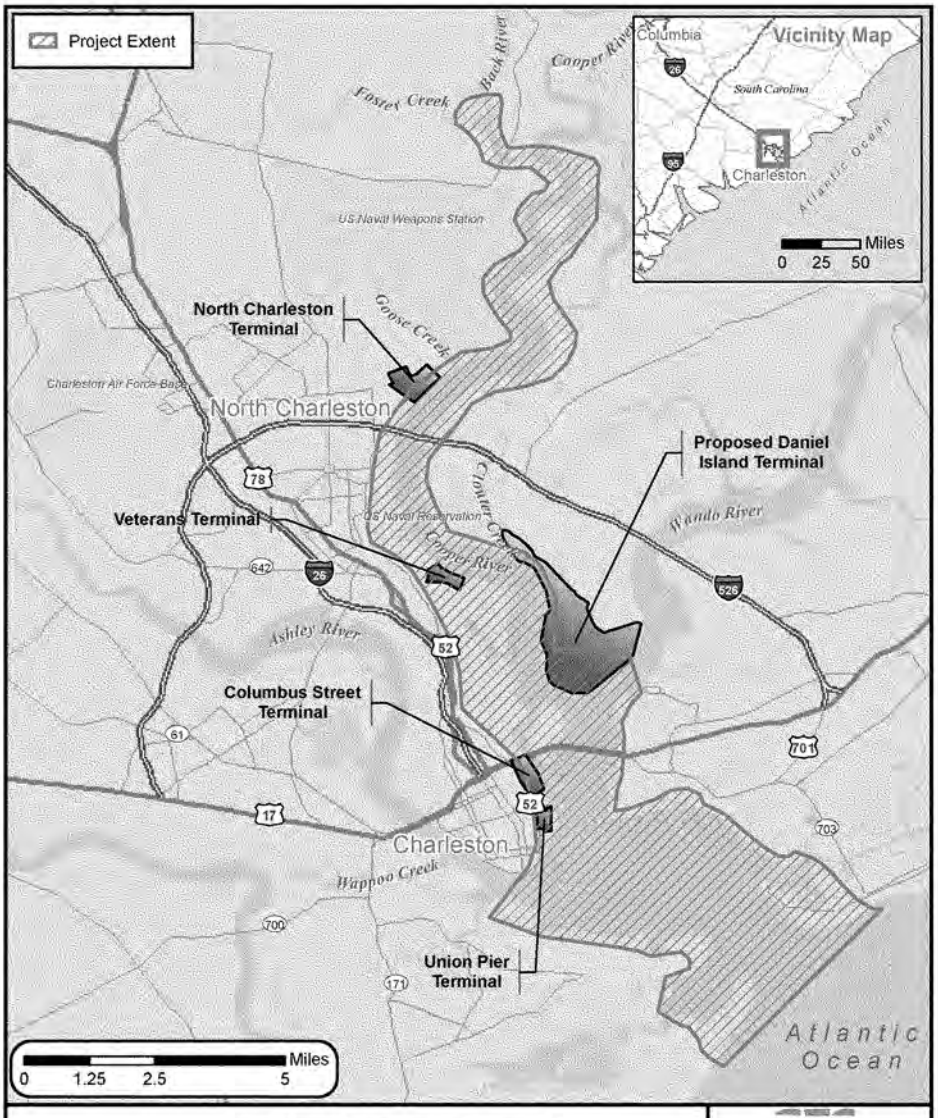
Air Quality

The Berkeley-Charleston County ROI is within an attainment zone for all six air criteria pollutants identified by the NAAQS. Concentrations of ozone and particulate matter in the ROI are somewhat elevated with respect to other criteria air pollutants; however, concentrations of these pollutants are still substantially within NAAQS limits. Air quality in the ROI is generally good to moderate, with minimal periods in which air quality is classified as unhealthy for the general public or for sensitive groups. No air quality data were available for the Jasper County ROI. The ROI is uninhabited and contains no emission sources. The Jasper County ROI is located several miles from the city of Savannah, Georgia, and likely experiences some degradation of air quality from its proximity; however, no indications that the Jasper County ROI has experienced impaired air quality conditions with respect to NAAQS were identified.

Potential primary impacts to air quality from port expansion within the Charleston ROIs that could adversely impact air quality include temporary increases in emissions from construction equipment during the construction of new port facilities and adjacent intermodal rail and surface road accesses and from dredging vessels during dredging operations. Potential secondary impacts to air quality resulting from potential port expansion activities within the ROIs include air quality degradation from emissions caused by an increase in cargo vessel traffic and transportation vehicles at adjacent intermodal rail and surface road accesses. Air quality has been assessed as a moderate constraint for port expansion within the Berkeley-Charleston County ROI; minor temporary primary adverse impacts and moderate secondary adverse impacts to air quality are anticipated as a result of potential expansion activities or consequences. Air quality has been assessed as a minor constraint to port expansion within the Jasper County ROI; minor primary adverse impacts and moderate secondary adverse impacts are anticipated as a result of potential expansion activities or consequences.

Water Quality

With the exception of the Wando River, waterbodies within the Berkeley-Charleston County ROI are listed as supporting recreational uses. The South Carolina Department of Health and Environmental Control (SCDHEC) has documented decreasing trends in fecal coliform,

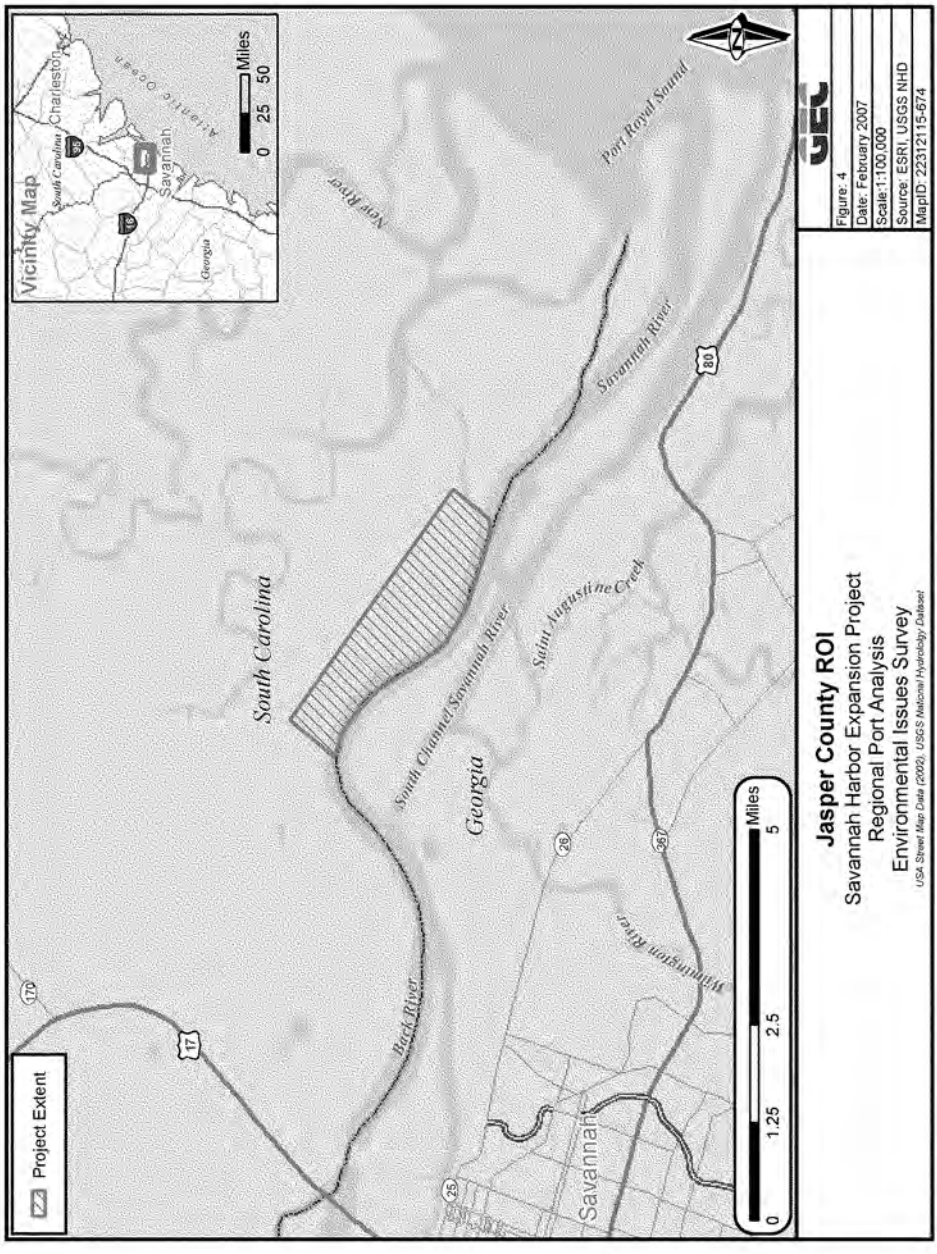


Berkeley - Charleston County ROI

Savannah Harbor Expansion Project
Regional Port Analysis
Environmental Issues Survey

USA Street Map Data (2002), USGS National Hydrology Dataset

Figure: 3
Date: February 2007
Scale:1:150,000
Source: ESRI, USGS NHD
MapID: 22312115-676


Project Extent
Vicinity Map
Charleston
South Carolina
Savannah
Atlantic Ocean
Georgia
Miles
0 25 50
South Carolina
Georgia
New River
Port Royal Sound
Savannah River
Saint Augustine Creek
South Channel Savannah River
Back River
Wilmington River
Savannah
80
26
367
17
170
25
0 1.25 2.5 5 Miles
Jasper County ROI
Savannah Harbor Expansion Project
Regional Port Analysis
Environmental Issues Survey
USA Street Map Data (2002), USGS National Hydrology Dataset
GEC
Figure: 4
Date: February 2007
Scale:1:100,000
Source: ESRI, USGS NHD
MapID: 22312115-674

five-day biochemical oxygen demand, total phosphorus, and total nitrogen concentrations. Waterbodies within the Jasper County ROI are currently listed as only partially supporting their designated uses because of low dissolved oxygen, fecal coliform, and metals contamination.

Potential primary impacts to water quality within the Charleston ROIs resulting from port expansion activities include emissions from construction and dredging equipment, impairment from runoff at port facility or adjacent intermodal accesses, and temporary impairment from sediment disturbance during dredging operations. Potential secondary impacts include increases in cargo vessel traffic and associated emissions, increases in point and nonpoint pollution sources associated with the construction of new port facilities and adjacent intermodal rail and surface road accesses, and increases in salinity in coastal river systems associated with channel deepening. Water quality has been assessed as a moderate environmental constraint within the Berkeley-Charleston County ROI. Minor temporary primary impacts and moderate secondary adverse environmental impacts are anticipated for this resource as a result of potential port expansion. Water quality has been assessed as a substantial environmental constraint within the Jasper County ROI, and minor temporary adverse impacts and substantial secondary adverse environmental impacts are anticipated for this resource as a result of potential port expansion.

Sediment Quality

Sediment quality may pose a potential constraint to some port expansion activities, particularly dredging operations. Significantly contaminated sediments may pose a concern for disposal, and dredging operations may resuspend and redistribute contaminated sediments that were previously restricted in areal extent. Primary adverse impacts to sediment quality within the Charleston ROIs that could result from potential port expansion activities include emissions and discharges from construction equipment during the construction of new port facilities and associated intermodal rail and surface road accesses and disturbance and redistribution of any contaminated sediments during dredging operations. Potential secondary adverse impacts include increases in emissions and discharges associated with increased cargo vessel traffic and increases in point and nonpoint pollution sources associated with the operation of new port facilities and adjacent intermodal rail and surface road accesses.

Data from the South Carolina Estuarine and Coastal Assessment Program (SCECAP) indicate that sediment quality is generally good in the Berkeley-Charleston County ROI. PCB concentrations were below SQGs in all sediments sampled within the ROI. Metals and PAH concentrations were generally below SQGs, although several samples exhibited concentrations exceeding the most conservative SQGs utilized in the study. Sediment quality has been assessed as a moderate constraint to potential port expansion within the Berkeley-Charleston County ROI; minor primary adverse impacts and moderate secondary adverse impacts are anticipated as a result of potential expansion opportunities.

Recent sediment quality studies in Savannah Harbor indicate that metals contamination is a concern for sediments in the vicinity of the Jasper County ROI. PCB and PAH concentrations were below detection limits in virtually all sediments sampled, with the exception of the areas around Savannah port facilities, which exhibited significant exceedences of PAH SQGs. SQG exceedences for arsenic, cadminum, and magnesium were documented in a number of sediment

samples collected from the harbor. Sediment quality has been assessed as a substantial constraint to potential port expansion within the Jasper County ROI. Minor primary adverse impacts and substantial secondary adverse impacts are anticipated as a result of potential expansion activities or consequences.

Noise Environment

Ambient noise levels are impaired in portions of the Berkeley-Jasper County ROI, particularly in the vicinity of the U.S. Naval Reservation on the Charleston peninsula. Noise-sensitive areas within the ROI include populated places such as the City of Charleston and the town of Mount Pleasant. No noise data are available for the Jasper County ROI, and no noise-sensitive areas within the ROI were identified. Actions associated with port expansion within the Charleston ROIs that could result in primary adverse impacts to the noise environment include construction of new port facilities and adjacent intermodal rail or surface road accesses; these impacts would be temporary in nature. Secondary adverse impacts to the noise environment associated with potential port expansion within the ROI could include increases in noise levels from equipment and facility operations at new port facilities and adjacent intermodal accesses and from an increase in cargo vessel traffic. Noise environment has been assessed as a substantial constraint to potential port expansion within the Berkeley-Charleston County ROI, and moderate primary adverse impacts and substantial secondary adverse impacts to this resource are anticipated as a result of potential expansion activities or consequences. Because no sensitive areas appear to exist within the Jasper County ROI, noise environment is not believed to be a constraint to potential port expansion within the ROI at this time, and no appreciable primary or secondary adverse impacts are anticipated as a result of potential port expansion.

Coastal Zone Management Act Resources

The ROIs are located entirely within the designated coastal zone for the state of South Carolina. Additionally, both ROIs are located entirely within designated critical areas. Potential primary adverse impacts to CZMA resources within the ROIs resulting from port expansion activities include the loss of CZMA resources within the construction footprints of new or expanded port facilities and associated intermodal rail and surface road accesses. Potential secondary impacts to CZMA resources associated with port expansion include the degradation or loss of CZMA resources in the ROIs from wave erosion associated with increased commercial vessel traffic and from increased emissions associated with increased vessel and surface vehicle traffic. Such impacts could be minimized by adhering to state coastal management policies as mandated by the Federal consistency provision (Section 307) of the CZMA. Because the ROIs are located entirely within designated critical areas of the state coastal zone, CZMA resources have been assessed as a substantial constraint to port expansion activities within the ROI. With adherence to state coastal management policies, moderate primary and secondary adverse impacts are anticipated as a result of potential expansion activities or consequences.

Wetlands

Wetlands comprise a significant percentage of land surfaces within both ROIs. Primary impacts to wetlands that could result from potential port expansion include wetland loss from the

construction of new port facilities and adjacent intermodal rail or surface road accesses. However, opportunities exist to mitigate these primary wetland impacts by wetland creation on upland or submerged lands in or adjacent to the ROIs. Potential secondary impacts to wetlands resulting from port expansion could include erosion of wetlands from increased wake action caused by an increase in cargo vessel traffic. Wetlands have been assessed as a moderate constraint to port expansion within the Charleston ROIs. Minor primary adverse impacts and moderate secondary adverse impacts are anticipated as a result of potential expansion activities at both ROIs.

Wildlife Resources

Invasive Species

At least 42 invasive species may be present within the Berkeley-Charleston County ROI, and at least 46 invasive species may be present within the Jasper County ROI. Potential primary adverse impacts associated with invasive species resulting from port expansion activities within the ROIs include the introduction of new species to the ROIs from fill material used in construction of new port facilities and adjacent intermodal rail and surface road accesses. Additionally, disposal of dredged material from channel deepening operations could result in the introduction of invasive species already present within the ROIs to new areas. Secondary impacts associated with invasive species within the ROIs resulting from port expansion activities include the introduction of new species as a result of ballast water dumping from commercial vessels utilizing the new or expanded port facilities. Primary impacts associated with invasive species could be reduced or eliminated by using fill material already located within the ROIs and disposing of any dredged material at locations within the ROIs, preventing the offsite spread of invasive species. Secondary impacts associated with invasive species could be reduced by the enforcement of USCG ballast water management guidelines established in 33 CFR 151. Invasive species have been assessed as a moderate constraint to port expansion activities within both ROIs. Minor primary adverse impacts and moderate secondary adverse impacts are anticipated as a result of potential expansion activities or consequences.

Natural Areas

Natural areas are not present in significant quantities in either ROI. Managed conservation areas are present in the U.S. Naval Weapons Station in the Berkeley-Charleston County ROI. No other state or Federal designated conservation lands were identified within either ROI. Primary adverse impacts to natural areas that could result from port expansion within the ROI include loss of natural areas from construction of new port facilities and adjacent intermodal rail and surface road accesses. Potential secondary impacts include erosion of nearshore natural areas from increased wake action resulting from an increase in cargo vessel traffic and disturbance of natural areas caused by increases in cargo vessel traffic and surface transport vehicles at intermodal accesses. While it is unlikely that port expansion would occur in either of the designated preserves, the increase in cargo vessel traffic and surface transport vehicles associated with port expansion could result in adverse impacts to these resources.

Natural areas have been assessed as a minor constraint to potential port expansion within the Berkeley-Charleston County ROI, and minor primary and secondary adverse impacts to this resource are anticipated as a result of potential expansion activities within the ROI. Natural areas are not believed to constitute a constraint to potential port expansion within the Jasper County ROI at this time, and no appreciable primary or secondary adverse impacts to this resource are anticipated as a result of potential expansion activities within the ROI.

Threatened and Endangered Species

Numerous Federal and state listed species are present in the vicinity of both ROIs. Primary adverse impacts to threatened and endangered species that could result from port expansion within the ROI include loss of terrestrial and nearshore habitat from construction of new port facilities and adjacent intermodal rail or surface road accesses and incidental or accidental takes of listed species during construction activities. Potential secondary adverse impacts include disturbance of terrestrial habitat from transport vehicles at adjacent intermodal accesses, disturbance of benthic habitat from dredging operations, and disturbance of terrestrial, nearshore, benthic, and pelagic habitat from increased cargo vessel traffic. Species of particular concern for the Berkeley-Charleston County ROI include the North Atlantic right whale, piping plover, sea turtles, shortnose sturgeon, least tern, island glass lizard, and beach morning glory. Species of particular concern for the Jasper County ROI include the North Atlantic right whale, piping plover, sea turtles, and shortnose sturgeon.

The NMFS SERO has stated that the species of greatest concern with regard to port expansion in the South Atlantic is the North Atlantic right whale (Habitat Conservation Division, personal communication). The SERO further stated that port expansion projects that result in increased vessel traffic threats to North Atlantic right whales will be subject to intense scrutiny by NMFS. The SERO explained that, because takes of this species cannot be authorized (due to small population size), for some port expansion actions (in or near right whale critical habitat) to proceed, it may be necessary for NMFS to impose reasonable and prudent alternatives on the Federal action agency to prevent the expansion project(s) from putting the right whales in a "jeopardy" situation. Although no critical habitat for the North Atlantic right whale is present within either ROI, both ROIs are located immediately west of South Atlantic coastal waters that are used as a migration corridor by the species.

Because of concerns raised by environmental agencies over potential impacts to threatened and endangered species resulting from port expansion operations, threatened and endangered species have been assessed as a substantial constraint to port expansion at both Charleston ROIs. Substantial primary and secondary adverse environmental impacts are anticipated for this resource as a result of potential expansion activities within the Berkeley-Charleston County ROI. Moderate primary adverse impacts and substantial secondary adverse impacts to threatened and endangered species are anticipated as a result of port expansion activities within the Jasper County ROI.

Critical Habitat

No critical habitat is present within either ROI. Consequently, critical habitat is not considered to be a constraint for potential port expansion for either ROI at this time, and no appreciable primary or secondary adverse environmental impacts to critical habitat are anticipated as a result of potential expansion activities within either ROI.

Unique or Unusual Habitats

Significant quantities of oyster reefs and communities are present in the Berkeley-Charleston County ROI, particularly near the mouth of Charleston Harbor. The South Carolina Department of Natural Resources (SCDNR) reports that oyster communities within the harbor are impaired because of water quality. Small discontinuous populations of oysters are present within the Jasper County ROI. No significant SAV communities or natural hardbottoms have been identified within either ROI.

Primary adverse impacts to unique or unusual habitats that could result from port expansion within the ROI include loss of terrestrial and nearshore habitat from construction of new port facilities and adjacent intermodal rail or surface road accesses and disturbance of benthic habitat from dredging operations. Potential secondary impacts to unique or unusual habitats associated with potential port expansion within the ROIs include disturbance of nearshore and benthic habitat from increased cargo vessel traffic and habitat impairment from increased point and nonpoint pollution sources associated with the construction of new port facilities and adjacent intermodal accesses. Unique or unusual habitats have been assessed as a moderate constraint to port expansion within the Berkeley-Charleston County ROI, and moderate primary and secondary adverse impacts are anticipated as a result of potential expansion activities within the ROI. Unique or unusual habitats have been assessed as a minor constraint to port expansion within the Jasper County ROI, and minor primary and secondary adverse impacts are anticipated as a result of potential expansion activities within the ROI.

Essential Fish Habitat

EFH is found throughout both ROIs for a large assemblage of managed marine fishes and invertebrates, including various shrimp species, red drum, members of the snapper-grouper complex, and highly migratory managed species. Potential primary adverse impacts to EFH that could result from port expansion activities within the Charleston ROIs include loss of nearshore EFH from construction of new port facilities and adjacent intermodal rail and surface road accesses and loss or disturbance of benthic EFH from dredging operations. Potential secondary adverse impacts from port expansion include disturbance of nearshore, benthic, and pelagic EFH from increased cargo vessel traffic and degradation or loss of EFH from increased point and nonpoint pollution sources associated with port operations. Because of the widespread nature of EFH within both ROIs, this resource has been assessed as a substantial environmental constraint, and substantial primary and secondary adverse impacts are anticipated to EFH as a result of potential expansion activities or consequences.

Cultural Resources

The Berkeley-Charleston County ROI contains an abundance of cultural resource sites. Despite the large number of sites within the ROI, many of these sites are concentrated in the Charleston Peninsula in the vicinity of the existing Union Pier and Columbus Street terminals, at James Island near the mouth of Charleston Harbor, on the eastern shore of Charleston Harbor at Mount Pleasant, and at the confluence of the Wando and Cooper rivers. The Jasper County ROI is comprised of dredged material disposal areas that were selected because of minimal impacts to environmental resources, including cultural resources. The likelihood of significant cultural resources occurring within this ROI is believed to be minimal.

Potential primary adverse impacts to cultural resources from port expansion activities within the Charleston ROIs include destruction of cultural resource sites from the construction of new port facilities and adjacent intermodal rail and surface road accesses. Potential secondary impacts include the damage or loss of nearshore cultural resources from wave action associated with increased commercial vessel traffic. Significant areas with low densities of cultural resource sites are present within the Berkeley-Charleston County ROI, indicating that construction of new facilities may not pose a significant threat to cultural resources; however, the loss of nearshore sites from wave action remains a possibility. Because significant opportunities for avoidance of sensitive areas are possible, cultural resources have been assessed as a moderate constraint to port expansion within the Berkeley-Charleston County ROI; minor primary adverse impacts and moderate secondary adverse impacts are anticipated for cultural resources as a result of potential expansion activities within the ROI. Cultural resources are not believed to constitute a constraint to port expansion within the Jasper County ROI at this time, and no appreciable primary or secondary adverse impacts to this resource are anticipated as a result of potential expansion activities or consequences.

Hazardous, Toxic, and Radioactive Waste

HTRW may pose a constraint to port expansion activities. The presence of significant REC sites in a given area may render the area infeasible for port expansion because of HTRW concerns. Additionally, potential port expansion may pose an HTRW concern to the surrounding environment. Potential primary impacts associated with port expansion activities include discharges from construction or dredging equipment during the construction of new port facilities and adjacent intermodal rail and surface road accesses or dredging operations. Potential secondary impacts include increases in point and nonpoint pollution sources associated with the construction of new port facilities and adjacent intermodal accesses, as well as the potential increase in pollutant or contaminant discharges from accidents involving cargo vessels.

Significant concentrations of potential REC sites in the Berkeley-Charleston County ROI are present on the Charleston Peninsula in the vicinity of the U.S. Naval Reservation near Shipyard Creek and the Columbus and Union Pier Terminals. The U.S. Naval Reservation and immediate vicinity are believed to constitute a substantial HTRW concern. Much of the remainder of the ROI, however, exhibits a low density of potential REC sites. No REC sites were identified within the Jasper County ROI.

Considerable potential for the avoidance of existing HTRW sites exists within the Berkeley-Charleston County ROI, and the likelihood of substantial primary adverse impacts resulting from port expansion activities is believed to be minimal. Secondary HTRW impacts are a substantial concern, however. HTRW has been assessed as a minor constraint to port expansion within the Berkeley-Charleston County ROI. Minor primary adverse impacts and substantial secondary adverse impacts are anticipated as a result of potential port expansion. HTRW is not believed to constitute a constraint to port expansion within the Jasper County ROI at this time; minor primary adverse impacts and substantial secondary adverse impacts are anticipated as a result of potential port expansion.

Socioeconomic Profile

Expansion of port facilities in the Charleston ROIs would likely result in the creation of new jobs and new infrastructure within the ROIs. Potential primary impacts to socioeconomic conditions within the Charleston ROIs include the acquisition of property from landowners or residents for the construction of new port facilities and adjacent intermodal rail and surface road accesses. It is anticipated that compensation would be provided to any impacted residents or socioeconomic groups impacted by property acquisition, offsetting or mitigating the impacts. No secondary adverse impacts to socioeconomic conditions are anticipated as a result of port expansion activities. Port expansion would likely constitute a net benefit to socioeconomic conditions within the ROIs. Overall socioeconomic conditions are not believed to constitute a constraint to potential port expansion within the Charleston ROIs at this time, and no net primary or secondary adverse impacts to this resource are anticipated as a result of potential port expansion.

Environmental Justice

Areas with significant minority and/or poverty levels within the Berkeley-Charleston County ROI include the Charleston Peninsula from the Columbus Street Terminal north to the Berkeley-Charleston County line and the Charleston Naval Complex on the Cooper River. Construction of new port facilities and adjacent intermodal rail and surface road accesses in these areas could result in primary adverse impacts to minority or disadvantaged populations. However, ample areas exist within the ROI for port expansion that would not result in disproportionate impacts to such groups, and the construction of new port facilities and the associated increase in jobs and infrastructure could result in a net benefit to minority and disadvantaged populations within the ROI. Environmental justice has been assessed as a minor constraint to port expansion within the Berkeley-Charleston County ROI. Minor primary adverse impacts are anticipated as a result of potential port expansion. No net secondary adverse impacts are anticipated as a result of potential port expansion.

The Jasper County ROI is included within a U.S. Census block characterized as having a high percent of minority and disadvantaged residents; however, this area is virtually unpopulated, and population demographics are not applicable to the ROI. Environmental justice is not believed to constitute a constraint to port expansion within the Jasper ROI at this time, and no net primary or secondary adverse impacts are anticipated to this resource as a result of potential port expansion within the ROI.

Transportation

The Berkeley-Charleston County ROI contains an extensive network of surface roads, railroads, and waterways with shipping channels that support residential and commercial traffic activity in the area. The Jasper County ROI has been operated by the USACE as a dredged material disposal area and contains no significant transportation infrastructure. Potential primary adverse impacts to transportation resulting from port expansion activities include the temporary disruption of traffic on surface roads and railways in construction areas for expanded port facilities or adjacent intermodal rail and surface road accesses (in the case of the Berkeley-Charleston County ROI), and temporary disruption of vessel traffic in areas selected for channel modification (in the case of both ROIs). Additionally, the construction of landside features could result in the permanent loss of portions of surface roads or railroads within the construction footprint of the expanded facilities. Traffic disruptions from construction activities would likely be temporary in nature, however, and any permanent surface route closures from construction activities could be offset by construction of new nearby routes to replace the closed routes. Potential secondary impacts to transportation resulting from port expansion activities within the ROIs include increased use of transportation routes from commercial vehicle, train, and vessel traffic associated with expanded port facilities. Such increases in traffic could require substantial additions to or modifications of the existing transportation infrastructures. Consequently, transportation has been assessed as a substantial constraint to port expansion within both ROIs. Minor primary adverse impacts and substantial adverse secondary impacts are anticipated as a result of potential port expansion within either ROI.

Recreation

Common recreational activities in the vicinity of the Berkeley-Charleston County ROI include boating, fishing, birding, and visiting the area's historic sites. A substantial recreational fishing industry is centered around Charleston Harbor. Numerous marinas, piers, and public boat ramps offer access to inshore and offshore fishing. Common recreational activities in the vicinity of the Jasper County ROI include boating and fishing. Potential primary adverse impacts to recreation within the ROIs resulting from port expansion include loss of nearshore recreational space from the construction of new port facilities and adjacent intermodal rail and surface road accesses; secondary impacts include the disturbance of waterborne and ecotourist recreation activities from increased cargo vessel traffic.

Considerable commercial and military vessel traffic is present within the Berkeley-Charleston County ROI. Landside recreational activities appear to have adjusted to any disturbances caused by vessel traffic and would likely adjust to any increases without significant impairment. Waterborne recreational activities would likely experience greater adverse impacts. Recreation has been assessed as a moderate constraint to port expansion within the Berkeley-Charleston County ROI; minor primary adverse impacts and moderate secondary adverse impacts are anticipated for the resource as a result of potential port expansion within the ROI.

Recreational boating and fishing in the ROI are currently not prominent acitivities because of the high volume of cargo vessel traffic associated with port operations.

Consequently, recreation has been assessed as a minor constraint to port expansion within the Jasper County ROI, and minor primary and secondary adverse impacts are anticipated for the resource as a result of potential port expansion within the ROI.

WILMINGTON REGION OF INTEREST

There is one ROI in the Wilmington area (Figure 5). Potential impacts to each environmental resource in the ROI are summarized in the following subsections.

Geology and Soils

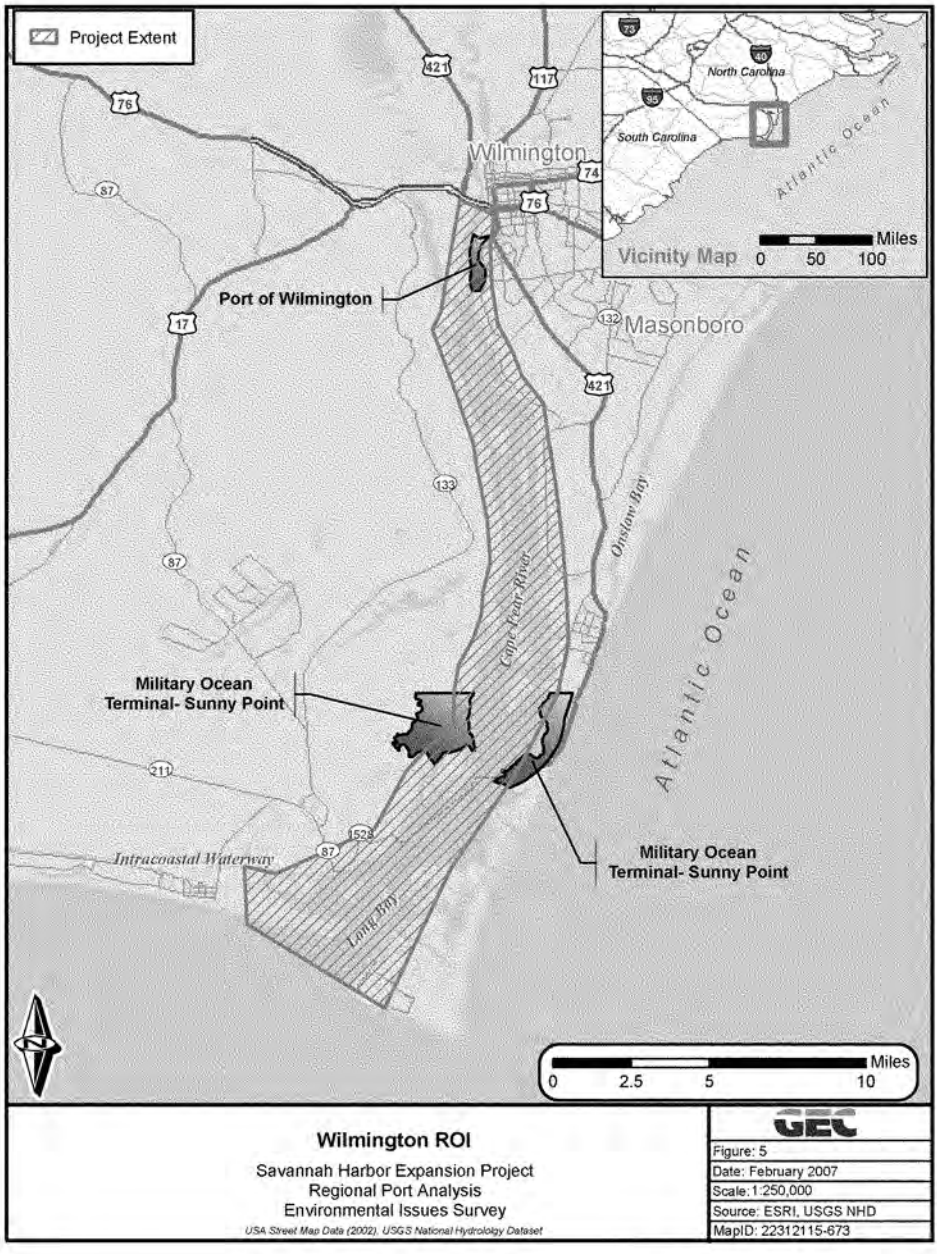
No rare or environmentally sensitive geologic features are present within the Wilmington ROI. Although prime or unique farmland soils are present within the ROI, these soils are not present in sufficient quantity to meet the U.S. Department of Agriculture's definition of prime or unique farmland. Consequently, geology and soils do not pose an environmental constraint for potential expansion activities within the Wilmington ROI, and no appreciable adverse environmental impacts to these resources are anticipated as a result of any expansion activities.

Air Quality

The Wilmington ROI is within an attainment zone for all six air criteria pollutants identified by the NAAQS. Concentrations of ozone in the ROI are near the NAAQS limit, however, and particulate matter concentrations are also somewhat elevated with respect to other criteria air pollutants. Air quality in the ROI is generally good, with minimal periods in which air quality is classified as unhealthy for the general public or for sensitive groups. Potential primary impacts to air quality from port expansion within the Wilmington ROI that could adversely impact air quality include temporary increases in emissions from construction equipment during the construction of new port facilities and adjacent intermodal rail and surface road accesses and from dredging vessels during dredging operations. Potential secondary impacts to air quality resulting from potential port expansion activities within the ROI include air quality degradation from emissions caused by an increase in cargo vessel traffic and transportation vehicles at adjacent intermodal rail and surface road accesses. Air quality has been assessed as a moderate constraint for port expansion within the Wilmington ROI, and minor temporary primary impacts and moderate secondary adverse impacts to air quality are anticipated as a result of potential expansion activities or consequences.

Water Quality

Waterbodies within the Wilmington ROI are currently listed as impaired for aquatic life and shellfish harvesting uses. Potential primary impacts to water quality within the Wilmington ROI that could result from port expansion activities include emissions from construction and dredging equipment, impairment from runoff at port facility or adjacent intermodal accesses, and temporary impairment from sediment disturbance during dredging operations. Potential


Project Extent
Wilmington
Port of Wilmington
Masonboro
Military Ocean Terminal- Sunny Point
Military Ocean Terminal- Sunny Point
Cape Fear River
Onslow Bay
Atlantic Ocean
Intracoastal Waterway
Long Bay
North Carolina
South Carolina
Atlantic Ocean
Vicinity Map
Miles
0 50 100
Miles
0 2.5 5 10
Wilmington ROI
Savannah Harbor Expansion Project
Regional Port Analysis
Environmental Issues Survey
USA Street Map Data (2002), USGS National Hydrology Dataset
Figure: 5
Date: February 2007
Scale: 1:250,000
Source: ESRI, USGS NHD
MapID: 22312115-673

secondary impacts include increases in cargo vessel traffic and associated emissions, increases in point and nonpoint pollution sources associated with the construction of new port facilities and adjacent intermodal rail and surface road accesses, and increases in salinity in coastal river systems associated with channel deepening. Water quality has been assessed as a substantial environmental constraint within the Wilmington ROI; minor temporary adverse impacts and substantial secondary adverse impacts are anticipated for this resource as a result of potential port expansion.

Sediment Quality

Sediment quality may pose a potential constraint to some port expansion activities, particularly dredging operations. Significantly contaminated sediments may pose a concern for disposal, and dredging operations may resuspend and redistribute contaminated sediments that were previously restricted in areal extent. Primary adverse impacts to sediment quality within the ROI that could result from potential port expansion activities include emissions and discharges from construction equipment during the construction of new port facilities and associated intermodal rail and surface road accesses and disturbance and redistribution of any contaminated sediments during dredging operations. Potential secondary adverse impacts to water quality from port expansion activities include increases in emissions and discharges associated with increased cargo vessel traffic and increases in point and nonpoint pollution sources associated with the operation of new port facilities and adjacent intermodal rail and surface road accesses.

Recent studies in Wilmington Harbor indicate that sediment quality is good to moderate within the ROI. PAH concentrations exceeding conservative SQGs were present in several locations, particularly in the vicinity of the Military Ocean Terminal at Sunny Point. PCB concentrations were generally below SQC levels, with several minor exceptions. SQG exceedences for arsenic, chromium, and nickel were documented in a number of sediment samples collected from the harbor, particularly in the vicinity of the Port of Wilmington and the Military Ocean Terminal at Sunny Point. Sediment quality has been assessed as a moderate constraint to potential port expansion within the Wilmington ROI. Minor primary adverse impacts and moderate secondary adverse impacts are anticipated as a result of potential expansion activities or consequences.

Noise Environment

No noise data are available for the Wilmington ROI. Noise-sensitive areas within the ROI include natural areas such as the Carolina Beach State Park and North Carolina Coastal Reserve sites and populated places such as the City of Wilmington and the town of Southport. Actions associated with port expansion within the Wilmington ROI that could result in primary adverse impacts to the noise environment include construction of new port facilities and adjacent intermodal rail or surface road accesses; these impacts would be temporary in nature. Secondary adverse impacts to the noise environment associated with potential port expansion within the ROI could include increases in noise levels from equipment and facility operations at new port facilities and adjacent intermodal accesses and from an increase in cargo vessel traffic. Noise environment has been assessed as a moderate constraint to port expansion within the Wilmington

ROI, and moderate primary and secondary adverse impacts to this resource are anticipated as a result of potential expansion activities or consequences.

Coastal Zone Management Act Resources

The ROI is located entirely within the designated coastal zone for the state of North Carolina. Additionally, the ROI is located entirely within the state's designated Area of Environmental Concern (AEC). Potential primary adverse impacts to CZMA resources within the ROI resulting from port expansion activities include the loss of CZMA resources within the construction footprints of new or expanded port facilities and associated intermodal rail and surface road accesses. Potential secondary impacts to CZMA resources associated with port expansion include the degradation or loss of CZMA resources in the ROI from wave erosion associated with increased commercial vessel traffic and from increased emissions associated with increased vessel and surface vehicle traffic. Such impacts could be minimized by adhering to state coastal management policies as mandated by the Federal consistency provision (Section 307) of the CZMA. Because the ROI is located entirely within the designated AEC of the state coastal zone, CZMA resources have been assessed as a substantial constraint to port expansion activities within the ROI. With adherence to state coastal management policies, moderate primary and secondary adverse impacts are anticipated as a result of potential expansion activities or consequences.

Wetlands

Wetlands comprise a significant percentage of land surface within the Wilmington ROI. Primary impacts to wetlands that could result from potential port expansion include wetland loss from the construction of new port facilities and adjacent intermodal rail or surface road accesses. However, opportunities exist to mitigate these primary wetland impacts by wetland creation on upland or submerged lands in or adjacent to the ROI. Potential secondary impacts to wetlands resulting from port expansion could include erosion of wetlands from increased wake action caused by an increase in cargo vessel traffic. Wetlands have been assessed as a moderate constraint to port expansion within the Wilmington ROI. Minor primary adverse impacts and moderate secondary adverse impacts are anticipated as a result of potential expansion activities or consequences.

Wildlife Resources

Invasive Species

At least 54 invasive species may be present within the Wilmington ROI. Potential primary adverse impacts associated with invasive species resulting from port expansion activities within the ROI include the introduction of new species to the ROI from fill material used in construction of new port facilities and adjacent intermodal rail and surface road accesses. Additionally, disposal of dredged material from channel deepening operations could result in the introduction of invasive species already present within the ROI to new areas. Secondary impacts associated with invasive species within the ROI resulting from port expansion activities could include the introduction of new species as a result of ballast water dumping from commercial

vessels utilizing the new or expanded port facilities. Primary impacts associated with invasive species could be reduced or eliminated by using fill material already located within the ROI and disposing of any dredged material at locations within the ROI, preventing the offsite spread of invasive species. Secondary impacts associated with invasive species could be reduced by the enforcement of USCG ballast water management guidelines established in 33 CFR 151. Invasive species have been assessed as a moderate constraint to port expansion activities within the Wilmington ROI. Minor primary adverse impacts and moderate secondary adverse impacts are anticipated as a result of potential expansion activities or consequences.

Natural Areas

Natural areas are found throughout the Wilmington ROI. Managed conservation areas within the ROI include the Carolina Beach State Park, the Fort Fisher State Recreation Area, two North Carolina Coastal Reserve Sites, and the Bald Head Island Complex. Additionally, the lower Cape Fear River has been designated a Primary Nursery Area by the North Carolina Marine Fisheries Commission, and numerous areas within the ROI have been designated natural areas by the North Carolina Natural Heritage Program (NCNHP). Actions associated with potential port expansion that could result in primary adverse impacts to natural areas include loss of natural areas from construction of new port facilities and adjacent intermodal rail and surface road accesses. Secondary impacts to natural areas resulting from potential port expansion within the ROI include erosion of nearshore natural areas from increased wake action resulting from an increase in cargo vessel traffic and disturbance of natural areas caused by increases in cargo vessel traffic and surface transport vehicles at intermodal accesses. While it is unlikely that port expansion would occur in either of the designated preserves, the increase in cargo vessel traffic and surface transport vehicles associated with port expansion could result in adverse impacts to these resources. Additionally, because natural area designation by the NCNHP does not necessarily indicate any legal protection status, these natural areas could be adversely impacted by the construction of new port facilities and adjacent intermodal rail and surface road accesses. Natural areas have been assessed as a substantial constraint to potential port expansion within the Wilmington ROI. Moderate primary adverse impacts and substantial secondary adverse impacts to this resource are anticipated as a result of potential expansion activities or consequences.

Threatened and Endangered Species

Numerous Federal and state listed species are present in the Wilmington ROI. GIS data provided by the North Carolina National Heritage Program indicate that listed species occurrences are widespread throughout the ROI. Primary adverse impacts to listed species resulting from port expansion within the ROI may include loss of terrestrial and nearshore habitat from construction of new port facilities and adjacent intermodal rail or surface road accesses and incidental or accidental takes of listed species during construction activities. Potential secondary adverse impacts include disturbance of terrestrial habitat from transport vehicles at adjacent intermodal accesses, disturbance of benthic habitat from dredging operations, and disturbance of terrestrial, nearshore, benthic, and pelagic habitat from increased cargo vessel traffic. Species of particular concern for the Wilmington ROI include the North Atlantic right whale, piping plover, sea turtles, and Carolina gopher frog (*Rana capito*),

The NMFS SERO has stated that the species of greatest concern with regard to port expansion in the South Atlantic is the North Atlantic right whale (Habitat Conservation Division, personal communication). The SERO further stated that port expansion projects that result in increased vessel traffic threats to North Atlantic right whales will be subject to intense scrutiny by NMFS. The SERO explained that, because takes of this species cannot be authorized (due to small population size), for some port expansion actions (in or near right whale critical habitat) to proceed, it may be necessary for NMFS to impose reasonable and prudent alternatives on the Federal action agency to prevent the expansion project(s) from putting the right whales in a "jeopardy" situation. Although no critical habitat for the North Atlantic right whale is present within the ROI, the ROI is located immediately west of South Atlantic coastal waters that are used as a migration corridor by the species.

Because of concerns raised by environmental agencies over potential impacts to threatened and endangered species resulting from port expansion operations, threatened and endangered species have been assessed as a substantial constraint to port expansion within the Wilmington ROI, and substantial primary and secondary adverse environmental impacts are anticipated for this resource as a result of potential expansion activities or consequences.

Critical Habitat

Critical habitat is present within the Wilmington ROI for the piping plover in the Fort Fisher State Recreation Area. Potential primary impacts to critical habitat resulting from port expansion within the ROI include loss of critical habitat from construction of new port facilities and adjacent intermodal rail and surface road accesses. Secondary impacts to critical habitat resulting from potential port expansion within the ROI include erosion of nearshore critical habitat from increased wake action resulting from an increase in cargo vessel traffic and disturbance of critical habitat caused by increases in cargo vessel traffic and surface transport vehicles at intermodal accesses. Although it is unlikely that the construction of new port facilities and adjacent intermodal accesses would occur with a designated critical habitat area, potential secondary impacts from wave erosion and noise disturbance associated with vessel traffic increases are possible. Because nearshore critical habitat is present within the ROI, this resource has been assessed as a substantial constraint. Minor primary impacts and substantial secondary adverse environmental impacts are anticipated as a result of potential expansion activities or consequences.

Unique or Unusual Habitats

Few data are currently available about unique or unusual habitats within the ROI. Little if any SAV is believed to be present within the ROI. Intertidal oyster communities are known to be present in the lower Cape Fear River and adjacent waterbodies, but no maps of oyster communities currently exist for the area. Hardbottoms are not present within the ROI. Potential primary adverse impacts to unique or unusual habitats from port expansion within the ROI include loss of terrestrial and nearshore habitat from construction of new port facilities and adjacent intermodal rail or surface road accesses and disturbance of benthic habitat from dredging operations. Potential secondary impacts to unique or unusual habitats associated with

potential port expansion within the ROI include disturbance of nearshore and benthic habitat from increased cargo vessel traffic and habitat impairment from increased point and nonpoint pollution sources associated with the construction of new port facilities and adjacent intermodal accesses. Unique or unusual habitats have been assessed as a moderate constraint to port expansion within the Wilmington ROI, and moderate primary and secondary adverse impacts are anticipated to this resource as a result of potential port expansion.

Essential Fish Habitat

EFH is found throughout the Wilmington ROI for a large assemblage of managed marine fishes and invertebrates, including various shrimp species, red drum, members of the snapper-grouper complex, and highly migratory managed species. Potential primary adverse impacts to EFH that could result from port expansion activities within the ROI include loss of nearshore EFH from construction of new port facilities and adjacent intermodal rail and surface road accesses and loss or disturbance of benthic EFH from dredging operations. Potential secondary adverse impacts from port expansion include disturbance of nearshore, benthic, and pelagic EFH from increased cargo vessel traffic and degradation or loss of EFH from increased point and nonpoint pollution sources associated with port operations. Because of the widespread nature of EFH within the ROI, this resource has been assessed as a substantial environmental constraint, and substantial primary and secondary adverse impacts are anticipated to EFH as a result of potential expansion activities or consequences.

Cultural Resources

Few data are available regarding cultural resources within the Wilmington ROI. Significant concentrations of cultural resources are present on the left descending bank of the Cape Fear River in the vicinities of the City of Wilmington and Fort Fisher and on the right descending riverbank north of the Military Ocean Terminal at Sunny Point and in the vicinity of the town of Southport. Numerous historic shipwrecks are known to be present in the lower Cape Fear River. Although no maps of these resources were provided by state agencies, available literature on cultural resources indicates that many of these shipwrecks are located in the vicinity of Fort Fisher. Potential primary adverse impacts to cultural resources from port expansion activities within the ROI include destruction of cultural resource sites from the construction of new port facilities and adjacent intermodal rail and surface road accesses. Potential secondary impacts include the damage or loss of nearshore cultural resources from wave action associated with increased commercial vessel traffic. Significant areas with low densities of cultural resource sites are present within the ROI, indicating that construction of new facilities may not pose a significant threat to cultural resources; however, the potential loss of nearshore sites from wave action remains a possibility. Because of the likely presence of significant numbers of submerged cultural resources within the Wilmington ROI and the vulnerability of these resources to the abovementioned secondary adverse impacts, cultural resources have been assessed as a substantial constraint to port expansion within the Wilmington ROI; minor primary adverse impacts and substantial secondary adverse impacts are anticipated for cultural resources as a result of potential expansion activities or consequences.

Hazardous, Toxic, and Radioactive Waste

HTRW may pose a constraint to port expansion activities. The presence of significant REC sites in a given area may render the given area infeasible for port expansion because of HTRW concerns. Additionally, potential port expansion may pose an HTRW concern to the surrounding environment. Potential primary impacts associated with port expansion activities include discharges from construction or dredging equipment during the construction of new port facilities and adjacent intermodal rail and surface road accesses or dredging operations. Potential secondary impacts include increases in point and nonpoint pollution sources associated with the construction of new port facilities and adjacent intermodal accesses, as well as the potential increase in pollutant or contaminant discharges from accidents involving cargo vessels.

Significant concentrations of potential REC sites in the Wilmington ROI are present on the left descending riverbank in the vicinity of the city of Wilmington, on the right descending riverbank in the vicinity of the town of Southport, and on both riverbanks in the vicinity of the Military Ocean Terminal at Sunny Point. Much of the remainder of the ROI, however, exhibits a low density of potential REC sites. Considerable potential for the avoidance of existing HTRW sites exists, and the likelihood of substantial primary adverse impacts resulting from port expansion activities is believed to be minimal. Secondary HTRW impacts are a substantial concern, however. Consequently, HTRW has been assessed as a minor constraint to port expansion within the Wilmington ROI. Minor primary adverse impacts and substantial secondary adverse impacts are anticipated as a result of potential port expansion.

Socioeconomic Profile

Expansion of port facilities in the Wilmington ROI would likely result in the creation of new jobs and new infrastructure within the ROI. Potential primary impacts to socioeconomic conditions within the Wilmington ROI include the acquisition of property from residents for the construction of new port facilities and adjacent intermodal rail and surface road accesses. It is anticipated that compensation would be provided to any impacted residents or socioeconomic groups impacted by property acquisition, offsetting or mitigating the impacts. No secondary adverse impacts to socioeconomic conditions are anticipated as a result of port expansion activities. Port expansion would likely constitute a net benefit to socioeconomic conditions within the ROI. Overall socioeconomic conditions are not believed to constitute a constraint to potential port expansion within the Wilmington ROI at this time, and no net primary or secondary adverse impacts to this resource are anticipated as a result of potential port expansion.

Environmental Justice

Areas with significant minority and/or poverty levels within the ROI include the left descending riverbank in the vicinity of the Port of Wilmington, the right descending riverbank between the U.S. Highway 74 Bridge and Town Creek, and both riverbanks in the vicinity of the river mouth. Construction of new port facilities and adjacent intermodal rail and surface road accesses in these areas could result in primary adverse impacts to minority or disadvantaged populations. However, ample areas exist within the ROI for port expansion that would not result in disproportionate impacts to such groups, and the construction of new port

facilities and the associated increase in jobs and infrastructure could result in a net benefit to minority and disadvantaged populations within the ROI. Environmental justice has been assessed as a minor constraint to port expansion within the Wilmington ROI. Minor primary adverse impacts are anticipated as a result of potential port expansion. No net secondary adverse impacts are anticipated as a result of potential port expansion.

Transportation

The Wilmington ROI contains an extensive network of surface roads, railroads, and waterways with shipping channels that support residential and commercial traffic activity in the area. Potential primary adverse impacts to transportation resulting from port expansion activities include the temporary disruption of traffic on surface roads and railways in construction areas for expanded port facilities or adjacent intermodal rail and surface road accesses, and temporary disruption of vessel traffic in areas selected for channel modification. Additionally, the construction of landside features could result in the permanent loss of portions of surface roads or railroads within the construction footprint of the expanded facilities. Traffic disruptions from construction activities would likely be temporary in nature, however, and any permanent surface route closures from construction activities could be offset by construction of new nearby routes to replace the closed routes. Potential secondary impacts to transportation resulting from port expansion activities within the ROI include increased use of transportation routes from commercial vehicle, train, and vessel traffic associated with expanded port facilities. Such increases in traffic could require substantial additions to or modifications of the existing transportation infrastructures. Consequently, transportation has been assessed as a substantial constraint to port expansion within the Wilmington ROI. Minor primary adverse impacts and substantial adverse secondary impacts are anticipated as a result of potential port expansion within the ROI.

Recreation

Common recreational activities in the vicinity of the Wilmington ROI include boating, fishing, and visiting the area's historic sites and natural preserves. Recreational boating and ecotourism are particularly popular recreational activities within the ROI. Actions or consequences of potential port expansion that could result in primary adverse impacts to recreation within the ROI include loss of nearshore recreational space from the construction of new port facilities and adjacent intermodal rail and surface road accesses. Secondary adverse impacts associated with port expansion include the disturbance of waterborne and ecotourist recreation activities from increased cargo vessel traffic. Because of the popularity and vulnerability of ecotourism and boating activities within the ROI, recreation has been assessed as a substantial constraint to port expansion within the Wilmington ROI. Moderate primary adverse impacts and substantial secondary adverse impacts are anticipated for the resource as a result of potential port expansion within the ROI.

NORFOLK REGION OF INTEREST

There is one ROI in the Norfolk area (Figure 6). Potential impacts to each environmental resource in the ROI are summarized in the following subsections.

Geology and Soils

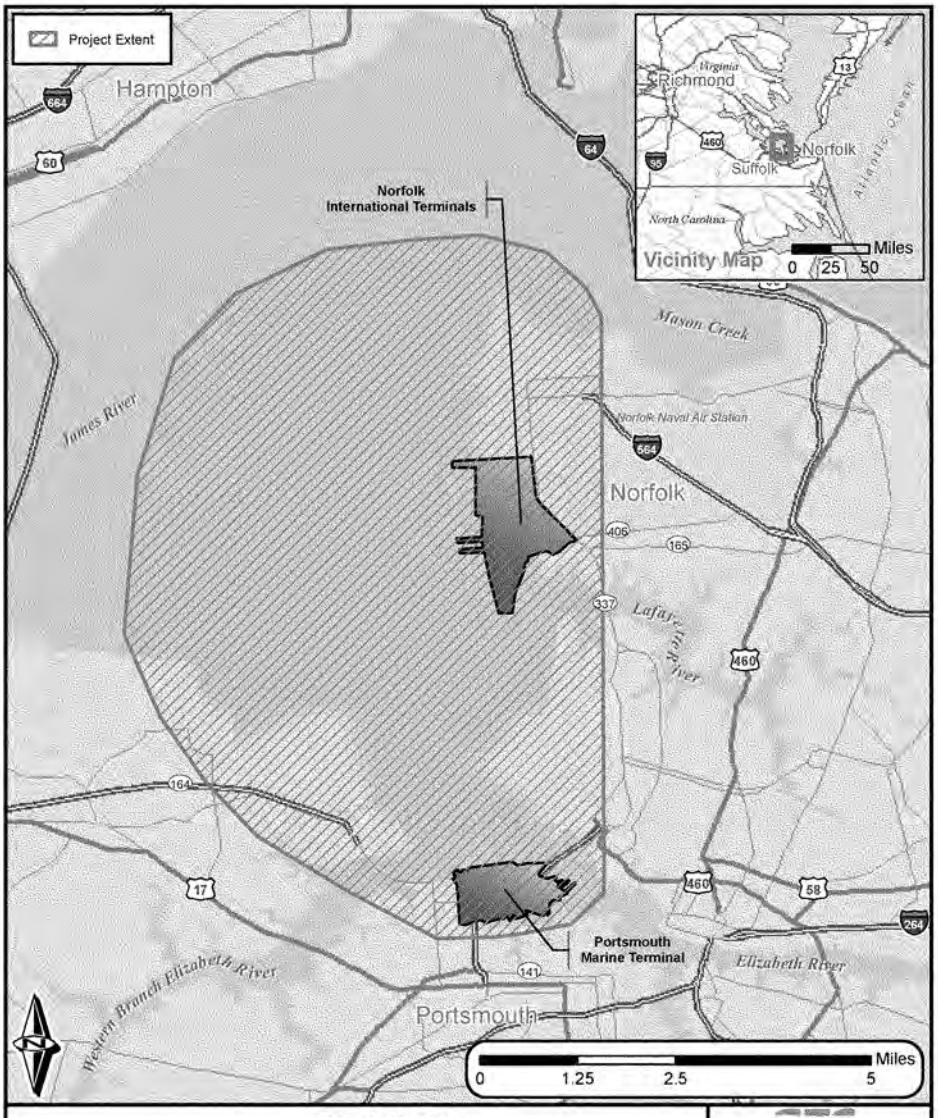
No rare or environmentally sensitive geologic features are present within the Norfolk ROI. No prime or unique farmland soils are present within the ROI. Consequently, geology and soils do not pose an environmental constraint for potential expansion activities within the Norfolk ROI, and no appreciable adverse primary or secondary environmental impacts to these resources are anticipated as a result of any expansion activities.

Air Quality

The ROI is within a nonattainment zone for ozone as defined by NAAQS and has been assessed as in Marginal attainment for this parameter since June 2004. Concentrations of particulate matter in the ROI are also near the NAAQS limit. Air quality in the ROI is generally good to moderate, with minimal periods in which air quality is classified as unhealthy for the general public or for sensitive groups. Potential primary impacts to air quality from port expansion within the Norfolk ROI include temporary increases in emissions from construction equipment during the construction of new port facilities and adjacent intermodal rail and surface road accesses and from dredging vessels during dredging operations. Potential secondary impacts to air quality resulting from potential port expansion activities within the ROI include air quality degradation from emissions caused by an increase in cargo vessel traffic and transportation vehicles at adjacent intermodal rail and surface road accesses. Because the ROI is currently near nonattainment status with regard to air quality, this resource has been assessed as a substantial constraint for port expansion within the Norfolk ROI. Primary adverse impacts to air quality from potential port expansion are anticipated to be minor and temporary in nature; however, substantial secondary adverse impacts to air quality are anticipated as a result of potential expansion activities or consequences.

Water Quality

Waterbodies within the Norfolk ROI are currently listed as impaired for their designated uses because of low dissolved oxygen, fecal coliform, enterococcus, and PCB contamination. Potential primary impacts to water quality within the Norfolk ROI that could result from port expansion activities include emissions from construction and dredging equipment, impairment from runoff at port facility or adjacent intermodal accesses, and temporary impairment from sediment disturbance during dredging operations. Actions or consequences associated with port expansion within the ROI that could result in secondary adverse impacts to water quality include increases in cargo vessel traffic and associated emissions, increases in point and nonpoint pollution sources associated with the construction of new port facilities and adjacent intermodal rail and surface road accesses, and increases in salinity in coastal river systems associated with channel deepening. Water quality has been assessed as a substantial environmental constraint within the Norfolk ROI. Minor temporary primary adverse impacts and substantial secondary



Norfolk ROI

Savannah Harbor Expansion Project
Regional Port Analysis
Environmental Issues Survey

USA Street Map Data (2002), USGS National Hydrology Dataset

Figure: 6
Date: February 2007
Scale:1:100,000
Source: ESRI, USGS NHD
MapID: 22312115-672

adverse environmental impacts are anticipated for this resource as a result of potential port expansion.

Sediment Quality

Sediment quality may pose a potential constraint to some port expansion activities, particularly dredging operations. Significantly contaminated sediments may pose a concern for disposal, and dredging operations may resuspend and redistribute contaminated sediments that were previously restricted in areal extent. Primary adverse impacts to sediment quality within the Norfolk ROI that could result from potential port expansion activities include emissions and discharges from construction equipment during the construction of new port facilities and associated intermodal rail and surface road accesses and disturbance and redistribution of any contaminated sediments during dredging operations. Potential secondary adverse impacts to water quality from port expansion activities include increases in emissions and discharges associated with increased cargo vessel traffic and increases in point and nonpoint pollution sources associated with the operation of new port facilities and adjacent intermodal rail and surface road accesses.

Recent sediment quality studies in the vicinity of the ROI indicate that metals contamination is a concern for sediments within the ROI. PCB and PAH concentrations in exceedence of conservative SQGs were detected in several locations within the ROI, and one sample exhibited PAH exceedence of NOAA Effects Range-Median (ERM) standards. SQG exceedences for arsenic, cadminum, copper, mercury, nickel, lead, and zinc were documented in a number of sediment samples collected from the ROI. Mercury and zinc concentrations were in exceedence of NOAA ERM standards in several locations. Sediment quality has been assessed as a substantial constraint to potential port expansion within the Norfolk ROI. Minor primary adverse impacts and substantial secondary adverse impacts are anticipated as a result of potential expansion activities or consequences.

Noise Environment

Ambient noise levels within the ROI appear to be within EPA and HUD recommended standards. Noise-sensitive areas within the ROI include the Craney Island Conservation Site and populated places such as the cities of Norfolk and Portsmouth. Actions associated with port expansion within the Norfolk ROI that could result in primary adverse impacts to the noise environment include construction of new port facilities and adjacent intermodal rail or surface road accesses; these impacts would be temporary in nature. Secondary adverse impacts to the noise environment associated with potential port expansion within the ROI could include increases in noise levels from equipment and facility operations at new port facilities and adjacent intermodal accesses and from an increase in cargo vessel traffic. Noise environment has been assessed as a moderate constraint, and moderate primary and secondary adverse impacts to this resource are anticipated as a result of potential expansion activities or consequences.

Coastal Zone Management Act Resources

The ROI is located entirely within the designated coastal zone for the state of Virginia. Potential primary adverse impacts to CZMA resources within the ROI resulting from port expansion activities include the loss of CZMA resources within the construction footprints of new or expanded port facilities and associated intermodal rail and surface road accesses. Potential secondary impacts to CZMA resources associated with port expansion include the degradation or loss of CZMA resources in the ROI from wave erosion associated with increased commercial vessel traffic and from increased emissions associated with increased vessel and surface vehicle traffic. Such impacts could be minimized by adhering to state coastal management policies as mandated by the Federal consistency provision (Section 307) of the CZMA. Because the ROI is located entirely within the designated coastal zone, CZMA resources have been assessed as a substantial constraint to port expansion activities within the ROI. With adherence to state coastal management policies, moderate primary and secondary adverse impacts are anticipated as a result of potential expansion activities or consequences.

Wetlands

Wetlands comprise a significant percentage of land surface within the Norfolk ROI. Primary impacts to wetlands that could result from potential port expansion include wetland loss from the construction of new port facilities and adjacent intermodal rail or surface road accesses. However, opportunities exist to mitigate these primary wetland impacts by wetland creation on upland or submerged lands in or adjacent to the ROI. Potential secondary impacts to wetlands resulting from port expansion include erosion of wetlands from increased wake action caused by an increase in cargo vessel traffic. Wetlands have been assessed as a moderate constraint to port expansion within the Norfolk ROI. Minor primary adverse impacts and moderate secondary adverse impacts are anticipated as a result of potential expansion activities or consequences.

Wildlife Resources

Invasive Species

At least 62 invasive species may be present within the Norfolk ROI. Potential primary adverse impacts associated with invasive species resulting from port expansion activities within the ROI include the introduction of new species to the ROI from fill material used in construction of new port facilities and adjacent intermodal rail and surface road accesses. Additionally, disposal of dredged material from channel deepening operations could result in the introduction of invasive species already present within the ROI to new areas. Secondary impacts associated with invasive species within the ROI resulting from port expansion activities could include the introduction of new species as a result of ballast water dumping from commercial vessels utilizing the new or expanded port facilities. Primary impacts associated with invasive species could be reduced or eliminated by using fill material already located within the ROI and disposing of any dredged material at locations within the ROI, preventing the offsite spread of invasive species. Secondary impacts associated with invasive species could be reduced by the enforcement of USCG ballast water management guidelines established in 33 CFR 151. Invasive species have been assessed as a moderate constraint to port expansion activities within

the Norfolk ROI. Minor primary adverse impacts and moderate secondary adverse impacts are anticipated as a result of potential expansion activities or consequences.

Natural Areas

Natural areas are not widespread throughout the Norfolk ROI. Managed conservation areas within the ROI include the Craney Island Conservation Site and portions of the U.S. Navy Craney Island Fuel Terminal and Norfolk Naval Station. Potential primary adverse impacts to natural areas that could result from port expansion within the ROI include loss of natural areas from construction of new port facilities and adjacent intermodal rail and surface road accesses. Secondary impacts to natural areas resulting from potential port expansion within the ROI include erosion of nearshore natural areas from increased wake action resulting from an increase in cargo vessel traffic and disturbance of natural areas caused by increases in cargo vessel traffic and surface transport vehicles at intermodal accesses. While it is unlikely that port expansion would occur in either of the designated preserves, the increase in cargo vessel traffic and surface transport vehicles associated with port expansion could result in adverse impacts to these resources. Natural areas have been assessed as a minor constraint to potential port expansion within the Norfolk ROI, and minor primary and secondary adverse impacts to this resource are anticipated as a result of potential expansion activities or consequences.

Threatened and Endangered Species

Several Federal and state listed species are present in the Norfolk ROI. Actions or consequences associated with potential port expansion within the ROI that could result in primary adverse impacts to threatened and endangered species include loss of terrestrial and nearshore habitat from construction of new port facilities and adjacent intermodal rail or surface road accesses and incidental or accidental takes of listed species during construction activities. Potential secondary adverse impacts include disturbance of terrestrial habitat from transport vehicles at adjacent intermodal accesses, disturbance of benthic habitat from dredging operations, and disturbance of terrestrial, nearshore, benthic, and pelagic habitat from increased cargo vessel traffic. Species of particular concern for the Norfolk ROI include the North Atlantic right whale, piping plover, sea turtles, least tern (*Sterna antillarum*), black-necked stilt (*Himantopus mexicanus*), and Atlantic sturgeon.

The NMFS SERO has stated that the species of greatest concern with regard to port expansion in the South Atlantic is the North Atlantic right whale (Habitat Conservation Division, personal communication). The SERO further stated that port expansion projects that result in increased vessel traffic threats to North Atlantic right whales will be subject to intense scrutiny by NMFS. The SERO explained that, because takes of this species cannot be authorized (due to small population size), for some port expansion actions (in or near right whale critical habitat) to proceed, it may be necessary for NMFS to impose reasonable and prudent alternatives on the Federal action agency to prevent the expansion project(s) from putting the right whales in a "jeopardy" situation. Although no critical habitat for the North Atlantic right whale is present within the ROI, the ROI is located immediately west of South Atlantic coastal waters that are used as a migration corridor by the species.

Because of concerns raised by environmental agencies over potential impacts to threatened and endangered species resulting from port expansion operations, threatened and endangered species have been assessed as a substantial constraint to port expansion within the Norfolk ROI, and substantial primary and secondary adverse environmental impacts are anticipated for this resource as a result of potential expansion activities or consequences.

Critical Habitat

No designated critical habitat is present within the ROI. Consequently, critical habitat is not considered to be a constraint for potential port expansion at this time, and no appreciable adverse environmental impacts to critical habitat are anticipated as a result of potential expansion activities or consequences.

Unique or Unusual Habitats

Three small oyster reefs are present within the ROI. Oyster communities within the greater Chesapeake Bay area are impaired because of degraded water quality and disease-causing microorganisms. No SAV communities or natural hardbottoms have been identified within the ROI. Because these resources are not present in significant quantities within the ROI, unique or unusual habitats have been assessed as a minor constraint, and minor primary and secondary adverse impacts are anticipated as a result of potential expansion activities within the ROI.

Essential Fish Habitat

EFH is found throughout the Norfolk ROI for a large assemblage of managed marine fishes and invertebrates, including bluefish (*Pomatomus saltatrix*), summer flounder (*Paralicthys dentatus*), red drum, butterfish (*Peprilus triacanthus*), black sea bass (*Centropristus striata*), members of the snapper-grouper complex, coastal migratory pelagic species, highly migratory managed species, and skates. Potential primary adverse impacts to EFH that could result from port expansion activities within the ROI include loss of nearshore EFH from construction of new port facilities and adjacent intermodal rail and surface road accesses and loss or disturbance of benthic EFH from dredging operations. Potential secondary adverse impacts from port expansion include disturbance of nearshore, benthic, and pelagic EFH from increased cargo vessel traffic and degradation or loss of EFH from increased point and nonpoint pollution sources associated with port operations. Because of the widespread nature of EFH within the Norfolk ROI, this resource has been assessed as a substantial environmental constraint, and substantial primary and secondary adverse impacts are anticipated to EFH as a result of potential expansion activities or consequences.

Cultural Resources

The ROI contains an abundance of cultural resource sites with a widespread distribution. The only area in the ROI without significant cultural resources is the Craney Island disposal site. Potential primary adverse impacts to cultural resources from port expansion activities within the

ROI include destruction of cultural resource sites from the construction of new port facilities and adjacent intermodal rail and surface road accesses. Potential secondary impacts include the damage or loss of nearshore cultural resources from wave action associated with increased commercial vessel traffic. Because significant opportunities for avoidance of sensitive areas may not be possible, cultural resources have been assessed as a substantial constraint to port expansion within the Norfolk ROI. Substantial primary and secondary adverse impacts are anticipated for cultural resources as a result of potential expansion activities or consequences.

Hazardous, Toxic, and Radioactive Waste

HTRW may pose a constraint to port expansion activities. The presence of significant REC sites in a given area may render the given area infeasible for port expansion because of HTRW concerns. Additionally, potential port expansion may pose an HTRW concern to the surrounding environment. Potential primary impacts associated with port expansion activities include discharges from construction or dredging equipment during the construction of new port facilities and adjacent intermodal rail and surface road accesses or dredging operations. Potential secondary impacts include increases in point and nonpoint pollution sources associated with the construction of new port facilities and adjacent intermodal accesses, as well as the potential increase in pollutant or contaminant discharges from accidents involving cargo vessels.

Significant concentrations of potential REC sites in the ROI are present in the vicinity of the Norfolk Naval Station, the U.S. Navy Craney Island Fuel Terminal, and the Portsmouth Marine Terminal. Because these areas comprise a significant portion of the total ROI, the potential for avoidance of cultural resource sites is problematic. Consequently, HTRW has been assessed as a substantial constraint to port expansion within the Norfolk ROI. Substantial primary and secondary adverse impacts are anticipated as a result of potential port expansion.

Socioeconomic Profile

Expansion of port facilities in the Norfolk ROI would likely result in the creation of new jobs and new infrastructure within the ROI. Potential primary impacts to socioeconomic conditions within the Norfolk ROI include the acquisition of property from residents for the construction of new port facilities and adjacent intermodal rail and surface road accesses. It is anticipated that compensation would be provided to any impacted residents or socioeconomic groups impacted by property acquisition, offsetting or mitigating the impacts. No secondary adverse impacts to socioeconomic conditions are anticipated as a result of port expansion activities. Port expansion would likely constitute a net benefit to socioeconomic conditions within the ROI. Overall socioeconomic conditions are not believed to constitute a constraint to potential port expansion within the Norfolk ROI at this time, and no net primary or secondary adverse impacts to this resource are anticipated as a result of potential port expansion.

Environmental Justice

Areas with significant minority and/or poverty levels within the ROI include the vicinity of the Norfolk Naval Station and Norfolk International Terminals, and the U.S. Navy Craney Island Fuel Terminal. The Craney Island disposal area is included within a U.S. Census

block characterized as having a high percent of minority and disadvantaged residents; however, this area is unpopulated, and population demographics are not applicable to this portion of the ROI. Construction of new port facilities and adjacent intermodal rail and surface road accesses in these areas could result in primary adverse impacts to minority or disadvantaged populations. However, areas exist within the ROI for port expansion that would not result in disproportionate impacts to such groups, and the construction of new port facilities and the associated increase in jobs and infrastructure could result in a net benefit to minority and disadvantaged populations within the ROI. Environmental justice has been assessed as a minor constraint to port expansion within the Norfolk ROI. Minor primary adverse impacts are anticipated as a result of potential port expansion. No net secondary adverse impacts are anticipated as a result of potential port expansion.

Transportation

The Norfolk ROI contains an extensive network of surface roads, railroads, and waterways with shipping channels that support residential and commercial traffic activity in the area. Potential primary adverse impacts to transportation resulting from port expansion activities include the temporary disruption of traffic on surface roads and railways in construction areas for expanded port facilities or adjacent intermodal rail and surface road accesses, and temporary disruption of vessel traffic in areas selected for channel modification. Additionally, the construction of landside features could result in the permanent loss of portions of surface roads or railroads within the construction footprint of the expanded facilities. Traffic disruptions from construction activities would likely be temporary in nature, however, and any permanent surface route closures from construction activities could be offset by construction of new nearby routes to replace the closed routes. Potential secondary impacts to transportation resulting from port expansion activities within the ROI include increased use of transportation routes from commercial vehicle, train, and vessel traffic associated with expanded port facilities. Such increases in traffic could require substantial additions to or modifications of the existing transportation infrastructures. Consequently, transportation has been assessed as a substantial constraint to port expansion within the Norfolk ROI. Minor primary adverse impacts and substantial adverse secondary impacts are anticipated as a result of potential port expansion within the ROI.

Recreation

Common recreational activities in the vicinity of the Norfolk ROI include boating, fishing, crabbing, and visiting the area's historic sites. Potential primary adverse impacts to recreation within the ROI associated with port expansion include loss of nearshore recreational space from the construction of new port facilities and adjacent intermodal rail and surface road accesses; secondary impacts include the disturbance of waterborne and ecotourist recreation activities from increased cargo vessel traffic. Fishing and crabbing in the ROI are currently not prominent activities because of impaired water quality. Recreational boating is a popular activity, however, despite the high volume of military and cargo vessel traffic in the area. Recreational boaters use the ROI primarily for transit rather than as a destination. Landside recreational activities appear to have adjusted to any disturbances caused by high military and cargo traffic volumes and would likely adjust to any increases without significant impairment.

Consequently, recreation has been assessed as a minor constraint to port expansion within the Norfolk ROI, and minor primary and secondary adverse impacts are anticipated for the resource as a result of potential port expansion.

III. INSTITUTIONAL ANALYSIS

OBJECTIVES

The scope of work included an Institutional Analysis (IA) task to address specific local critical factors that would affect different ports, marine terminals, and sites relative to their ability to expand as part of a regional port concept. The institutional constraints were drawn with a wide boundary to allow for unique local circumstances for particular ports, terminals, and communities to be considered. The stated purpose of the IA was to focus on "deal makers and breakers" that would affect expansion of capacity and regional port development. The IA was to effectively complement the capacity and expansion analyses at the local marine terminal and site levels and the associated environmental surveys by bringing into specific consideration other factors not expressly incorporated in these prior tasks that could enhance or negate other advantages to capacity expansion.

Similar to the environmental survey, the IA was perceived as being relatively port and site specific. The subsequent reorientation of the scope away from fieldwork among the ports (including existing, planned, and potential marine terminals) to desktop analysis through Corps District secondary resources and possible local port inputs did not enable local critical factors and deal makers/breakers specific to the ports, terminals, and sites to be identified as such.

METHODOLOGY

Similar to the capacity analysis (First Interim Report – July 2006) and environmental survey, the orientation of the IA shifted from a port, terminal, and site orientation to a desktop review of secondary materials that could be applicable to the expansion of South Atlantic container ports and marine terminals. The IA presented here deals with general critical factors affecting marine terminal capacity and development at the regional level. The IA applies to existing capacity of current facilities and new capacity of planned and potential facilities.

EXISTING CAPACITY

The capacity analysis in the First Interim Report indicated that marine terminal throughput was based on assumptions about key parameters that affect capacity, including: (1) gate access (hours and days of operations) between public roads and marine terminals; (2) labor practices and work rules; (3) storage and handling empty containers; (4) dwell time in the marine terminal for loaded containers; and (5) provision of highway truck chassis for container movements outside of the terminal. The institutional aspects of each will be discussed in the following subsections.

Gate Access

Marine container terminals are frequently represented as seamless logistical centers where cargo is swiftly transferred between vessels and land transportation. The terminals are assumed to work 24/7 with respect to hours of the day and days of the week, respectively. Although this 24/7 phenomenon is often the case for some parts of some of the terminals,

particularly vessel berth operations (ignoring some other constraints pertaining to labor overtime compensation that provide some disincentives for 24/7 staffing), in most instances the marine terminal public gates that allow ingress and egress of cargo from and to the local roads are limited to 8/5 with respect to hours of the day and days of the week, respectively. Effectively, the terminals typically operate with very limited hours for receipt and discharge of cargo by way of public roads.

There have been some movements to increase marine terminal gate operating hours, often by staffing during lunch and breaks when the gates have been otherwise customarily closed and by extended hours through a combination of early openings and late closings. Until several years ago, it was not uncommon to see marine container terminal public gates open at 7:00 A.M., close for a 15-minute break during the morning, close for a one-hour lunch break at noon, and close for a 15-minute break during the afternoon before closing for the rest of the day at 4:00 P.M. Effectively, the marine gates would be open about 37.5 hours per week during the five days from Monday to Friday.[1]

Today, most of the container terminal gates are operating more or less continuously during the eight-hour day, often with extended hours up to 10 hours daily for the South Atlantic ports. The Georgia Ports Authority (GPA) has regular Saturday gate hours that are still an anomaly for most of the other East Coast container ports. Extended gate operating hours are regarded as a precursor to improved marine terminal throughput in the absence of other changes such as container dwell time. This is particularly important if there are weekend sailings for which export cargo must be received at the terminal before gate closure on Friday and import cargo cannot be discharged from the terminal before gate opening on Monday.

However, extended gate operating hours are not a sufficient condition for improved throughput unless there are businesses that can be effectively served with deliveries and pickups outside of the traditional eight-hour workday timeframe for most shipments and related business hours. Extended marine terminal gate access by more operating days and/or longer hours have not been particularly successful where local business hours for shipments are limited to five days and eight hours. Extended gate operating hours have worked better when there are distribution centers that are more inclined to operate over longer hours for receipt of freight deliveries or non-local customers such that the transit time can still fit into a traditional five-day eight-hour window for delivery/pickup; but shipments can leave or arrive at the port with more flexibility under extended gate operations.[2]

The impact of extended gate operating hours will vary by port depending on the mix of local and non-local customers that can be effectively served by extended gate operating hours. Simulations of marine container box movements through gates with weekend operations that are

[1] In some instances, the gates would actually be open fewer hours when the longshoremen reported for duty at the hall and then had to be transported to and from the gates. The relatively small size of the South Atlantic container terminals does not present much of a problem for "floating" labor compared to larger terminals and congested urban areas on the West Coast, where gate openings and closures would often be delayed and accelerated by as much as 30 minutes for labor transportation.

[2] The paramount issue is the extent to which these businesses will receive cargo outside of the normal 8/5 practice. The businesses may be open for extended hours (for example, retailing), but may not receive freight concurrent with these extended hours.

not constrained by customers' abilities to receive freight outside of traditional hours indicate substantial improvements in terminal throughput (depending on the volume of weekend box movements).[3] The evolving development of major retail regional distribution centers locating in close proximity to major container ports such as GPA bodes well for supporting effective use of extended gate hours and possibly days of operation. Expanded gate operations have been gradually evolving on the West Coast in response to severe congestion affecting marine terminals. To the extent that the container port distribution centers operate longer hours and days than conventional 8/5 businesses, there should be a baseline level of traffic for longer gate hours.[4]

Although extended gate operating hours are widely perceived as a potential contribution to improved marine terminal throughput capabilities, there are a number of interrelated institutional issues that have limited the extent to which ports and/or steamship lines are willing to operate longer gate hours. The major limiting institutional issues affecting the use of extended gate hours to increase marine terminal capacity (throughput) are largely outside of the control of the ports and lines. The issues are:

- Extent to which local shippers, including intermodal terminals, can accept shipments (imports) outside of 8/5 hours and days per week framework.
- Labor flexibility and expense associated with extended gate operations.
- Willingness of steamship lines to absorb extra costs, primarily labor, of extended gate hours.
- Truck curfews and/or noise restrictions on adjacent local roads.

For these reasons, ports have not aggressively pursued extended gates. In many instances the use of extended gates is significantly lower than the traditional peak inflows at 7:00 A.M. and outflows at 4:00 P.M. Until there is a sufficient volume of local marine container traffic that is not limited to 8/5 hours per day and days per week for delivery (imports), most ports will probably continue with restricted gate operating hours compared to an unconstrained 24/7 phenomenon. Gate constraints are particularly applicable to U.S. East Coast ports because of the very high level of dependence on trucks (upwards to 80 percent of containers move exclusively by truck) for local movements up to 250 miles.

Labor Flexibility

Typical marine terminals staffed with union labor in the South Atlantic coast (International Longshoremen's Association and International Brotherhood of Teamsters) are under a master contract with local addenda for particular circumstances. Consequently, there are variations among the ports with respect to start times, shifts, etc. The discussion that follows is

[3] *Response Model to Disruption of Maritime Transportation Systems*, Maritime Administration (August 31, 1996).
[4] Drayage of marine containers by local trucks is normally compensated on a trip basis. To the extent that drayage firms can make more trips per day or make trips faster during the latter part of the day, there are other improvements in marine related productivity and costs.

intended to provide general guidance and may not exactly reflect the local labor situation with respect to work rules and practices at each of the five major container ports and terminals.[5]

Longshoremen labor work rules will typically reflect fixed start times for gangs to be ordered to work cargoes and other terminal staffing. Generally, the daytime shifts (typically 7:00 A.M. to 4:00 P.M.) will work at straight labor time compensation. Shifts outside of this timeframe will typically receive overtime compensation for the affected hours. Moreover, overtime will typically be paid for weekend work. Additional premiums may be paid for overtime work that extends past midnight, etc. Shift start times are usually fixed per the agreement and typically allow for minimum pay per call, often four hours, regardless of the duration.

Effectively, vessels can only work around the shift start times or pay for idle labor wait for ships (gangs ordered for a shift that begins before the vessel arrives) and/or overtime to extend shifts for cargo handling (gangs held beyond the eight-hour shift to work a vessel). Some cost-sensitive lines at smaller ports will seek to work vessels during daylight hours to minimize longshoremen costs of overtime. Similarly, lines might seek to work vessels at other than weekend periods to avoid overtime. However, for most large container ports, these preferences are more difficult to implement because the lines have schedules and often there are limited berth opportunities. Moreover, for large container vessels, the opportunity costs of delay are perceived as normally outweighing higher labor (longshoremen) costs from overtime hours, premium labor shifts, and days of operation.

Labor staffing has been a particularly sensitive issue for extending gate operating hours. Because there are fixed start times, opening gates earlier or closing them later has normally required special negotiations and labor overtime payments. Similarly, extending gate days of operation usually results in labor overtime payments. Extended gate hours or days of operation beyond the traditional workday timeframe should normally be regarded as requiring overtime payments. Gate staffing differs among the ports, but a typical "gate" portal will have a staff of three persons. Consequently, gate overtime can become very expensive for the convenience (as opposed to the necessity) of allowing cargo to enter or exit outside of the normal straight-time labor schedule.

Gate labor costs are commonly viewed as inflated by staffing and work rules that require a minimum number of persons per portal (gate) for the purposes of receiving and discharging equipment and cargo to and from the marine terminal. Gate automation of certain functions such as electronic data interchange (EDI), pre-cleared documentation, etc., has vastly reduced the labor time and staffing actually needed, but usually not without corresponding reductions in union work rules.[6]

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[5] In addition to differences among the ports with respect to unions (International Longshoremen's Association or International Brotherhood of Teamsters), there are differences within the ports with respect to unions, particularly when the International Brotherhood of Teamsters staff marine terminal gates rather than the International Longshoremen's Association.

[6] The labor unrest at the West Coast ports has partially reflected concerns about outsourcing of gate clerks as a result of automated data exchange, virtually eliminating the need for manual data entry by union clerks with a base rate in excess of $100,000 per year.

No effort to extend gate hours and days of operation can ignore the increased costs of overtime and fixed staffing dictated by traditional union work rules built around an 8/5 (hours and days) framework for port operations. The commodity-like nature of the container marine business has meant that steamship lines and ports have striven to minimize costs whenever possible. Expanded gate hours and days is regarded as an expensive alternative for increasing terminal capacity (throughput), particularly if there is a sharp decline in gate utilization outside of the normal hours and marked by overtime labor costs. Consequently, some ports or lines have extended gate hours only to discover that demand was insufficient to justify the additional expense.

The result is that changes in the work hours at the ports, particularly marine terminal gate access, cannot be viewed as a panacea for improved throughput if local businesses remain committed to a traditional 8/5 hours and work days when cargo will be received. Extending the gate hours and days adds little to productivity at the expense of substantially higher labor costs unless the adjacent shipping community likewise adopts more flexible operating practices.

Empty Containers

Steamship lines commonly maintain pools of empty containers at the ports to fill customer orders for shipments. The sizes of empty container pools vary by line, trade, and time of the year. Line contracts with the ports normally allow for a maximum free container storage time beyond which stowage charges are applicable to empty containers. For several reasons, lines have had incentives to maintain larger pools of empty containers than commonly required. Until the recent substantial increase in steel prices, it was usually assumed in the industry that it was cheaper to build new containers in China than to ship empty containers back to China for more loads (imports). Moreover, the West Coast port labor disruption and associated productivity issues led lines to move West Coast empty containers to East Coast ports. This exacerbated the storage problem to the extent that some East Coast ports (including Savannah) took action to embargo receipt of container empties other than what had previously been discharged (imported) through the port.

A common practice has been to seek to store excess empty containers off port in auxiliary lots. Some ports have considered this an alternative to on-site marine terminal storage. However, off-terminal stowage of empty containers involves some issues, which are largely related to responsibility for equipment control and gate inspection operations. It is not clear that off- terminal storage of empty containers other than to augment reduced on terminal stowage will be a supplement to the dispatch of empty containers from the marine terminal for loading. In addition to equipment liability issues, there is also the issue of union sector labor staffing for off-site terminal operations with regard to "gates" that would allow for empties to be picked up or dropped by truckers independent of the marine terminal or in conjunction with it as part of an equipment flow.

Consequently, other than long-term storage of excess empties, off-terminal siting of empty containers is not regarded as very practical without labor flexibility to staff and operate these facilities. Moreover, the ports have the ability to limit empty containers with respect to numbers of boxes and dwell times through existing tariff and contract provisions. In the past, the

ports have been reluctant to apply the penalties, but the recent trend is to tighten the supply of empties, particularly for low-volume lines, and enforce shorter dwell times.

As a practical matter, normal working inventories of empty containers do not have an appreciable effect on marine terminal capacity and throughput for several reasons. First, empty containers are often stowed in the least desirable portion of the yard with respect to berth access, which may not otherwise be suitable by layout, surface condition, or location for loaded containers. Second, because empty containers have substantially greater stowage density than loaded containers with respect to height and less row spacing, the yard space occupied is not equivalent. Third, most trades have seasonal fluctuations in commodities that lead to ebbs and flows of empties, including storage fluctuations, as lines can reposition them. Fourth, and perhaps most important, is that the empty container problem is quite limited in terms of the numbers of boxes and productive yard space that is effectively occupied. When viewed from the perspectives of other determinants of marine terminal capacity and throughput, the empty container problem is relatively modest.

Dwell Time

Dwell time is a measure of the days that loaded boxes of imports and exports stay in the marine terminal prior to discharge. Dwell time has a direct effect on yard occupancy and throughput capability. Shorter dwell times result in faster turns of the yard inventory of loaded boxes and therefore produce increased throughput. Conversely, longer dwell times result in slower turns of the yard inventory of loaded boxes and reduced throughput.[7]

Dwell time varies primarily by service and cargo. Less frequent services will tend to have larger dwell times (exports) as cargo accumulates. Lower-value cargo will also tend to have longer dwell time, particularly exports. The average dwell time days for containers in the marine terminal for a weekly service for nonperishable imports and exports will typically range from three to five days. However, the average dwell time does not tell the whole story from the perspective of the dwell time distribution. Typical dwell time distributions measured in days are skewed. For example, a four-day average dwell time might have the following distribution of days and boxes for imports in the yard before discharged out of the gates: 2 days – 5 percent; 3 days – 10 percent; 4 days – 35 percent; 5 days – 15 percent; 6 days – 10 percent; 7 days – 10 percent; 8 days – 5 percent; 9 days – 5 percent and 10 days – 5 percent. The weighted average dwell time would be 4.25 days as reflected in Table 2.

For illustration purposes, Table 2 includes three alternative container dwell time distributions to identify the impact on average dwell time. The five day maximum dwell time effectively eliminates any boxes in the yard over five days. The weighted average dwell time is 4.05 days, an improvement of 0.20 days. The accelerated dwell time shifts the entire dwell time distribution back one day and has a five-day limit on maximum dwell time. The resulting weighted average dwell time is 3.25 days, an improvement of one day over the status quo.

[7] Conceptually, it is useful to regard the marine container terminal as a warehouse and the stock of containers as inventory. The throughput of the warehouse is a function of the number of inventory turns. The average length of the dwell time is a reflection of the inventory turns and the throughput capability of the marine terminal.

Finally, a four day maximum dwell time that is also accelerated has a weighted average of three days, which is a 1.25-day improvement over the status quo.

Table 2. Effect of Container Dwell Time Distribution on Average Total Dwell Time (Days)

Dwell Days	Existing Percent	Dwell Average	Five Day Max Percent	Dwell Average	Accelerated Percent	Dwell Average	Four Day Max Percent	Dwell Average
1		0.00		0.00	0.05	0.05	0.05	0.05
2	0.05	0.10	0.05	0.10	0.20	0.40	0.20	0.40
3	0.10	0.30	0.20	0.60	0.40	1.20	0.40	1.20
4	0.35	1.40	0.40	1.60	0.10	0.40	0.35	1.40
5	0.15	0.75	0.35	1.75	0.25	1.25		0.00
6	0.10	0.60		0.00		0.00		0.00
7	0.10	0.70		0.00		0.00		0.00
8	0.05	0.40		0.00		0.00		0.00
9	0.05	0.45		0.00		0.00		0.00
10	0.05	0.50		0.00		0.00		0.00
Total	100%	4.25	100%	4.05	100%	3.25	100%	3.00

Source: G.E.C., Inc.

Several features of the different container dwell time distributions in Table 2 should be noted:

- Shifts in outlier dwell times in which a small percentage of boxes remain in the yard for disproportionate lengths of time up to ten days have little effect on average dwell time and yard capacity.[8] Although ports can track lagging boxes, the lines may have average dwell time agreements that allow for averaging of certain discretions between extremely short and long dwell times for boxes. Alternatively, not all laggard boxes will belong to the same lines and customers, which makes maximum dwell time enforcement costly relative to the yard space gained.

- Backward shifts (reductions) in days for dwell times produce substantial results in terms of the capability for increased yard throughput, but would likely require effective use of extended gate hours and days of operation to be achievable. The absence of weekend gate operations is probably a substantial impediment to significant shifts (improvements) in dwell time.

- Substantial improvements in average yard dwell time can lead to significant increases in yard throughput capacity. In the example cited in Table 2, a backward shift (reduction) in dwell time distribution by one day can lead to about a 30 percent increase in yard throughput, other things being equal. Most yard capacity models assume average dwell times. Reductions in average dwell time can result in vastly

[8] Accelerated shifts in dwell times wherein a small proportion of boxes leave the yard earlier during extended gate operations would have a similar minimal impact on weighted average dwell time and terminal throughput.

improved marine terminal throughput, but would likely require other institutional changes such as extended gate hours and days of operation.

Chassis Supply

The U.S. is reportedly the only major containerized shipping nation in which steamship lines provide chassis for highway movements of their containers by third-party trucks. The container chassis belong to particular steamship lines or are shared by them in a common user pool. The steamship lines are responsible for the provision of chassis that are suitable for public roads, including such things as safety features. The chassis issues are legion with respect to container port productivity and throughput and can be summarized as follows:

- Chassis take up yard space that could otherwise be used for containers. Some ports have stacked the chassis, but there are issues related to damage, particularly lighting systems that require repair before use by union labor.

- Truckers require port time and capacity at the gates and in the yard when picking up or dropping chassis in the marine terminal. There are also gate times for equipment inspection and, when necessary, repairs for road suitability (particularly lights).

- Lines sometimes have their own separate pools of chassis, effectively increasing the total number of chassis units at the marine terminal compared to a common user pool. Issues similar to off-site stowage of empty containers also apply to chassis. Chassis management pools can to some extent provide for better utilization of the equipment inventory with less equipment, but not all lines want to relegate control of their means of customer delivery of containers to third parties.

Steamship lines have long argued that the "chassis problem" can be solved by adopting the worldwide practice (other than U.S.) of requiring the trucker to provide the chassis for movements of marine containers. This would remove chassis storage, pickup, and dropoff from the marine terminals, creating more space in the yard and less gate traffic. The trucker would be responsible for the safety status of the chassis and would be able to make any repairs off site before coming to the terminal for containers. In recent years, there have been some incremental changes in chassis supply and management, primarily through equipment pools. However, this does not address the fact that unlike the rest of the developed world, U.S. marine container terminals are also chassis depots.

CRITICAL FACTORS AFFECTING EXPANSIONS AND NEW CAPACITY FOR MARINE CONTAINER TERMINALS

The generally perceived critical institutional factors affecting expansion of existing marine container terminals and development of new terminals are land, landside accesses (highway and rail), public/private participation and funding, and community acceptance. Other institutional factors may exist at particular sites, but these were not incorporated into the level of analysis for reasons outlined in the introductory section of this report.

Land

There is no apparent shortage of developable land for potential marine container terminal port sites. Rather, there are land utilization issues in conjunction with landside traffic flows and affected environmental resources. Evidence with respect to sites is limited to secondary materials other than in the case of the Georgia Ports Authority (GPA). Norfolk, for example, has noted that several sites were evaluated for marine terminal construction, including: (1) 400 acres along the Chesapeake Bay and Back River in Mapton, Virginia; (2) Crab Neck in York County – the site is located south of Goodwin Islands along Chesapeake Bay, Virginia; (3) Glouchester Point along the York River in Gloucester, Virginia; (4) sites along the James River in Newport News and Isle of Wright County, Virginia; and (5) sites along the Elizabeth River in Norfolk and Portsmouth, Virginia.[9]

Other ports have numerous potential sites, but it is conjectural to speculate on whether these could be developed without more specific information. These sites include alternatives to the proposed Charleston Navy Container Terminal at Charleston Harbor (Upper Cooper River), including Daniel Island and Drum Island; Savannah River sites potentially developable by GPA to augment capacity at a fully built out Garden City Terminal as well as Jasper County, South Carolina; and Jacksonville Harbor. In terms of developable sites, 200 acres appears to be the threshold for a large container terminal footprint. It is unlikely that smaller sites would be developed other than as additions to existing footprints.

Marine Terminal Landside Access

Marine container terminals are intermodal hubs where cargo is transferred between waterborne and surface modes. Marine container terminals do not originate or terminate cargo other than as a point of cargo accumulation and transfer. Consequently, all cargo transits the terminal. As a result, efficient landside connections with major highway and rail networks are deemed as important to facilitate the movement of containers.

Although considerable emphasis seems to be placed on rail access to marine container terminals, the common practice for U.S. East Coast ports (ECUS) is to rely predominantly on truck for movements of loaded containers up to distances of 500 miles (one-day truck trip). For most ECUS container ports, truck movements between gates and shippers/receivers account for about 80 percent or more of total container volumes.[10] Rail is usually for longer distance movements (exceeding 500 miles) and often for boxes characterized by overweight cargo (for highway movement), low value cargo, or repositioning of empty containers.

Although rail access is desirable for marine container terminals from a planning perspective, there is debate over whether access by two railroads is preferable to one railroad.

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[9] Draft Environmental Impact Statement for the Craney Island Eastward Expansion Norfolk Harbor and Channels, Hampton Roads, Virginia.

[10] Some of the more intensive rail intermodal ports such as Hampton Roads have assumed 25 percent rail usage. Rail intermodal average total marketshare of all marine containers handled is probably less than 10 percent for Jacksonville and less than 15 percent for Savannah and Charleston.

Two-railroad access is usually regarded as more effective for competition among the railroads from the perspective of ports. However, because the steamship lines typically directly negotiate the rail rates on behalf of their customers and do so with the same railroads calling different ports, there is considerable monopsony power.[11] Moreover, there may be advantages of single rail services to particular ports characterized by larger volumes and associated economies of scale and service frequency.

There is also debate from the steamship line perspective about what constitutes effective access by two railroads at ports and marine terminals, particularly when one railroad has near-dock location inside or adjacent to the terminal and one railroad is off-dock and requires public road access.[12] Off-dock railroad intermodal locations will encounter restricted marine terminal gate hours and potential gate queues and will also need to use highway tractors and licensed chassis as opposed to yard equipment for near-dock moves. On-dock or near-dock rail intermodal can avoid the public gate access restrictions and use cheaper container yard equipment to move containers, which is not subject to public road standards.

If two railroads are to serve the marine terminal, they will normally require separate independent access and terminals unless there is some trackage sharing among them or between a third party owner/operator of the port intermodal facility and access. These issues characterized the Intermodal Container Transfer Facility (ICTF) opened by GPA in 2001. Norfolk Southern (NS) had direct rail access to the GPA ICTF terminal, but CSX did not. NS and CSX were unable to reach an agreement to allow CSX direct access to the ITCF via NS. Consequently, CSX is unable to use the ICTF until GPA builds a separate access for CSX to reach the facility.

Similar rail intermodal issues characterize Blount Island at Jacksonville, which is served directly by CSX. Containers to be shipped by NS have to be drayed about 20 miles over public roads to the west side of Jacksonville to the NS intermodal facility located there. For all practical purposes, on-dock rail or near-dock rail intermodal facilities that are served equally by two major railroads such as NS and CSX are quite rare other than for new special-purpose built for joint use or shared use facilities such as the eventual completion of the ICTF at GPA. Most of the older ECUS marine container terminals do not have on-dock or near-dock rail access. When it exists, it is captive to one railroad and may be an operating extension of a larger general purpose public intermodal facility in the urban area.

There are marine container terminals that lack near-dock rail intermodal service, such as the Wando Welch facility at Charleston Harbor and the proposed Charleston Navy Container Terminal. The Jasper County potential site currently has no active rail connection. Similarly, the proposed/developing North Carolina Intermodal Port (NCIP) currently lacks rail access, and

[11] In economics, monopsony is a market form of imperfect competition in which only one buyer, called a monopsonist, faces many sellers (compared to a monopoly in which there is only one seller facing many buyers). The market power of the steamship lines to whipsaw competing railroads at the same port or competing ports is legendary in an effort to obtain the lowest intermodal rates through "discounts" and volume incentive agreements not otherwise available to other buyers of similar services.

[12] Even a relatively short distance off-port drayage to a rail intermodal facility would likely add $75 to $100 more to the rail portion of the movement compared to an on-port rail intermodal terminal.

the nearest rail access is a U.S. government military installation that serves the Sunny Point munitions depot.

All of the ports and terminals in the scope of the RPA as previously indicated are heavily reliant on truck for movement of containers to customers or off-dock public rail intermodal terminals. Consequently, highway access and road connections are of critical importance to existing and developing marine container terminals. For example, the Craney Island marine container truck estimates expressed in average daily truck trips to and from the terminal and total trips rise from 858 and 1,502 per day, respectively, for 300,000 TEU annual throughput in 2017 to 1,697 and 2,341, respectively, for 600,000 TEU annual throughput, then to 2,089 and 2,833, respectively, for 782,500 TEU annual throughput, and continue to 5,964 and 7,608, respectively, for 2,500,000 TEU annual throughput in 2032.[13] Truck trips would decline after 2032 associated with an increased rail intermodal share of 2,500,000 annual TEUs.[14] Similar analyses for other ports and terminals, although with lower rail intermodal shares, would likewise reveal the large increase in truck traffic that is concentrated at the marine terminal public road accesses normally for limited periods of the day and days consistent with limited gate operations.

The primary measure of marine terminal highway access is the proximity to a four-lane limited access highway, normally part of the Interstate network. Otherwise, four-lane connectors exist or can be constructed, such as those proposed to Craney Island and the Charleston Navy Container Terminal. There is obvious specificity of local issues about marine terminal truck access with respect to proximity to four-lane highways and designated local truck roads. It should be noted that although the volume of marine container terminal truck traffic is substantial in terms of vehicles using the gates, once outside the gates on the local highway network the typical dispersion of routings adds very little traffic to the existing community base load of average annual daily traffic (AADT), except possibly for peak times of the day when most urban systems are typically congested. Therefore, most marine terminal truck access issues are "near gate" in nature, reflecting the general lack of immediate access to a four-lane highway of Interstate standards for the older ECUS marine container terminals. To the extent that local truck routes use public streets and share traffic with locals, there will be marine truck terminal issues, particularly near the terminals as the routes converge for the gates.

Financing

Most container ports in the U.S., particularly ECUS, were initiated on or near former general cargo multipurpose terminal sites that were owned by public agencies. Some of the public agencies have evolved from city or local ownership to a wider basis of public control (for example, consolidation of the locally owned terminals at Hampton Roads under the Virginia Port Authority). There is no prevailing model for public ownership of ports. For the South Atlantic, including Norfolk, there are four state agencies -- Virginia Port Authority (VPA), North Carolina State Ports Authority (NCSPA), South Carolina State Ports Authority (SCSPA), and Georgia

[13] Draft Environmental Impact Statement for the Craney Island Eastward Expansion Norfolk Harbor and Channels Hampton Roads, Virginia.

[14] The truck trip projections assume that approximately 63 percent of the container freight handled by the Craney Island Terminal would be transported by truck at the initiation of Phase I in 2017, declining to 40 percent by a projected full buildout in 2050.

Ports Authority (GPA) -- and one local authority, Jacksonville Port Authority (JPA). The port authorities operate a variety of marine terminals other than container facilities, but in recent years the focus of growth has generally been development of container facilities.

Until recently, container ports have been entirely publicly owned and financed. The major differences among the financing and ownership patterns is the control of daily cargo handling operations of the facility and related facility use payments to the public agency. Two basic public/private ownership and operating arrangements exist, with multiple variations for marine terminals. There is the standard public agency ownership and lease of all facilities to private sector steamship lines and/or terminal operators or public agency ownership and cargo operations with assistance from the private sector such as stevedores. The traditional model is the landlord port, wherein the public agency receives a fixed rental payment for the provision of the facility but does not engage in operations and associated expenses. The public agencies that own and also operate the ports on a daily basis are less prolific. However, in the South Atlantic, including Norfolk, two of the largest ports are terminal operators at their facilities -- GPA and Virginia International Terminals subsidiary of VPA.[15] The NCSPA is also the terminal operator of the Port of Wilmington, including the container terminal. The SCSPA is a landlord port, leasing its facilities to steamship lines and terminal operators. Similarly, JPA is a landlord port, although at one time it also had a small operation component that has been discontinued to make it entirely a landlord port.

There are various schools of thought about the advantages and disadvantages of public port authorities engaging in terminal operations. A landlord (non-operating) port has been regarded as doing what the public sector does best in providing the infrastructure and public (political) support for port financing and capital expenditures for economic development. The port operations are commonly regarded as left to commercial enterprises such as steamship lines and terminal operators that specialize in cargo movement and have a commercial enterprise for-profit orientation. Conversely, there is a distinct minority of public ports that are also terminal operators. Rather than lease the port infrastructure to third party terminal operators and/or steamship lines, the port authority will have a commercial operations element that performs this service. One argument in favor of the public operating port is that the agency has more control over the efficient use of the infrastructure through one owning and operating entity and as a result is better able to assess the short-term and long-term facility maintenance and capital needs. It is also contended that public operations will seek to maximize use of the facility rather than profit, which will provide greater spillover secondary benefits to the taxpayers subsidizing the facility.

The conventional historical model for public ports has been the landlord setup, wherein the public agency provides the marine infrastructure and leaves the commercial operations of the facility to a private sector for-profit enterprise. The model has worked well when ports are regarded as major avenues for economic development. State investment in the ports is viewed as a precursor to attracting industry and jobs. In recent years, there have been some challenges to the economic development paradigm, which has required substantial public investment to

[15] The Virginia International Terminals is the operating subsidiary of a public entity, VPA. VIT is authorized to enter into collective bargaining contracts.

develop increased capacity and is critically viewed by some as subsidizing the steamship lines because most public ports do not recover the cost of capital.

The major emerging port development issue is control of the terminal operations. Increasingly, steamship lines want to run their own terminals with respect to berth operations and cargo storage in the yard. A landlord operation has favored this form of control, where the steamship line will have leased terminal space, perhaps preferential berthing and possibly their own gates. The steamship line in turn may act as a terminal operator and allow other lines to use its space, for which it provides terminal services.

There are widely held views about the nature of the terminal operator and its relationship to vessel operators. A non-integrated terminal operator is regarded as more proprietary with respect to the commercial accounts of the different lines that it handles. Conversely, a steamship line that is integrated as a terminal operator is viewed more of a potential competitor that handles the accounts of other lines and is able to learn their commercial relationships.

Until recently, there was no alternative model to the landlord or public port terminal operator concept for container ports. The Maersk SeaLand marine terminal that is under development at Hampton Roads will be the first completely privately owned and financed marine container terminal in the U.S. Terminal operators have traditionally not looked with favor on making large capital investments in marine terminal infrastructure unless reimbursed by the lease operating agreement with the landlord port authority. The operators regard themselves as effectively competing with other publicly owned marine facilities that usually only cover operating costs and do not directly earn sufficient profit to provide a return of marine terminal capital investment (although the public ports would strongly argue that the port-induced economic development impacts, including such things as taxes, would represent indirect capital recovery of the public investments, or that the state investments have been such things as grants or forgiven loans).

The Maersk facility appears to be a notable exception to the prevailing paradigm that the public provides the infrastructure and the operator manages the commercial sector under a leasehold arrangement. The Maersk terminal at Hampton Roads would normally be regarded as a competitor to VPA's three other container terminals, except that the public agency's existing facilities are projected to run out of capacity (other than the Hampton Roads cargo that Maersk SeaLand will shift to its new facility) and need to be augmented by the proposed Craney Island facility (VPA owned and operated), which will probably not begin operations until about 2017.

The Maersk facility at Hampton Roads has broken new ground for a likely paradigm shift in the private sector provision of marine container terminal infrastructure, away from public sector domination and toward more total private investment and control beyond long-term leases of landlord facilities. The large steamship lines are looking for substantially more terminal space (upwards to 200 acres) that they can completely control from a landlord port operations perspective. Terminal operating companies have consolidated into an international industry with very few large players that provide multiple port services for groups of lines around the globe. The large players, which are steamship lines with their own captive terminal operations subsidiaries and independent global terminal operators, are looking for new Greenfield container

port sites as partners with existing public ports or as developers with nominal public entity participation and control.

It is entirely possible that new public ports may emerge in conjunction with sites and developers (steamship lines and terminal operators) that would augment the regional port concept. In conjunction with the worldwide trend to port privatization (other than in the U.S. except as noted), there is an emerging shift to container port development in less developed markets such as U.S. Gulf Coast. Developers are looking less for large local markets and more for regional access by rail and highway. Examples are the proposed container port development in Mobile (rail) and several sites in Texas (highway). Overall, it is clear that there are no regional monopolies on port development, as witnessed by the shift away from the West Coast that has favored East Coast ports and prospective emerging developments in the Gulf Coast.

Community Acceptance

Public ports appear to have a life-cycle of community acceptance as a function of other developments in the local community. Where ports are part of an industrial network in an otherwise commercial development and related transportation infrastructure, there is a community fit. However, where the ports are viewed as encroaching on non-industrial development, land use conflicts can arise.

Port economic development impacts in terms of such things as employment and sales are often quite large when viewed from a regional perspective. However, local impacts other than economic are often viewed as quite large in terms of community and environmental impacts. Ports are often less regarded as the primary regional engine for economic development in developed regions (primarily urban areas) compared to rural areas where there are fewer non-maritime opportunities.

Consequently, it is not unusual to see competing land uses and economic development scenarios emerge with controversy over the extent to which local container ports contribute to the local economy while handling a large volume of non-local cargo. The community may regard the port impacts of local development to be significant; but there is also the attendant impacts of non-local cargo, which has little direct positive impact on the local community other than the marine terminal throughput. It may be argued that from a local development perspective economies of scale of terminal development and efficient use require a substantial proportion of non-local cargo that is a natural byproduct of the local cargo. For example, container lines choose local ports based on the mix of local and non-local cargo. While the local cargo has visible economic development impacts, the non-local cargo is part of the successful mix of the marine terminal throughput.

The container port cargo geographic mix and the views of the local communities of interest will vary among the ports. It appears that port development is likely to shift more to rural areas where the local impacts of cargo flows, particularly rail and truck, will be less obtrusive than compared to non-industrialized urban areas. Moreover, as some urban areas de-industrialize and redevelop through restoration efforts, port industrial conflicts for traditional urban locations are likely to arise. This is analogous to residential land use that subsequently develops around a

commercial airport, creating land use conflicts not envisioned by the airport developers originally located in an undeveloped Greenfield.

Appendix A

SAVANNAH DISTRICT LETTER TO PORTS

DEPARTMENT OF THE ARMY
SAVANNAH DISTRICT, CORPS OF ENGINEERS
P.O. BOX 889
SAVANNAH, GEORGIA 31402-0889

REPLY TO
ATTENTION OF:
Civil Programs and Project Management

Mr. Rick Ferrin
Executive Director
Jacksonville Port Authority
Post Office Box 3005
Jacksonville, Florida 32206-0005

Dear Mr. Rick Ferrin:

The Savannah District Corps of Engineers is studying the deepening of Savannah Harbor in relation to other South Atlantic Coast marine container ports. The study includes a Regional Port Assessment that will address the capability of all major South Atlantic ports to absorb projected long-term increases in marine container traffic with existing and new facilities. The Regional Port Assessment will address alternatives to expanding the Savannah Harbor from a capacity perspective. The assessment uses a systems approach to port capacity that is likely to be applied to other major port deepening studies.

The regional assessment will determine the future capacity of existing or prospective new major container load center ports on the South Atlantic Coast as well as potential offshore hub ports. The capacity analysis will reflect existing facilities largely through publicly available information that can only be verified through site visits. The site visits will also be used to address the potential for Greenfield terminal expansions along the coast.

The Savannah District has contracted with Gulf Engineers and Consultants, Inc. (GEC) to assess the economic feasibility of deepening Savannah Harbor. The Regional Port Assessment is a part of this contract. GEC, through its Project Manager Kevin Horn, has collected website information relating to your port's marine container capacities. The next step is for Mr. Horn to contact your port for a site visit that will confirm existing capacity elements (berths, cranes, yard space, highway and intermodal connections), as well as expansion capability in the near and long term, including possible Greenfield sites.

The Regional Port Assessment will provide a long-term outlook consistent with the Corps' 50-year economic life for harbor deepening studies. Of particular interest will be the capability of the South Atlantic ports to enlarge existing facilities or provide new container facilities during the coming 50 years.

Your cooperation in this effort will enable the Corps to gain a regional perspective on the viability of Savannah Harbor deepening in the context of the capacities of competitive ports and will contribute to the rational allocation of public funds.

The US Army Corps of Engineers, Savannah District, Project Manager is Alan Garrett, who can be reached at (912) 652-5172. Kevin Horn, the GEC Project Manager, can be reached at (540) 364-0369. Please contact them if you have any questions about the nature of the study. Mr. Horn will be contacting you after Labor Day to arrange for a visit. A copy of this letter will be furnished to Ron Baker, David Kaufman and Robert Peek.

Sincerely,

PETE ODDI, P.E., PMP
Deputy District Engineer for Programs
and Project Management

Appendix B

SAVANNAH DISTRICT COMMUNICATION TO OTHER DISTRICTS

ATTACHMENT

Q: What is the status of the Savannah Harbor Expansion Project?

A: In the Water Resources Development Act (WRDA) of 1999, Congress authorized the Savannah Harbor Expansion Project based on a feasibility report prepared by the Georgia Ports Authority (GPA) per Section 203 of WRDA 1986. The authorization to deepen the Federal navigation project to 48 feet was conditioned on completing several evaluations that had not been conducted in the Feasibility phase and made available to decision-makers. The Chief of Engineers placed additional conditions on the project, including preparation of a General Re-evaluation Report (GRR). Savannah District is now in the process of conducting the GRR which includes additional hydrodynamic modeling, economic forecasts and modeling as well as the formulation of an environmental mitigation plan.

Q: Why specifically, was additional interest placed on the economic analysis?

In March 2000, environmental groups filed a lawsuit in Federal District Court challenging the Chief of Engineers' decision to approve the feasibility report. The lawsuit alleged that several issues were not addressed in the feasibility report and Tier I EIS. Among these issues was consideration of the project on a regional basis, i.e., determination of the feasibility of the proposed project in comparison with developments at competing ports, the existing and future conditions at competing ports, the cumulative impacts of other proposed deepening projects, the impacts, if any, of the proposed Savannah Harbor Project on its competing ports, the impacts of future expansion at competing ports on Savannah, the amount of projected trade, at both Savannah and competing ports, and the potential for oversupply of deep draft facilities in the South Atlantic region. On March 1, 2001, however, the District Court issued a decision for the Government dismissing the suit. Based on the Government's representations in the case, the court held that the Government assured that the plaintiffs' concerns regarding the Savannah Harbor Expansion Project may be raised during the GRR and Tier II process. The Court stated:

> "Plaintiffs' concerns are not precluded from review in the Tier II process and after the issuance of the final ROD. The Corps, in light of the negative review of the GPA's initial EIS and this lawsuit, are under significant pressure to ensure that all environmental concerns regarding this Project are addressed. Nothing precludes the Corps from evaluating the issues raised by the Plaintiffs in this case and ultimately declining to issue a final ROD stating that the Project should not go forward. *Most importantly, this court is confident that Plaintiffs' concerns, if meritorious, will have the opportunity to be raised and considered.* "(Emphasis added).

Q: Why perform a Regional Port Analysis?

A: The Regional Port Assessment will address alternatives to expanding the Savannah Harbor from a capacity perspective. The assessment is using a systems approach to port capacity that is likely to be applied to other major port deepening studies. The regional assessment will determine the future capacity of existing or prospective new major container load center ports on the South Atlantic Coast as well as potential offshore hub ports. The capacity analysis will reflect existing facilities largely through publicly available information that can only be verified through site visits. The site visits will also be used to address the potential for Greenfield terminal expansions along the coast.

Q: Is this in accordance with Corps' Policy?

A: Yes. Engineer Regulation (ER) 1105-2-100 requires "a systematic determination of alternative routing possibilities, regional port analyses, and intermodal networks". The scope of work for this Regional Port Analysis has been reviewed and approved by economists at the South Atlantic Division, the Institute of Water Resources, Headquarters USACE, and the Corps' Deep-Draft Navigation Planning Center of Expertise.

Q: What other ports have encountered similar issues?

A: The Charleston, South Carolina Daniels Island Marine Container Terminal Study (DIMCT) prepared by the South Carolina Ports Authority (SPA) in support of an application for a Department of the Army permit evoked the following response from the Environmental Protection Agency (EPA):

EPA has warned, in connection with the DIMCT, that "the relationship of how this particular construction will affect other competing facilities along the Atlantic coast which are subsidized by the federal government should be discussed in a multi-port analysis." No such analysis is contained in the DEIS, nor has the Corps or any other agency undertaken such an analysis through the NEPA process.

That document also evoked the following comment from the Southern Environmental Law Center:

The DEIS states that the DIMCT is needed to make SPA's Charleston operations "competitive" in the race to win the business of larger containerships. This essential rationale, however, is also being invoked in support of subsidized deepenings across the nation. For example, the ports of Savannah, Georgia; Jacksonville, Florida; Wilmington, North Carolina; Norfolk, Virginia; Baltimore, Maryland; Wilmington, Delaware and Newark/New York all have undertaken or are planning subsidized channel expansion projects to facilitate deeper draft containerships and bolster their competitive positions.

The resultant "race to the bottom" – with individual ports deepening their channels and expanding facilities to compete with each other for a limited fleet of mega-containerships – will likely end in an oversupply of subsidized deep draft capacity. The missing referee

for this wasteful competition is the Corps of Engineers. As the Corps is aware, the sum of individual local port traffic forecasts is often far greater than could be reasonably expected for the U.S. as a whole. The Corps is also aware that subsidized competition among individual ports encourages over-investment, facility duplication, expensive overcapacity, and unnecessary environmental degradation.

Before any port-related deepening or expansion can occur in the waters of the United States, the U.S. Army Corps of Engineers must issue a permit or a favorable Report and Recommendation for the project. Despite this broad regulatory and policy power, the Corps has not examined through the NEPA process the extent to which various deepening projects in the United States, on the east coast, and within the South Atlantic region could result in port overcapacity. In this case, for instance, the DEIS does not examine the expansion projects planned or ongoing in the South Atlantic or evaluate their comparative merit in accommodating expected deep draft containership traffic. Nor has the Corps of Engineers otherwise undertaken such an assessment through the NEPA process.

Expansion or deepening of the federal shipping channels and containership terminals in multiple major rivers on the eastern seaboard will cause cumulative or synergistic impacts on the nation's environment, including its riverine, estuarine and marine ecosystems. The Savannah, Charleston, Wilmington, Jacksonville and Norfolk deepening projects will impact endangered shortnose sturgeon, destroy rare tidal freshwater marsh or other valuable wetlands, diminish estuarine wildlife values and disrupt coastal sand flows. Terminal operations will present cumulative transportation impacts on coastal cities and their surrounding environments. Each terminal will have marked increases in ship, truck and train traffic, with concomitant impacts on the Nation's air and water quality in major river and estuarine systems.

Neither the DEIS nor the NEPA documentation for these other projects assesses the cumulative or synergistic impacts of multiple containership-related deepening and terminal expansion projects on the natural resources of the nation, the eastern seaboard or the South Atlantic region. Yet NEPA requires that, when proposals for related actions that will have cumulative or synergistic environmental impacts upon a region are pending concurrently before an agency, their environmental consequences must be considered together. Only through a comprehensive consideration of pending proposals can the agency evaluate different courses of action. See 40 C.F.R. §§ 1502.4; 1508.18(b)(3), (4); and 1508.25(a).

The need for a programmatic analysis under NEPA is especially clear where, as here, projects are being justified in terms of one another, presenting the danger of improperly "piggybacking" several related projects by justifying each on the assumption that the others are to be constructed, only to discover later that the overall combination of the projects may do more harm than good. NEPA also requires a comprehensive analysis when the various agency actions, taken together, will have an effect on the environment that might be overlooked if examined separately.

The Corps of Engineers, in conjunction with other federal agencies including the Department of Transportation's Maritime Administration, is permitting, promoting, recommending and subsidizing port expansion projects across the nation and in the South Atlantic region to accommodate new containerships with a draft equal to or greater than 40 feet. The various containership port expansions are related in at least three ways. First, each project claims to be a response to a technological innovation, the advent of a class of containerships with design drafts equal to or in excess of 40 feet. Second, each project is claimed to be necessary to enable individual ports to compete with their rival ports in the race to lure U.S. containership traffic. Third, in the South Atlantic region the projects impact related and connected ecological resources.

A comprehensive analysis would likely reveal that the subsidized expansion of some port facilities is unnecessary, inadvisable or otherwise not in the national interest and thus not deserving of federal funding, support, recommendation or a federal permit. Because NEPA requires the Corps to undertake a comprehensive examination of the nation's containerport expansion projects prior to concluding that such projects are in the public interest, the EIS must include that comprehensive examination before the Corps can complete its duties under NEPA and comply with the Section 404(b)(1) Guidelines on alternatives analysis."

Q: What has the Corps' contractor been asked to do regarding the assessment of environmental effects of future expansions of other ports in the region?

A: The Contractor will be responsible for preparing a spreadsheet listing all the environmental issues which would be evaluated during ***ANY*** (emphasis added) planned port/Federal deep-draft navigation channel expansion. No new data will be collected by the Contractor as part of this effort. Rather the contractor will base his assessment from publicly available information (web sites and existing reports) and discussions with Federal agency employees, including appropriate Corps District planning and regulatory staff. The Contractor may contact the port authorities to confirm the data collected and what is reported via this contract. All data used will be properly referenced and documented as to when and where collected.

The Contractor will display this information in the above mentioned spreadsheet in the following manner:

'+'	Major issue or large impact expected
'0'	Minor issue, small impact expected, or of some concern
' '	Not an issue at the present time

The spreadsheet will also reflect the importance of the issue and the extent of the expected impact. The Contractor's report addressing the environmental analysis will be qualitative in nature and will include enough information that the government can make an assessment of the level of impacts that may be associated with future expansion at any of the ports evaluated as compared with the level of impacts that might be associated with development of a regional port(s).

Appendix C

MEMORANDUM CONCERNING SECONDARY INFORMATION SOUGHT

Memorandum January 6, 2006

TO: Kenneth Classman/Thomas A. Garrett
FROM: Kevin Horn
SUBJECT: Savannah Harbor Expansion Program Regional Port Analysis – kickoff

We have exchanged e-mails about personal kickoff meeting with the Corps Districts covering the ports for the Regional Port Analysis (RPA) (Norfolk, Wilmington, Charleston, Savannah and Jacksonville). The purpose of the kickoff meetings would be to establish the points of contact at the District offices for capacity and related expansion and environmental issue data related to the RPA. It is my understanding that we will rely exclusively on secondary (existing) information related to ports and marine terminals existing and projected capacity, other expansions, and environmental issues related to capacity expansions at South Atlantic ports/marine terminals. The focus of the RPA will be on marine container capacity and environmental issues related to increased volume and expansions to meet future demand. We will not be concerned with other cargo terminals other than they may be used in whole or part for marine containers.

Capacity of marine terminals in general and container terminals in particular is a somewhat nebulous concept. Any data that exists that pertains to capacity (cargo volume throughput) of the terminal or its constituent components (access gates, yard storage and cargo handling, and berths (lengths) etc. would be useful. We have collected descriptive data for the existing marine terminals from the respective port web sites and Port Series and such as yard size, berths, etc. and would seek to have this data checked by what current data that the districts may have (other than the Port Series which we already have used).

Here is the "capacity" (marine container terminal) information we would seek to check or collect from local Districts:

1. Container "capacity" throughput of existing facilities for an annual basis in TEUs
   1.1 Container yard size (acres), container stacking heights.
   1.2 Container berths and lengths
2. Currently planned "capacity" enhancements at existing and new sites/marine terminals
3. Future potential "capacity" at existing and new (Greenfield) sites/marine terminals from full build out.
4. Railroad intermodal access to existing, planned or potential marine terminals
   4.1 Rail on terminal
   4.2 Rail adjacent to terminal (but controlled access via local or private roads)
   4.3 Rail outside of terminal (access via public roads)

For the environmental issues related to capacity expansions we would seek baseline information from existing conditions from documents such as:

- Port Master Plans

- NEPA documents for any port expansion/deepening projects (most common documents for ports are Dredged Material Management Plans [DMMPs] and Environmental Assessments [EAs] or Environmental Impact Statements [EISs] done in conjunction with DMMPs)

- Biological Surveys (onshore or offshore) in the vicinity of the ports and/or proposed expansion areas

- Hazardous, Toxic, or Radioactive Waste (HTRW) Investigations in the vicinity of the ports and/or proposed expansion areas

- Wetlands Surveys in the vicinity of the ports and/or proposed expansion areas

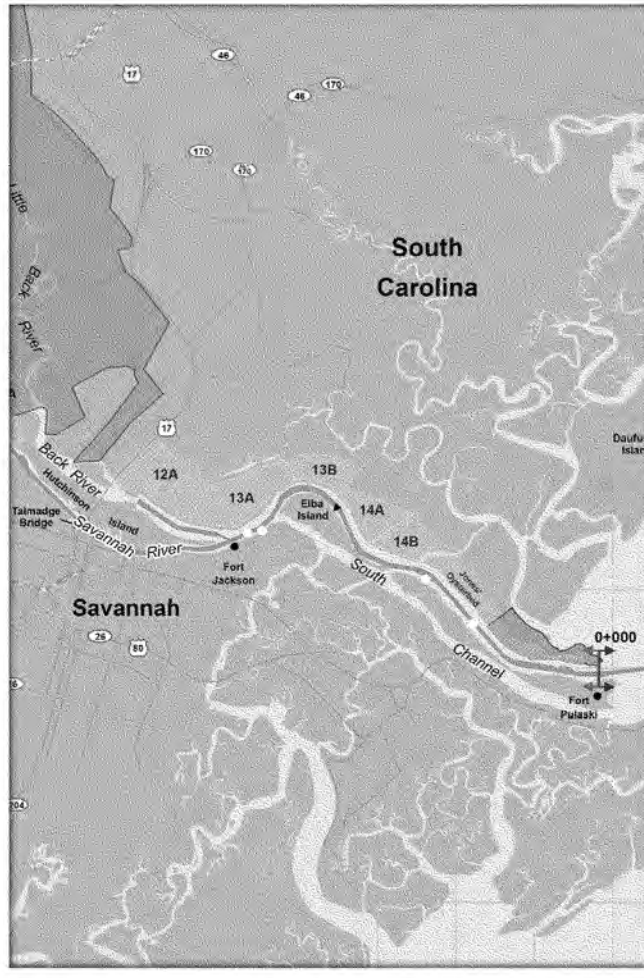
- Sediment Sampling Reports in the vicinity of the ports and/or proposed expansion areas

- Cultural Resource Surveys (onshore or offshore) in the vicinity of the ports and/or proposed expansion areas

We need to meet with the District persons familiar with port/marine terminal conditions and environmental conditions. Naturally, the capacity will be our first priority then the baseline environmental conditions.

GENERAL RE-EVALUATION REPORT
APPENDIX B: REAL ESTATE
SAVANNAH HARBOR EXPANSION PROJECT
Chatham County, Georgia and Jasper County, South Carolina

January 2012
(Revised July 2012)



US Army Corps
of Engineers
Savannah District
South Atlantic Division

REAL ESTATE PLAN
for
SAVANNAH HARBOR EXPANSION
GENERAL REEVALUATION REPORT

TABLE OF CONTENTS

SUBJECT	PAGE
1. The Real Estate Report	3
2. Authority & Purpose	3
3. Project Description	4
4. Real Estate Acquisition	5
5. Public Utility\Facility Relocation	33
6. Existing Projects	33
7. Environmental Impacts	33
8. Non-Federal Sponsor Responsibilities and Capabilities	33
9. Government Owned Property	34
10. Historical Significance	35
11. Mineral Rights	35
12. Public Law 91-646, Relocation Assistance Benefits	35
13. Attitude of Property Owners	35
14. Acquisition Schedule	35
15. Estate for Proposed Project	36
16. Induced Flooding	37
17. Zoning	37
18. Real Estate Estimate	37
19. Chart of Accounts	39

Exhibit A - Authorization for Entry for Construction
Exhibit B - Assessment of Non-Federal Sponsors Capabilities
Exhibit C - Formal Risk Notification Letter
Exhibit D - Non-Standard Estate Approval Memorandum

REAL ESTATE PLAN
FOR
GENERAL REEVALUATION REPORT
SAVANNAH HARBOR EXPANSION
SAVANNAH, GEORGIA

1. THE REAL ESTATE REPORT

This report is tentative in nature and is to be used for planning purposes only. Although the report is written based on specific data from Savannah District, modifications to the plan may occur thus changing the final acquisition areas and/or administrative and land cost. The main report addresses five options for deepening the harbor from its existing depth of 42' to depths of 44', 45', 46', 48' and the Selected National Economic Development (NED) plan of deepening to 47'. The purpose of the Real Estate Report is to detail the real estate components of the recommended plan for navigation improvements at Savannah Harbor and the associated environmental mitigation.

The following standard and non-standard estates will be acquired for this project and will be discussed in detail later in this report.

a. Fee Simple for mitigation lands and City of Savannah impoundment site
b. Non-Standard Channel Improvement\Sloughing Easement for channel wideners
c. Special Use Permit from the Department of Interior – US Fish & Wildlife Service (USFWS) for all lands needed for flow modifications within the boundary of the Savannah National Wildlife Refuge
d. A land exchange with the Department of Interior, United States Fish and Wildlife Service for lands lost due to harbor widening
e. Perpetual Road Easements for access to the proposed fish bypass channel and for the proposed Dissolved Oxygen Injection Site two.
f. Perpetual Pipeline Easement associated with the City of Savannah Impoundment Site

2. AUTHORITY AND PURPOSE

The Georgia Ports Authority (GPA) conducted a feasibility study of potential navigation improvements at Savannah Harbor, Georgia under the authority granted by Section 203 of Water Resources Development Act (WRDA) of 1986 (P.L. 99-662). The US Army Corps of Engineers (the Corps) adopted these documents prepared by the GPA and published a Draft Tier I EIS in May 1998 and the Final Tier I EIS in September 1998. In the Water Resources Development Act of 1999 (Section 101(b)(9)), the US Congress conditionally authorized deepening the Savannah Harbor navigation channel to a maximum depth of -48 feet Mean Low Water (MLW). The conditional authorization stipulated that approval of additional studies and the project is required from the Administrator of the Environmental Protection Agency, the Secretary of Commerce, the Secretary of Interior, and the Secretary of the Army.

The Corps completed the Tier I EIS process when it signed a Record of Decision (ROD) in December 1999. The ROD included additional requirements, including additional review by the Corps of Engineers and approval of the Chief of Engineers to ensure that construction of the project would comply with all applicable laws and policies.

The Savannah District of the Corps in conjunction with the USACE Deep-Draft Navigation Center of Expertise has developed this General Reevaluation Report (GRR) to fulfill the conditions of the conditional authorization granted in 1999 and to conduct investigations required by the National Environmental Policy Act of 1969 (NEPA). This GRR and EIS provide documentation of the technical and plan formulation analyses conducted in the development of a recommended plan for navigation improvement at Savannah Harbor and associated environmental mitigation. The GRR and EIS assess mitigation plans for alternative channel depths. The EIS includes a final mitigation plan and an incremental analysis of alternative channel depths from -42 to -48 feet, as required by the conditional authorization. This study identifies and selects the National Economic Development (NED) plan, the plan that has the greatest net economic benefits consistent with protection of the Nation's environment.

The Georgia Department of Transportation is the non-Federal Sponsor (NFS) for this project. All dredge material disposal areas and staging areas necessary for this project are currently vested in the NFS. These lands were provided for previous federal projects and credit for these lands will not be afforded.

3. PROJECT DESCRIPTION

Savannah Harbor is a Federal navigation project located along the Savannah River. The harbor comprises the lower 21.3 miles of the Savannah River (which, with certain of its tributaries, forms the boundary between Georgia and South Carolina along its entire length of 313 miles) and 11.4 miles of channel across the bar to the Atlantic Ocean. The Port of Savannah is owned by the State of Georgia, operated by the Georgia Ports Authority and is the fourth busiest and fastest growing container terminal in the United States. A vicinity map is at Figure 3-1.

Figure 3-1 Vicinity Map

4. REAL ESTATE ACQUISITION

The requirements for lands, easements, rights-of-way and relocations and disposal areas (LERRD) include the rights to construct, operate, and maintain channel improvement works in connection with the operation and maintenance of the Savannah Harbor. The real estate requirements for this project can be broken down into the following five acquisition categories. Table 4 shows a break down by interest to be acquired, acreage and the estimated land cost excluding administrative and contingencies.

Table 4
Land Cost by Estate & Acreage

Estate	Acreage	Estimated Cost
Fee	2314	$ 14,275,500
Easement	15	$ 138,000
Use Permit	48	$ -
TOTAL	**2377**	**$ 14,413,500**

Category one will consist of acquiring approximately seven acres of land necessary for the deepening phase of the project. This phase requires channel wideners that will be acquired using the non-standard channel improvement\sloughing easement at the locations identified on Table 4-1 and shown on figures 4.1-1 thru 4.1-3. Approval of this non standard estate was recommended in order to stay consistent with existing easements previously acquired throughout the harbor. Approval of this non-standard estate is addressed in Section 15 of this report. Of the seven acres needed for the deepening phase, approximately six acres of uplands and approximately seven (7.2) acres of wetlands identified on figure 4.1-1and 4.1-2 are managed by the USFWS. The loss of these lands will be offset through a land exchange with the USFWS. The estimated land cost for this category excluding contingencies and administrative cost is $70,500. The

actual land cost of the exchange will be based on an approved real estate appraisal meeting Federal Appraisal Standards conducted at the time of the transfer.

Category two will require the execution of a Special Use Permit between the NFS and the USFWS covering approximately forty-eight (48) acres of land required for the construction of mitigation features proposed within the boundaries of the Savannah National Wildlife Refuge. As part of these mitigation features proposed, the Tide Gate located on Back River constructed as part of the 1977 Savannah Harbor Project will be removed and a public boat ramp will be constructed in this location. Approximately twenty (20) acres in fee will be required for this feature at an estimated land cost of $1,885,000 excluding contingencies and administrative cost.

Category three will consist of acquiring approximately 2,245 acres of land necessary for mitigation purposes to offset losses to wetlands. These mitigation lands will be acquired in fee simple by the NFS and deeded to the USFWS to become part of the Savannah National Wildlife Refuge. The estimated land cost for the 2,245 acres is $10,102,500 excluding contingencies and administrative cost. Two additional properties consisting of approximately 10.5 acres in fee simple and approximately two acres in a perpetual road easement will be acquired by the NFS for the construction of Dissolved Oxygen Injection Systems. The Dissolved Oxygen facilities will be constructed and maintained by the United States of America, Savannah District, Corps of Engineers. The estimated land cost for these sites is approximately $397,500 excluding contingencies and administrative cost.

Category four will consist of the construction of an above ground raw water impoundment on approximately thirty-five (35) acres of NFS owned lands and the acquisition of a Perpetual Pipeline Easement from CSX Railroad Corporation for two pipeline crossings located adjacent to the impoundment. The estimated real estate cost for this feature is $1,926,000. Office of Counsel has determined based on the Chief's Report that this would be considered a chloride mitigation feature and not a utility relocation.

Category five will consist of acquiring approximately seven acres of land in fee for the proposed Fish Bypass Channel located at the New Savannah Bluff Lock & Dam at an estimated real estate cost of $24,500 excluding contingencies and administrative cost. A perpetual road easement over approximately six acres will also be required for access to the proposed fish bypass channel at an estimated real estate cost of $7,500 excluding contingencies and administrative cost.

A more detailed description of all project features and measures follows. All dredge material disposal areas and necessary staging areas are currently vested in the NFS and maintained by the Corps of Engineers as part of the existing Savannah Harbor Project. No real estate credit will be given for these disposal areas previously provided. The following is a description of lands required for each feature of the project.

4.1 CHANNEL WIDENERS

Three areas consisting of 6.6 acres above the ordinary mean high water mark along the harbor will be impacted by dredging. The mean high water mark was established by survey over a nineteen year (Jan 1983- Dec 2001) National Tidal Datum Epoch. These three areas are identified on Table 4-1 and Figures 4.1-1 and 4.1-2 and will be acquired using the non-standard Channel Improvement\Sloughing Easement. The uplands on the north side of Kings Island Turning Basin, station 97+000 and at station 102+000 are vested in the United States of America (USA) and managed by the USFWS and comprise a combined six acres of uplands. The loss of these uplands will be offset through a land exchange with the USFWS. The uplands on the north side of station 88+500 are vested in the Chatham County Economic Development Authority and consist of 0.60 of an acre above the ordinary mean high water mark. Approximately 7.2 acres of wetlands will be lost as a result of these wideners and turning basin thus requiring mitigation.

The navigational servitude is the dominant right of the Government under the Commerce Clause of the U.S. Constitution (U.S. CONST. Art.I, §8,cl.3) to use, control and regulate the navigable waters of the United States and the submerged lands thereunder for various commerce-related purposes including navigation and flood control. In tidal areas, the servitude extends to all lands below the ordinary mean high water mark. In non-tidal areas, the servitude extends to all lands within the bed and banks of a navigable stream that lie below the ordinary high water mark. It is a power, not a property right, and the owner of the underlying land is not entitled to compensation, as the ownership interest was always subject to this right.

The practical result is that no interest in real estate is required for the United States to implement a project purpose or measure related to navigation in areas subject to the navigation servitude. Here, the measures proposed for implementation within the servitude are related to navigation and include the navigation features and those measures to address the impacts of the navigation project.

The City of Savannah's municipal and industrial water supply intake is located within the navigational servitude but the proposed raw water impoundment designed to address impacts from increased chlorides is being treated as a mitigation feature authorized by the Chief's Report. See Section 4.4.

Some of the lands that are subject to the servitude are owned by the United States of America and managed by the U S Fish and Wildlife Service. The Corps of Engineers will not assert the navigational servitude against a sister agency. Rather, the land (approx. 7.2 ac. wetlands) that would otherwise be subject to the servitude will be included in the lands acquired through a land exchange from the other Federal Agency.

Historical maps have been reviewed and no lands proposed for acquisition appear to fall within lands filled during previous projects or by other mechanical means. A more detailed search of the historical records will be accomplished during the preliminary acquisition phase. After this more detailed search, any adjustments to acreage required for the project will be identified and adjustments made accordingly.

Table 4-1
LANDS REQUIRED FOR CHANNEL WIDENERS

FIGURE #	STATION LOCATION	OWNER	ACREAGE ABOVE MHW 46', 47' & 48' Depth
Figure 4.1-1	Kings Island Turning Basin	USFWS	4.4
Figure 4-1-1	102+000	USFWS	1.1
Figure 4-1-2	97+000	USFWS	0.5
Figure 4-1-3	87+500	Chatham County Economic Development Authority	0.6
		TOTAL	**6.6**

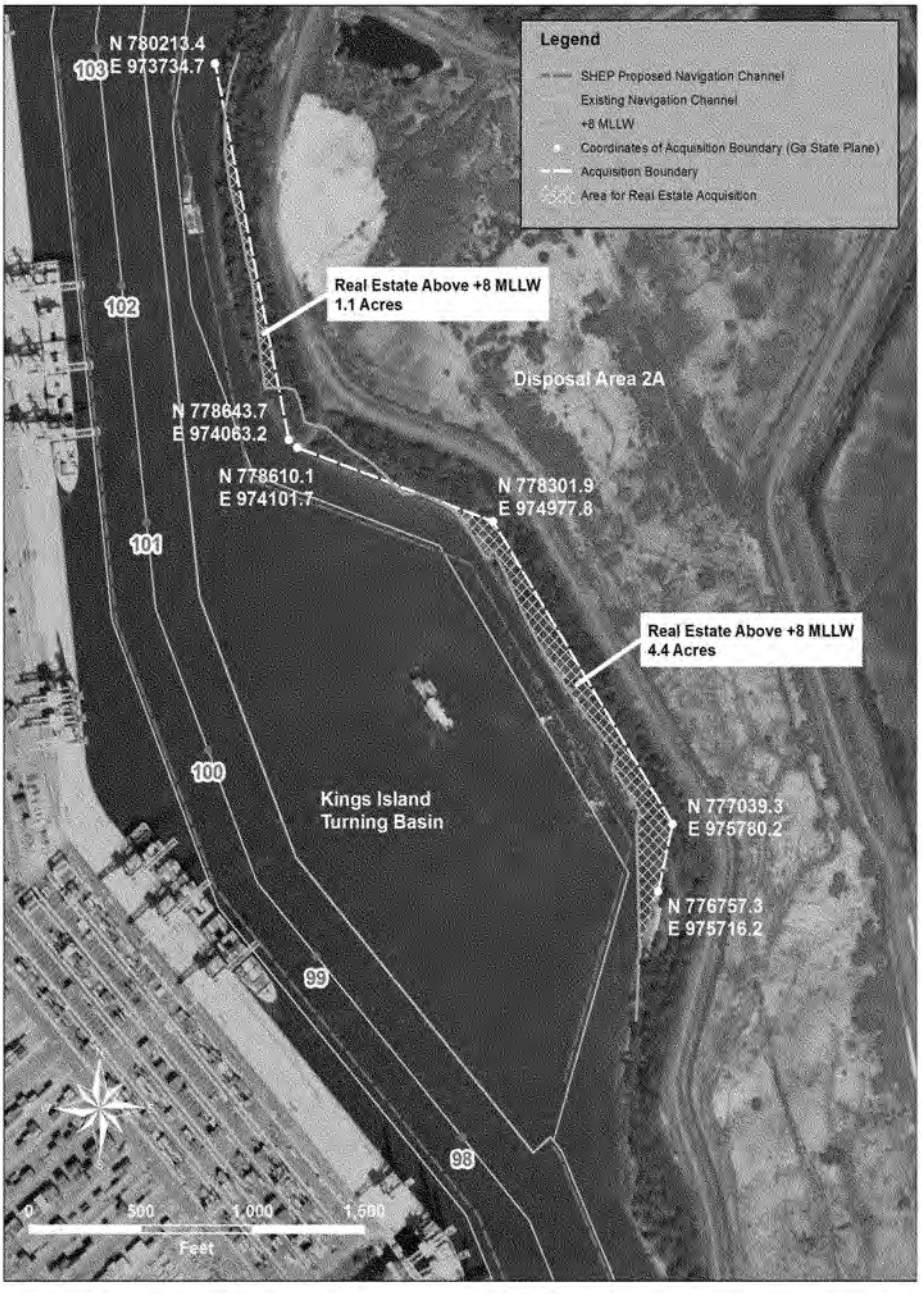


Figure 4.1-1 KINGS ISLAND TURNING BASIN and STATION 102+000

Figure 4.1-2 STATION 97+000

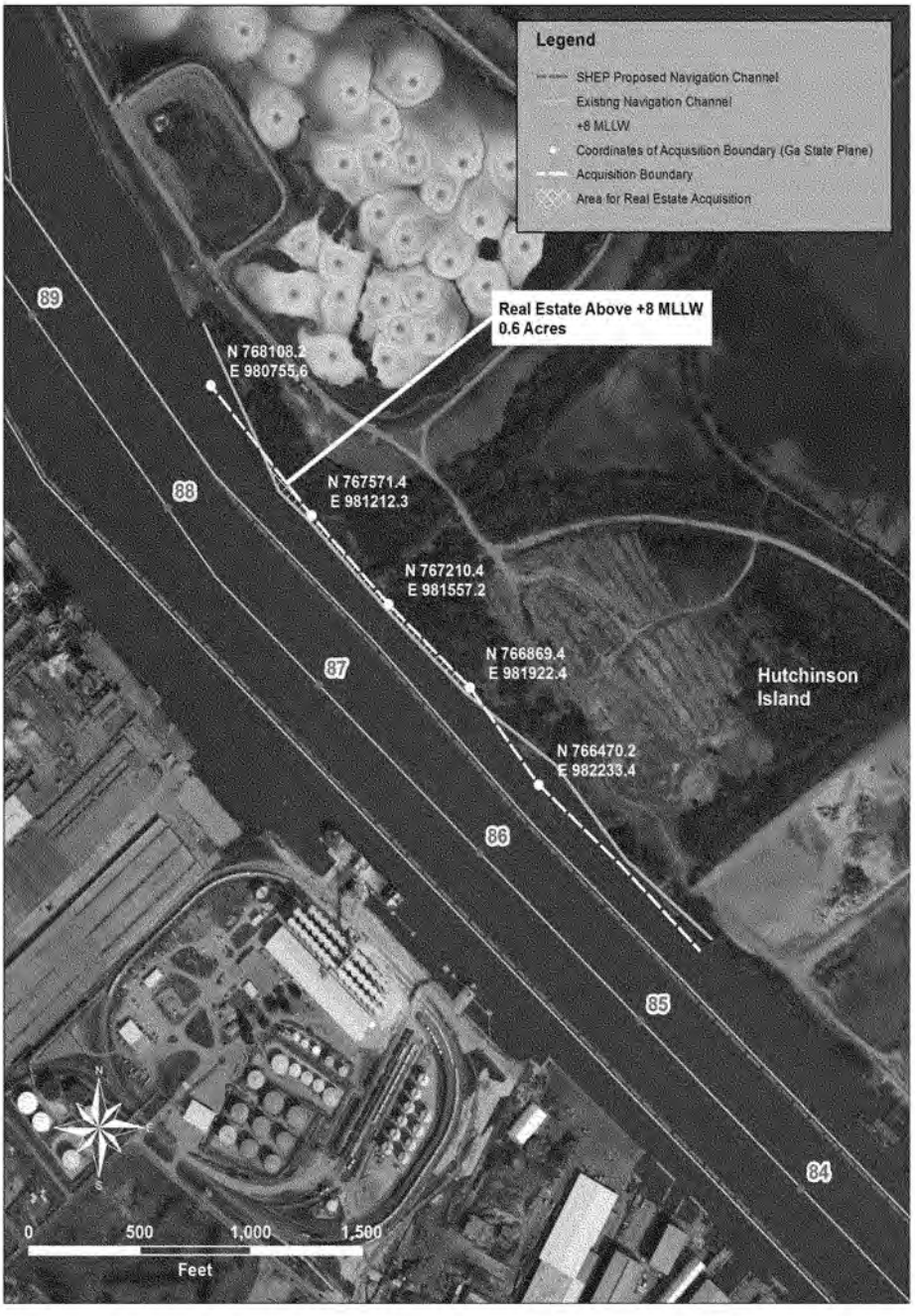


Figure 4.1-3 STATION 87+500

4.2 MITIGATION FEATURES CONSTRUCTED WITHIN REFUGE:

Mitigation Plan 6A, the recommended plan, identifies the need of approximately forty-eight (48) acres of land above the ordinary mean high water mark in various locations throughout the Savannah National Wildlife Refuge (Refuge) and approximately eighteen (18) acres of land located at the tide gate structure on Back River in order to construct water diversion features. The NFS will enter into a Special Use Permit with the USFWS for the forty-eight acres of land located within the Refuge. Table 4.2-1 (taken from Mitigation Plan) is a description of the features to be constructed within the Refuge. Figures 4.2-1 and 4.2-2 show the general location of each feature.

Table 4.2-1
Mitigation Plan 6A - Land Requirements

CHANNEL DEPTH	FLOW-ALTERING PLAN	FEATURES	ACREAGE ABOVE MHW
44'	PLAN 6B	Diversion Structure at McCoys Cut	1 Ac.
		Close western arm at McCoys Cut	1 Ac.
		Close Rifle Cut	1 Ac.
		Fill Sediment Basin	0 Ac.
		Remove Tidegate	18 Ac.
		Disposal Area 1S	45 Ac
45', 46', 47 and 48'	PLAN 6A	All of Plan 6B plus Deepen at McCoys Cut	0 Ac.
		Total for Plans 6 A&B	**66 Ac.**

McCoys Cut: The diversion at McCoys Cut would consist of two structures, one on each side of the river. A rock diversion structure would extend about 465' from the Georgia side of the river and a sheetpile diversion wall would extend roughly 150' out from the South Carolina shoreline. Working together, they would divert water flow down through McCoys Cut into the Back and Middle Rivers. Most of the construction would take place from barges to minimize impacts to adjacent lands. The western arm at McCoys Cut shown would be closed by constructing a plug at one end. Approximately two acres of land above the ordinary mean highwater line will be needed for these two features and is vested to the USA and managed by the USFWS.

Closure of Rifle Cut: The closing of Rifle Cut involves constructing a plug at Middle River. Approximately one acre (0.5 of an ac. on either side) of land above the ordinary mean high water mark will be needed for this feature and is vested to the USA and managed by the USFWS.

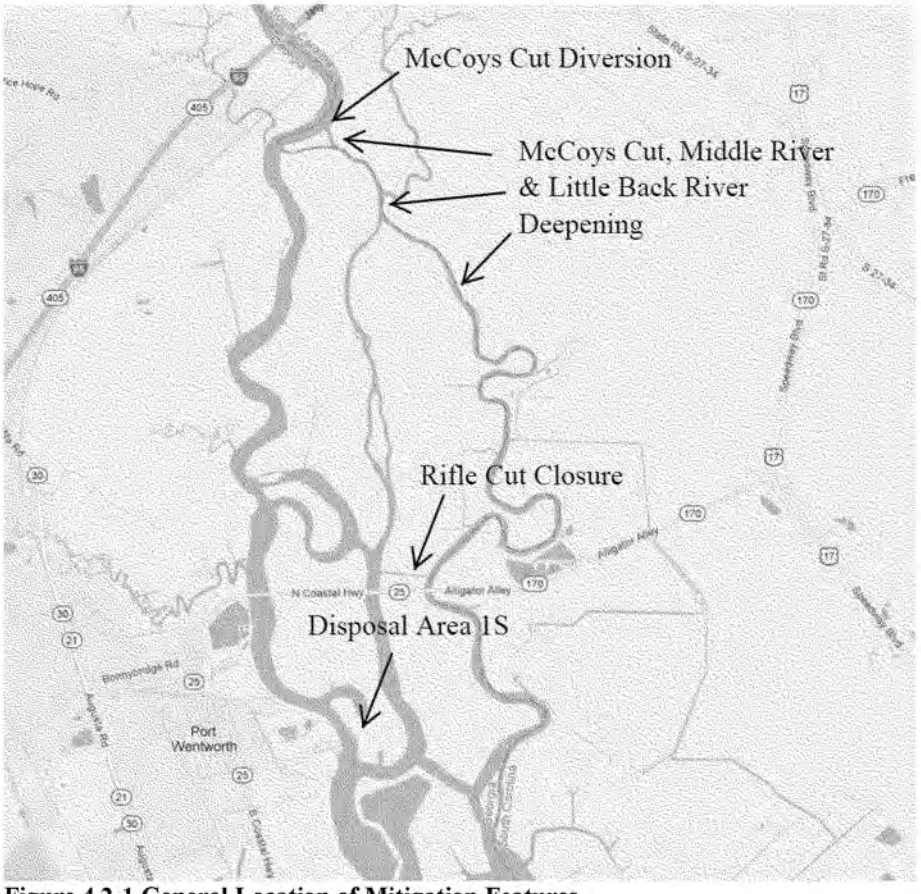


Figure 4.2-1 General Location of Mitigation Features

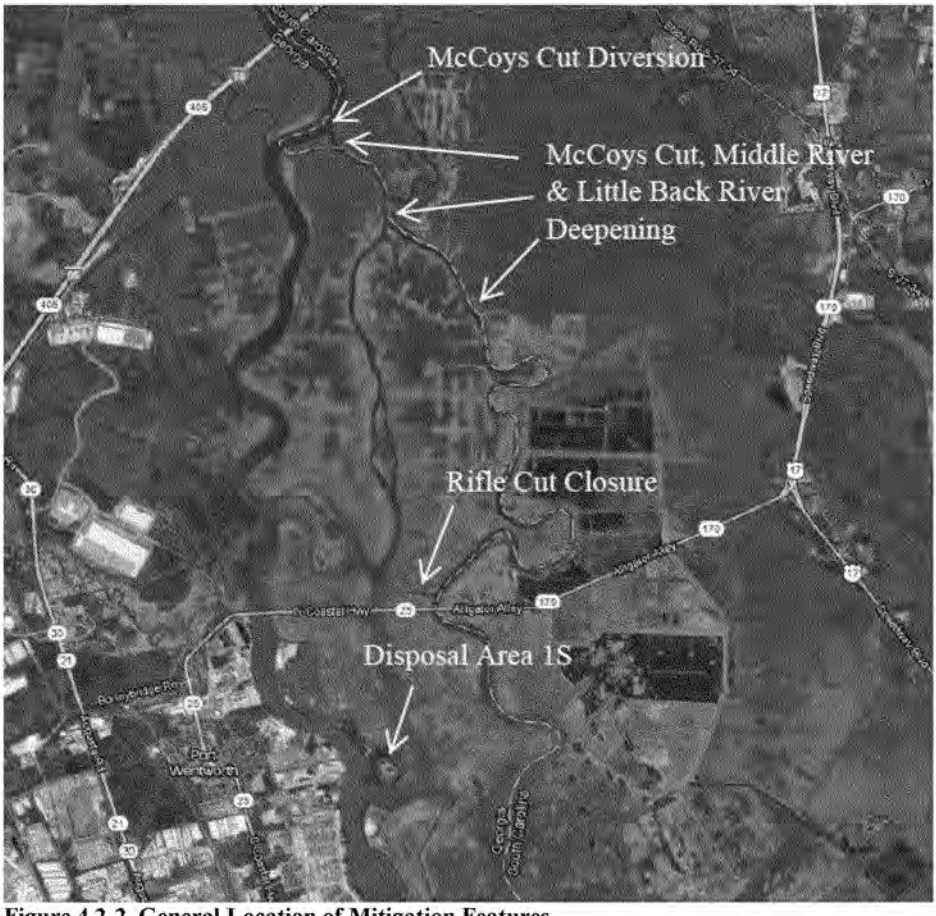


Figure 4.2-2 General Location of Mitigation Features

Fill Sediment Basin: There are no real estate requirements for this feature.

Remove Tide Gate: The Tide Gate and its abutments shown on Figure 4.2-3 through 4.2-5, are located on seventeen (17) acres of lands vested to the USA and managed by the US Army Corps of Engineers, Savannah District on Back River. The Tide Gate constructed in 1977 as part of the Savannah Harbor project would be removed so that tidal flows are no longer restricted in Back River. Approximately two acres of NFS owned lands would be excavated from the north abutment. Approximately eighteen (18) acres of which eight acres are vested to the United States of America, five acres is vested to Chatham County and, five acres of privately owned lands would be removed from the south abutment to expand the width of the river past the site.

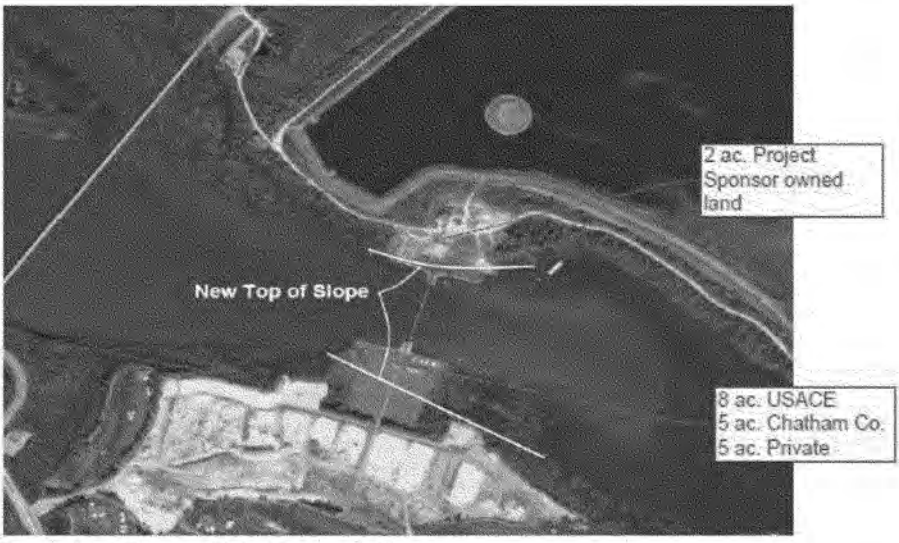


Figure 4.2-3 Remove Tide Gate and Abutments

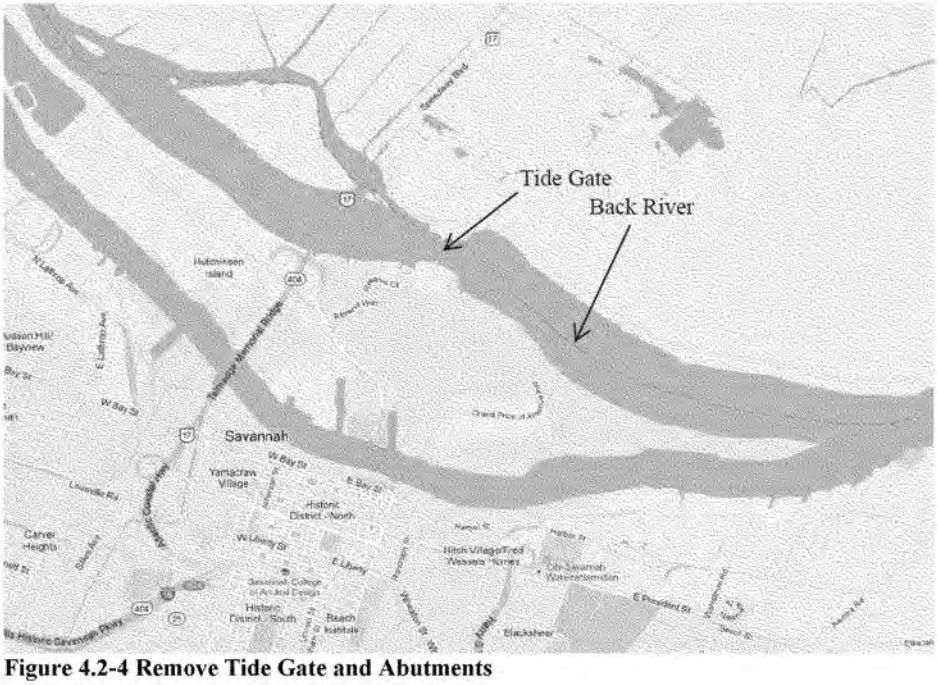


Figure 4.2-4 Remove Tide Gate and Abutments

Figure 4.2-5 Remove Tide Gate and Abutments

Disposal Area 1S: Disposal Area 1S, also known as Onslow Island shown on Figure 4.2-6 has been under a perpetual use permit from the U. S. Fish and Wildlife Service to the Corps of Engineers since June 1973. The Corps ceased using this area sometime in the early 1990's. The current proposal is to excavate approximately forty-five (45) acres of high ground down to the adjoining marsh elevation and allow the area to naturally re-vegetate itself with salt marsh. Upon completion of the restoration, the existing permit will be terminated. There are no operation and maintenance cost associated with this feature.

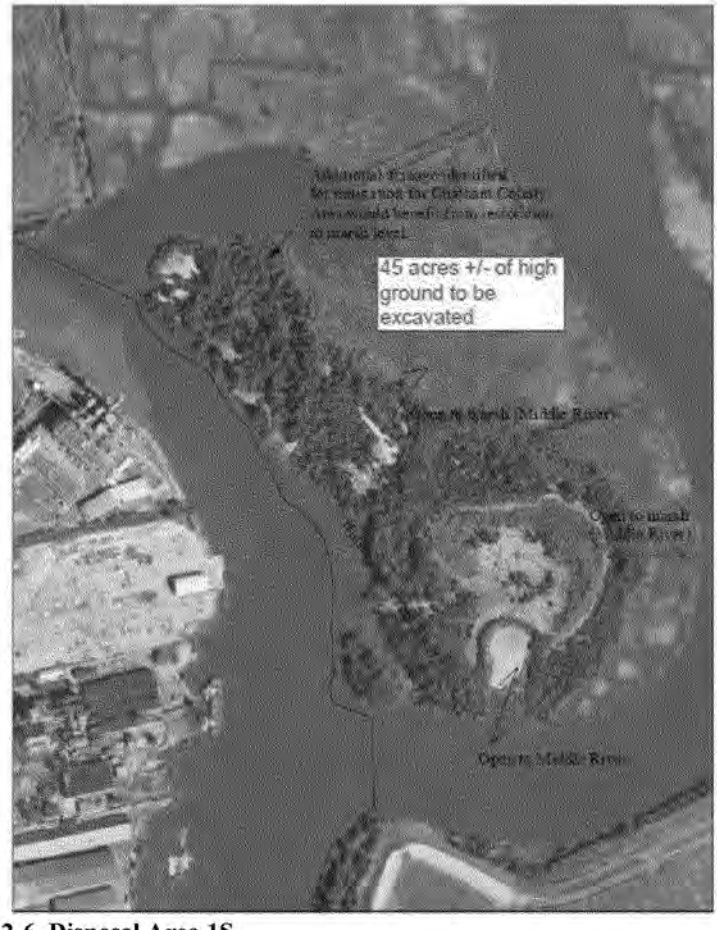


Figure 4.2-6 Disposal Area 1S

McCoys Cut, Middle and Little Back River Deepening: McCoys Cut and down both Little Back and Middle Rivers would be deepened to allow more freshwater to flow into Little Back and Middle Rivers. The 5,250 foot long section through McCoys Cut would be deepened to a depth of -13.1', while excavation would extend 5,565' down both Little

Back and Middle Rivers, and occur to a depth of -9.8'. There are no real estate requirements for this feature.

The above flow-altering features would be constructed within the Savannah National Wildlife Refuge. All work will be covered under a Special Use Permit between the NFS and the USFWS. The administrative cost for these permits and any additional lands payments required by the USFWS will be credited toward the project. These estimated costs are included in the real estate estimate. Acquisition of privately owned lands required for the removal of the Tide Gate and Abutments will be the responsibility of the NFS. For a more detailed description of these features, please see Section 8 of the Engineering Appendix.

4.2.1 Proposed Hutchinson Island Boat Ramp

Due to the proposed closure of Rifle Cut, recreational boater access routes will be interrupted. For recreational boaters using the public boat ramp at Houlihan Bridge on Front River, the route to move from this ramp to Back River will lengthen substantially as shown in red on Figure 4.2.1-1. To mitigate for this additional impact, a public boat ramp on Hutchinson Island is proposed. This public ramp would provide additional access to the Back River for recreational boaters.

The proposed boat ramp is located on lands vested to the United States of America at the tide gate on the north side of Hutchinson Island, adjacent to Back River. The proposed two lane concrete boat ramp shown on Figure 4.2.1-2 will include the following: floating dock, twenty (20) space trailer parking, handicap accessible parking, and parking spaces for twelve (12) single cars. After construction of the public ramp is complete, the remaining twelve (12) acres of land vested to the USA and managed by the US Army Corps of Engineers, Savannah District will be conveyed by quit claim deed to Chatham County and the ramp will be its responsibility to operate and maintain. Public Law 107-320 authorized the disposal of the tide gate lands to Chatham County, however this disposal action was never funded. Savannah District representatives have met with Chatham County and the County has agreed to the proposed boat ramp and disposal of remaining lands as described. The estimated administrative cost for this disposal action is $10,000 and is included in the real estate estimate.

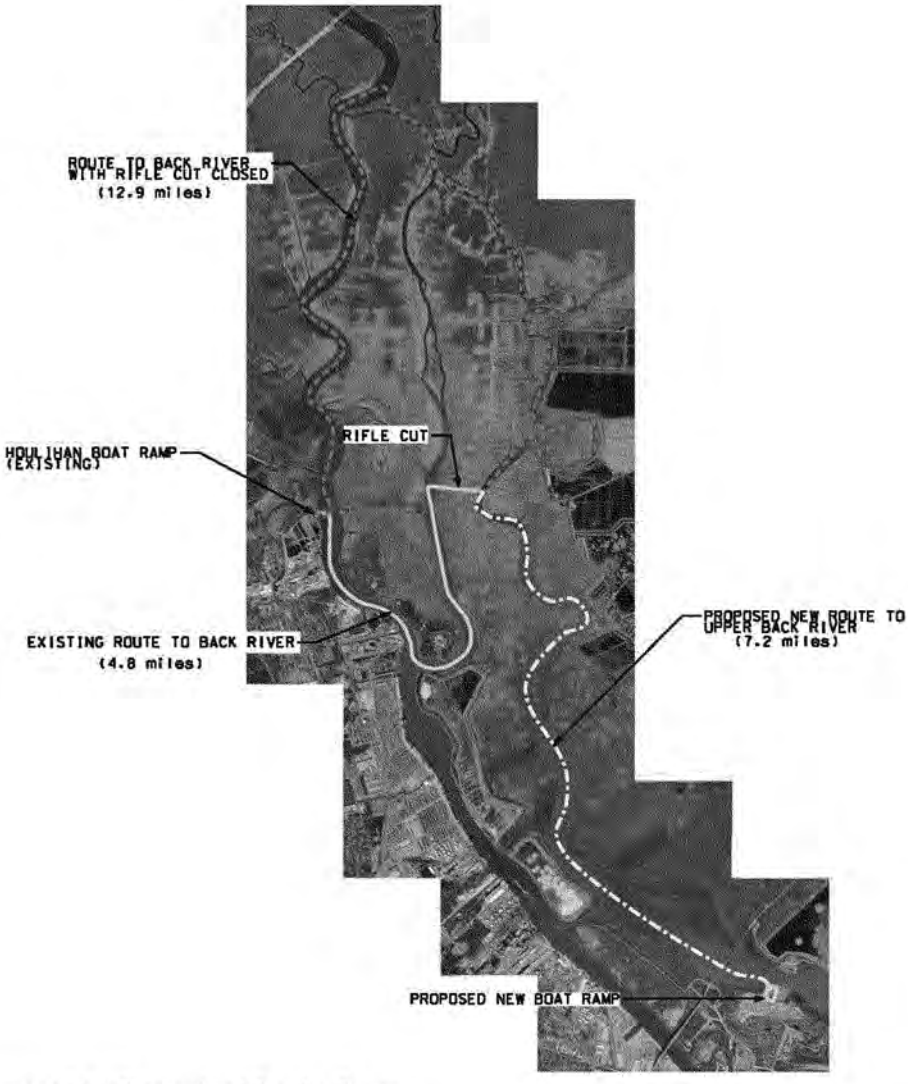


Figure 4.2.1-1 Recreational Boating Routes

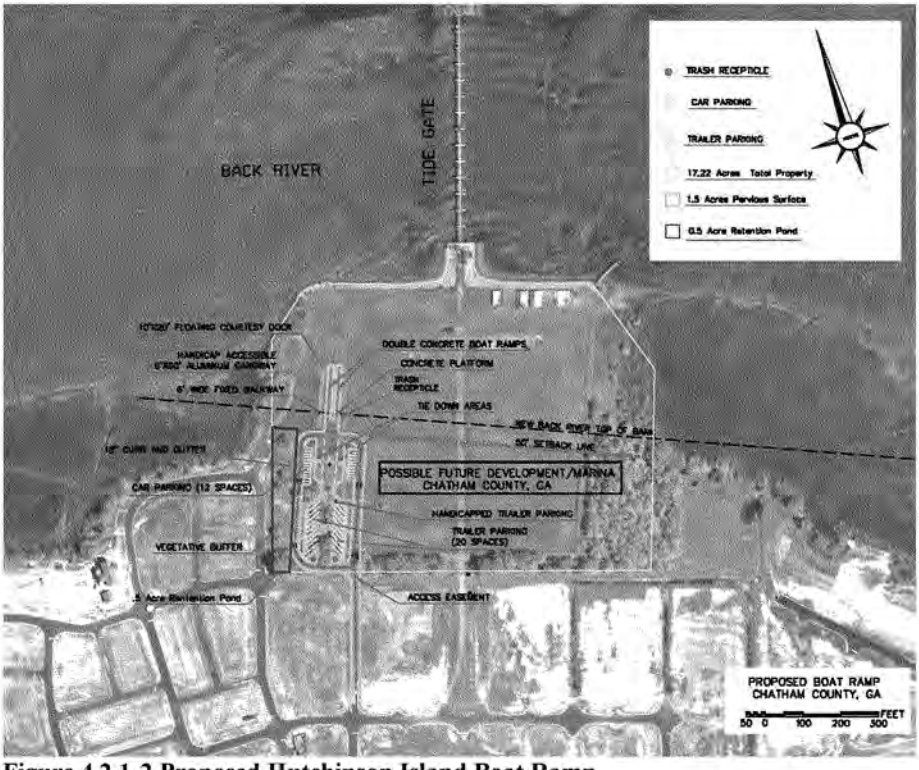


Figure 4.2.1-2 Proposed Hutchinson Island Boat Ramp

4.3 ACQUISITION OF WETLAND MITIGATION LANDS

After implementing the flow-altering features described above, some impacts to wetlands above and below the Ordinary Mean High Water Line would still remain. The Corps used the Savannah District Regulatory Standard Operating Procedures (SOP) to quantify impacts from this Savannah Harbor Expansion Project. That SOP had been developed by natural resources agencies in Georgia to evaluate impacts and mitigation on Regulatory projects requiring Section 404 permits.

Using the SOP, the Corps calculated the following preservation requirements as shown at Table 4.3-1.

TABLE 4.3-1
PROPOSED ACQUISITION OF WETLAND MITIGATION LANDS

CHANNEL DEPTH ALTERNATIVE	NET IMPACTS TO FRESHWATER WETLANDS (ACRES)	REQUIRED ACQUISITION ACREAGE
44-FOOT	-322	0
45-FOOT	32	1,643
46-FOOT	201	2,188
47-FOOT	**232**	**2,245**
48-FOOT	337	2,683

These requirements address remaining impacts to brackish and freshwater marshes, excavation of high ground and wetlands within the Savannah National Wildlife Refuge to enlarge the Kings Island Turning Basin, and an amount to compensate for uncertainty in the analysis procedure.

The USFWS and the Savannah National Wildlife Refuge have identified properties within the estuary that they believe are ecologically valuable and provide positive contributions to the goals of the Refuge and enhance the area's fish and wildlife resources. The latest version of the Refuge's Acquisition Plan and is included in the document titled "Final Environmental Assessment and Land Protection Plan; Proposed Expansion of Savannah National Wildlife Refuge." The NFS will acquire specific tracts of land identified in the Refuge's Acquisition Plan and provide them to the USFWS to manage as additions to the Savannah National Wildlife Refuge, to mitigate for the remaining wetland impacts from this project. The USFWS previously identified the ecological value of those properties and believes they would be valuable additions to, and advance the goals of, the Savannah Refuge. The USFWS has the authority to accept these lands, since the lands are already included in their approved Acquisition Plan. The location of these tracts is shown in Figures 4.3-1 through 4.3-3. It is anticipated that approximately 2,245 acres will be acquired in fee at an estimated land cost of $10,102,500 excluding contingencies and administrative cost. Upon project approval, Savannah District Planning and Real Estate Divisions along with the NFS will coordinate with USFWS to identify the parcels to be acquired.

Figure 4.3-1 USFWS Acquisition Plan (Chatham County, Georgia)

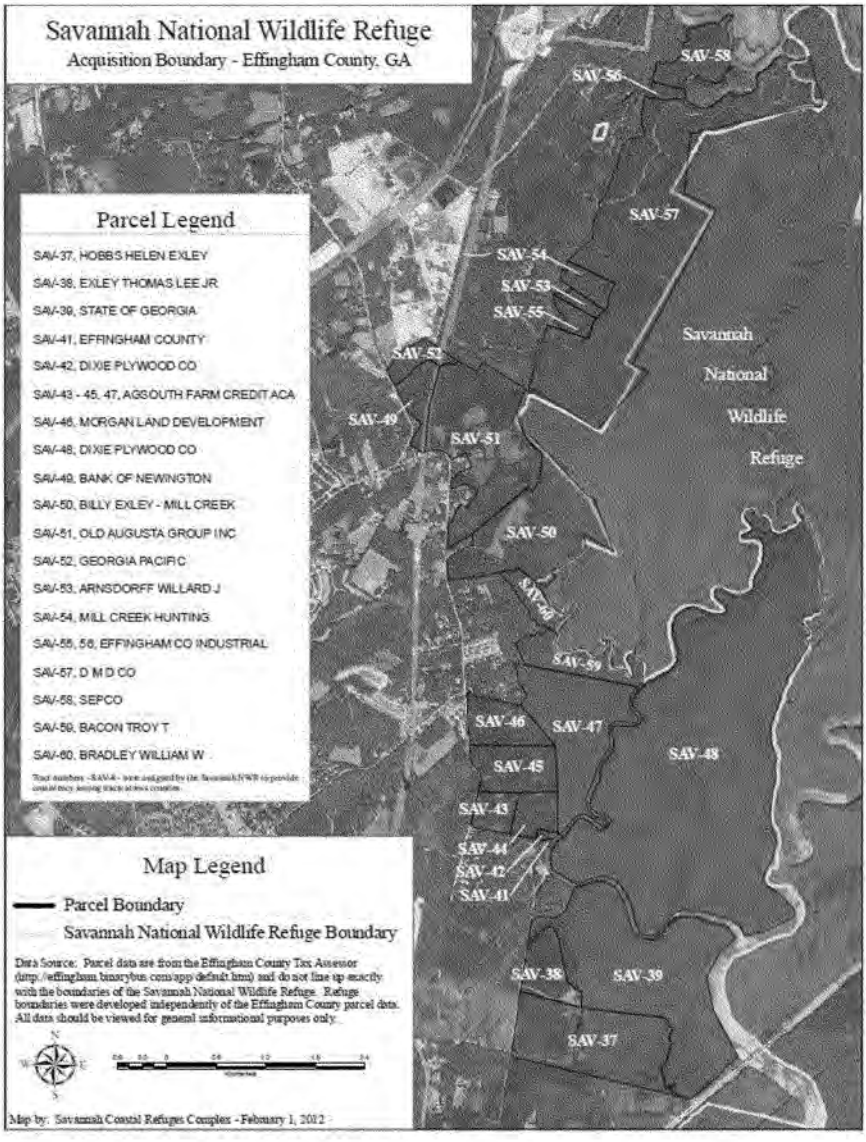


Figure 4.3-2 USFWS Acquisition Plan (Effingham County, Georgia)

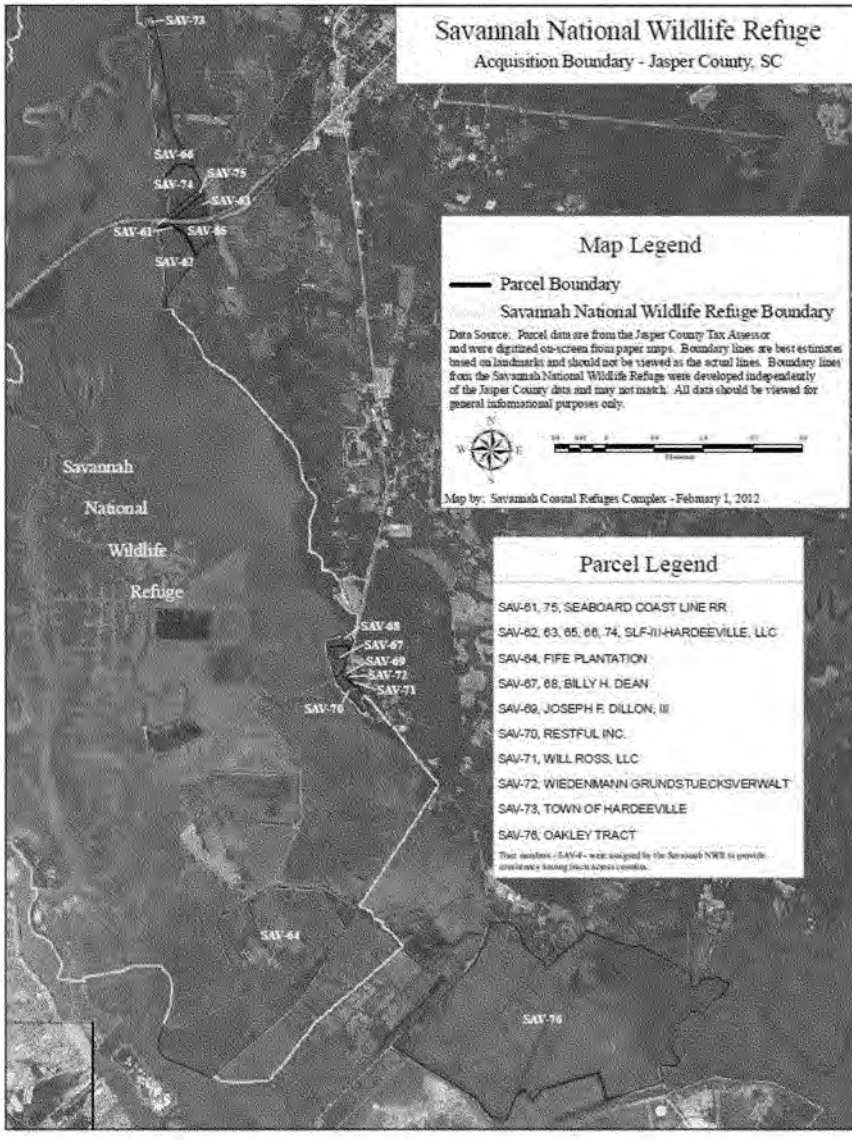


Figure 4.3-3 USFWS Acquisition Plan (Jasper County, South Carolina)

4.4 CHLORIDE MITIGATION FOR CITY OF SAVANNAH WATER INTAKE

The City of Savannah operates a municipal and industrial water supply intake located on Abercorn Creek (Figure 4.4-1). The facility is approximately eleven (11) river miles upstream of the proposed Savannah Harbor Expansion Project's deepening upstream limits and approximately thirty-one (31) miles from the Atlantic Ocean. Water supply from this source is utilized primarily by industrial users for specific plant processes; however, it also supplies residences in west Savannah, Pooler and south Effingham County. The water intake structure is located within the navigational servitude. However, Office of Counsel has determined that mitigation for chlorides is a mitigation feature authorized by the Chief's Report and not a utility/facility relocation.

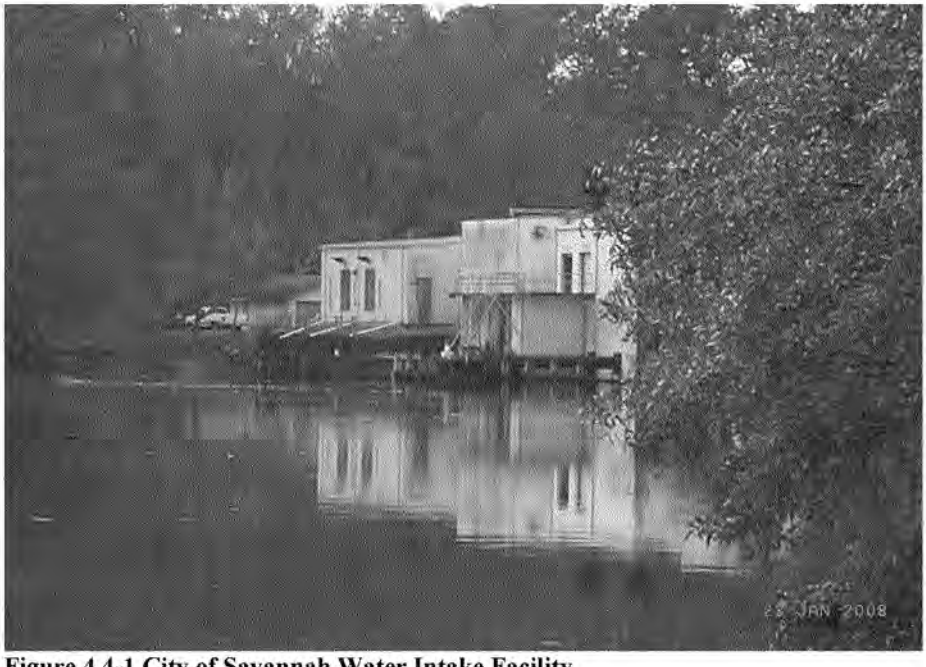


Figure 4.4-1 City of Savannah Water Intake Facility

Environmental studies coordinated with the City of Savannah indicate that the proposed deepening of Savannah Harbor will increase salinity and chloride concentrations in the upper reaches of the Savannah River Estuary, including Abercorn Creek. The proposed mitigation alternative is a raw water impoundment which provides the means to store water for use by the City for drinking water supply during times of high chloride events. The proposed mitigation was selected as it is the least cost, environmentally acceptable plan that meets the project needs.

Operation of the feature would require that water from the existing Abercorn Creek intake be utilized for treatment and pumped to the impoundment during occurrences of low chlorides. During occurrences of high chlorides, water from the impoundment will be pumped to the City's existing water treatment plant via the proposed pump station. During high chloride events at the intake, the intake pumps will be stopped and the plant will draw water from the impoundment thereby avoiding the high chlorides occurring in Abercorn Creek. When chloride concentrations on Abercorn Creek return to acceptable levels during low tide the impoundment can be refilled and made ready for use during the next high tide.

It is estimated that approximately thirty-five (35) acres of land will be required in fee for the construction of this feature. Lands currently owned by the NFS, identified as Parcel 3 on Figure 4.4-2, have been tentatively identified as a suitable construction site. The estimated cost of these lands exclusive of administrative and contingencies is $1,925,000. Two standard perpetual pipeline easements from CSX Corporation will also be required for the dual 36" influent and effluent pipes to connect the impoundment to the existing raw water pipeline. The estimated cost of the pipeline easements is $1,000 excluding contingencies and administrative cost. The conceptual site plan is shown at figure 4.4-3. An aerial image showing the locations of the City's raw water intake, the proposed impoundment and the City's raw water treatment facility is shown at Figure 4.4-4.

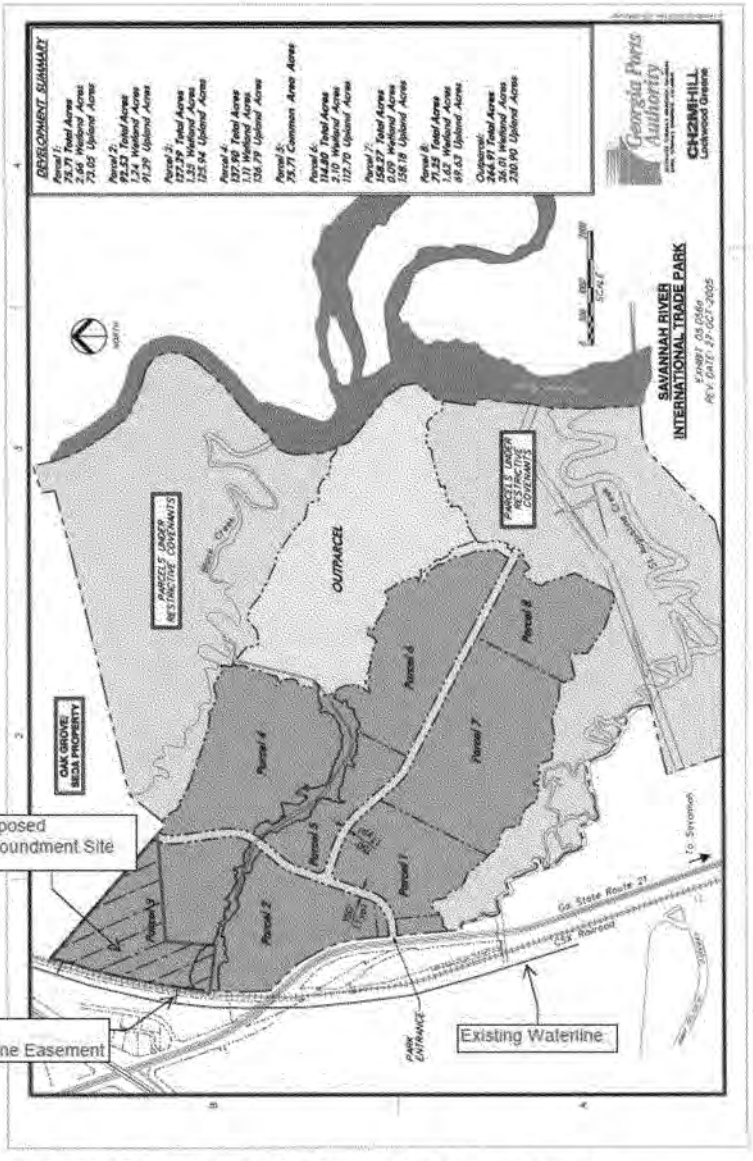


Figure 4.4-2 NFS Owned Lands for Raw Water Impoundment

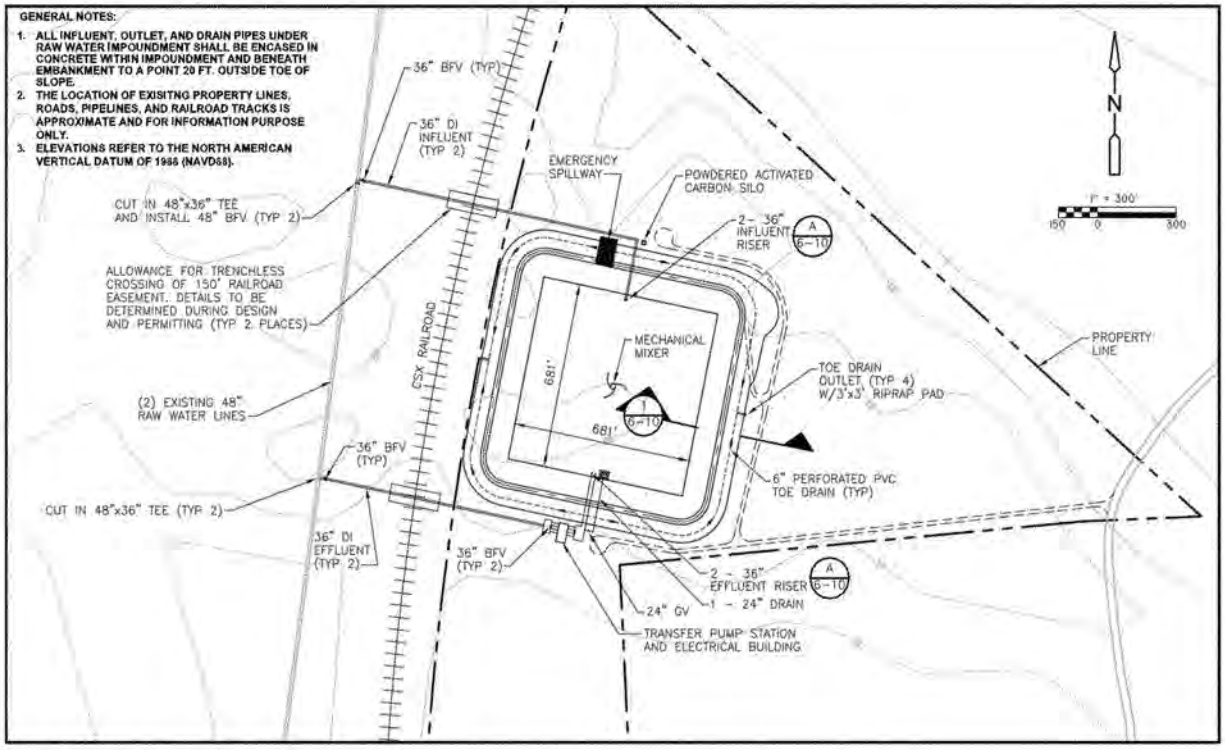


Figure 4.4-3 Conceptual Site Plan

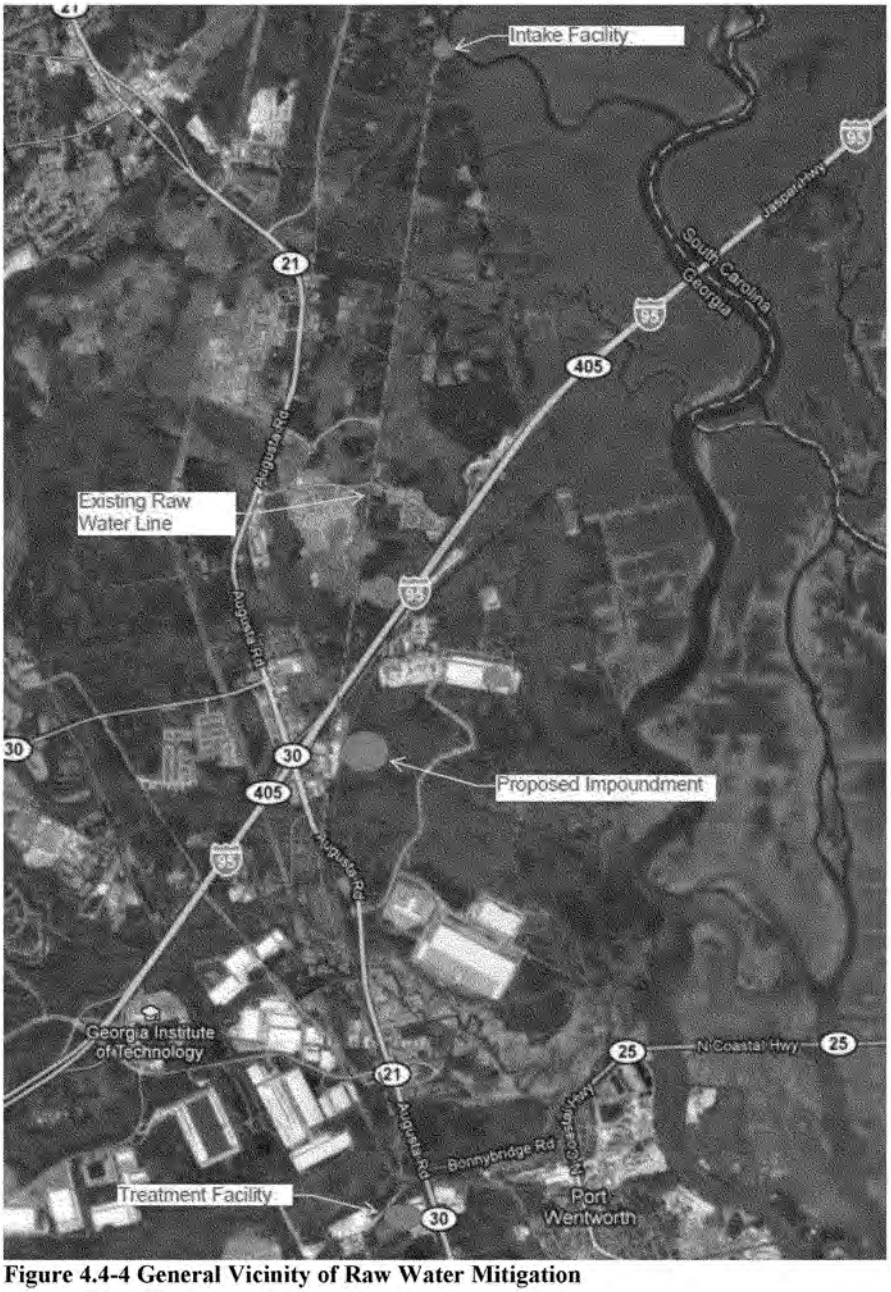


Figure 4.4-4 General Vicinity of Raw Water Mitigation

4.5 DISSOLVED OXYGEN MITIGATION

Deepening the navigation channel would adversely impact dissolved oxygen levels in the harbor. Since this is a critical resource in the harbor, the Corps has included a feature in the mitigation plan for each depth alternative that minimizes that adverse effect.

The Corps' studies indicate that oxygen injection is the most cost effective method to raising dissolved oxygen levels in the harbor. Due to site-specific requirements, the Corps has determined that a land based injection system would be the most effective solution. It identified use of Speece cones as the specific technique to inject oxygen into the water, although another land-based technique could be found to be more cost-effective. The site locations identified for these systems are shown in Figures 4.5-1 and 4.5-2. Site 1 is located on Hutchinson island and consists of 5.5 acres owned by International Paper and will be acquired in fee by the NFS. Access to the site will be across existing perpetual road easements owned by the NFS. Site 2 is located on lands owned by Georgia Power Company and consists of a three acre site to be acquired in fee along with a perpetual road easement for access consisting of approximately two acres. The systems would be land based, with water being withdrawn from the river through pipes, then treated and returned to the river. The water intake structure would include screens to reduce the intake of trash and other suspended solids. The intake and discharge would be located along the side of the river and not extend out into the navigation channel.

Figure 4.5-1 Proposed Dissolved Oxygen Site 1

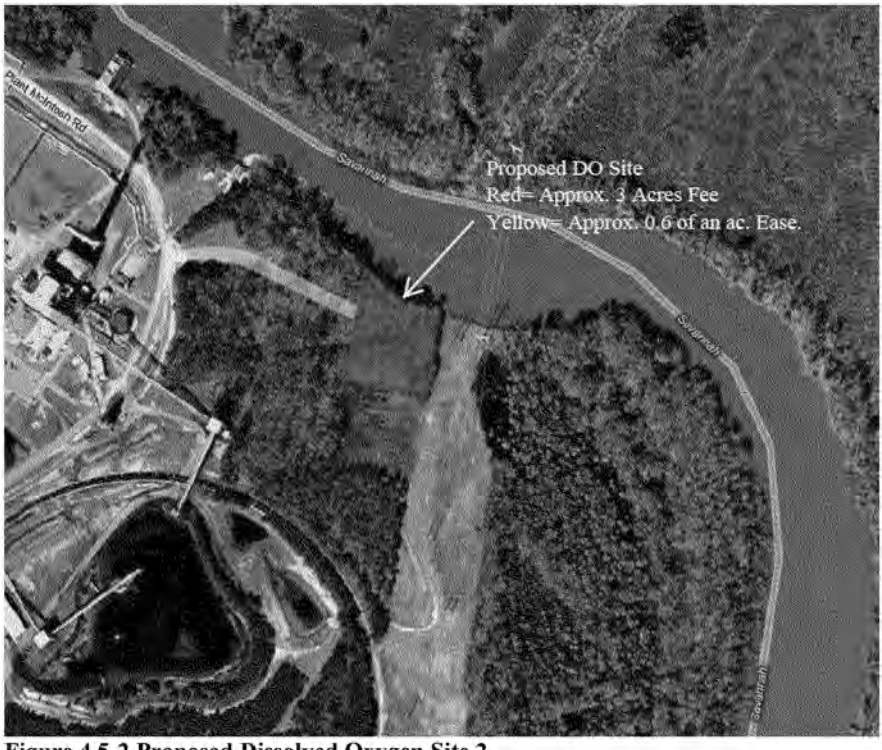


Figure 4.5-2 Proposed Dissolved Oxygen Site 2

4.6. SHORTNOSE STURGEON MITIGATION

The Corps consulted with natural resource agencies about potential ways to address remaining adverse impacts to Shortnose sturgeon. Neither the Corps nor the agencies could identify methods that could be implemented in the estuary that would restore sturgeon habitat or enhance existing habitats. The Corps suggested an action that had previously been identified on the Savannah River that would increase the extent of sturgeon habitat by allowing fish to bypass the lowest dam on the river, the New Savannah Bluff Lock & Dam (NSBL&D) at Augusta, Georgia, which is operated by the US Army Corps of Engineers. A fish bypass around the structure would allow migrating fish to move past the dam, opening up an additional twenty (20) miles of habitat upstream of the dam to Shortnose sturgeon. The structure would also open up the river to American shad and other fish species migrating up river, thereby helping those populations.

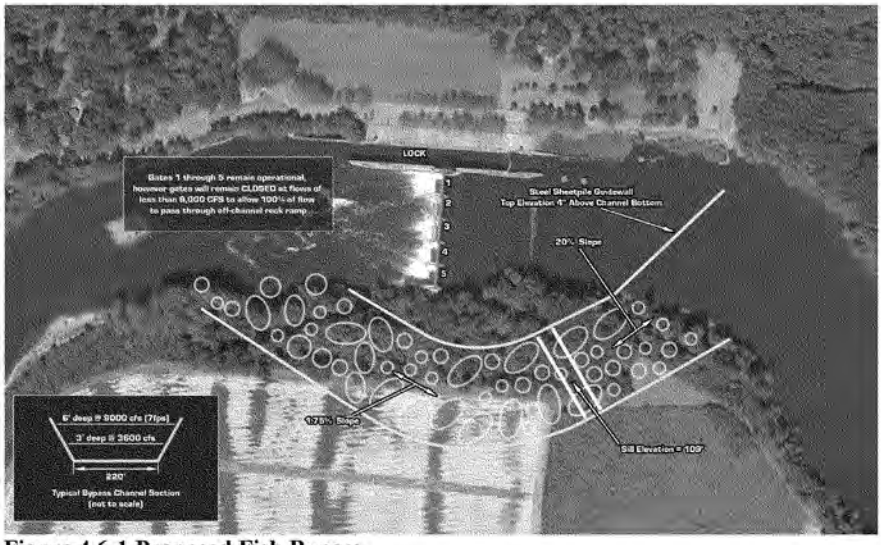


Figure 4.6-1 Proposed Fish Bypass

The fish bypass (Figure 4.6-1) would be located around the South Carolina side of the dam and be constructed on five acres of lands vested in the United States of America and approximately seven acres of privately owned lands. A perpetual, non-exclusive road easement for ingress and egress (Figure 4.6-2) consisting of approximately six acres would also be acquired to allow access for construction and maintenance of the fish bypass. This easement will follow an existing farm road in order to avoid disruptions to the owner.

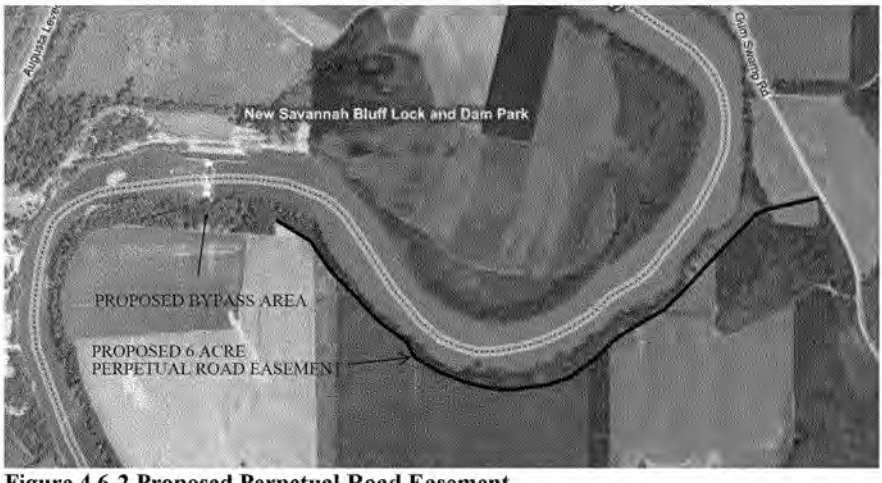


Figure 4.6-2 Proposed Perpetual Road Easement

5. PUBLIC UTILITY/FACILITY RELOCATION

There are two major privately owned pipelines crossing the channel. Savannah District has coordinated closely with Southern Energy and with International Paper to determine the exact location and depth of each pipe. Plans were submitted to both companies identifying the after project conditions (48' depth +over dig) where their pipelines are located. Both Savannah District and the owners agree that there will be no impacts to these pipelines and that relocation will not be required. Other than the Savannah Water Intake Structure addressed in Section 4.4 of this report, no other public or private utilities will be impacted by this project. Office of Counsel has determined that this feature was authorized as mitigation in the Chief's Report. This conclusion is further documented in the Draft EIS, Vol. 1, Section 5.22. In addition, the proposed project is not expected to impact any existing land-based navigational markers.

6. EXISTING PROJECTS

The Savannah Harbor is an existing Federal Project with the GDOT acting as the NFS. All staging areas and disposal areas are owned by the NFS and were provided for the existing Savannah Harbor.

7. ENVIRONMENTAL IMPACTS

There are no known or suspected contaminates located on the lands proposed for acquisition. Additional environmental impacts are addressed in the Environmental Impact Statement, Volume 1 and 2. Mitigation Features were previously discussed.

8. NON-FEDERAL SPONSOR RESPONSIBILITIES AND CAPABILITIES

The NFS has the responsibility to acquire all real estate interests required for the Project. The NFS shall accomplish all alterations and relocations of facilities, structures and improvements determined by the government to be necessary for construction of the Project.

Title to any privately owned lands acquired for the deepening will be retained by the NFS, and no interest will be conveyed to the United States of America. Title to lands acquired in fee by the NFS for the loss of uplands needed for deepening and lands needed for wetland mitigation purposes will be conveyed to the Department of Interior, U S Fish & Wildlife Service and will become part of the Savannah National Wildlife Refuge. Prior to advertisement of any construction contract, the NFS shall furnish to the government an Authorization for Entry for Construction (Exhibit A) to all lands, easements and rights-of-way, as necessary. The NFS will also furnish to the government evidence supporting their legal authority to grant rights-of-way to such lands. Georgia Code, Section 32-3-4 through Section 32-3-20 discusses the Georgia Department of Transportation's ability to condemn property needed for transportation purposes which includes channel construction, mitigation and other transportation purpose.

The NFS shall comply with applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, approved 2 January 1971, and amended by Title IV of the Surface Transportation Uniform Relocation Assistance Act of 1987, Public Law 100-17, effective 2 April 1989, in acquiring real estate interests for the Project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act(s). An Assessment of Non-Federal Sponsor's Real Estate Acquisition Capability has been prepared with cooperation of the NFS and is shown at (Exhibit B).

The NFS is entitled to receive credits against its share of project costs for the value of lands it provides and the value of any relocation that may be required for the project. The value of the real property interests will also include the documented incidental costs of acquiring such interests, as determined by the Government, to be reasonable. Credit for NFS owned lands that may have been acquired more than five years from the effective date of the Project Partnership Agreement (PPA) will not include incidental costs. Credit for land owned by the NFS at the effective date of the PPA will be based on fair market value of the land on the effective date of the PPA in accordance with federal appraisal rules. For land acquired after the effective date of the PPA, credit will be based on the fair market value at time of acquisition and administrative costs will be based on actual documented costs submitted by the NFS.

The NFS should not acquire lands required for the project prior to execution of the PPA. Should the NFS proceed with acquisition of lands prior to the execution of the PPA, it is at the risk of not receiving credit or reimbursement for any cost incurred in connection with the acquisition process should the PPA not be signed. There is also a risk of acquiring lands either not needed for the project or not acquired in compliance with requirements for crediting purposes in accordance with 49 CFR Part 24, dated March 2, 1989 as amended. A letter explaining these risks was provided to the NFS on 7 April 2011 and is attached as Exhibit C.

9. GOVERNMENT OWNED PROPERTY

Approximately sixty-seven (74) acres of lands owned by the United States of America are within the LERRD required for the project. Of the sixty-seven (74) acres, approximately eight acres are located on the Georgia side of the tide gate structure, approximately five acres are located on the South Carolina side of the New Savannah Bluff Lock & Dam and the remaining lands are located in various locations throughout the Refuge. Credit will not be allowed for the sixty-seven (74) acres of government owned lands.

Table 9.1 GOVERNMENT OWNED LANDS

Owner	Acreage
USA, Corps of Engineers	13
USA, US Fish & Wildlife	54

10. HISTORICAL SIGNIFICANCE

The CSS Georgia, a Civil War era iron clad vessel is located at station 58+500 and will be removed from the harbor prior to dredging in the area. The staging area for the removal of this vessel will be at the Engineer Yard, government owned lands located on Hutchinson Island. Planning for this archeological operation is currently being conducted as mitigation for the existing navigation project and is not considered part of this project.

11. MINERAL RIGHTS

There are no known mineral activities within the scope of the proposed Project.

12. PUBLIC LAW 91-646, RELOCATION ASSISTANCE BENEFITS

Public Law 91-646, Uniform Relocation Assistance provides entitlement for various payments associated with federal participation in acquisition of real property. Title II makes provision for relocation expenses for displaced persons, and Title III provides for reimbursement of certain expenses incidental to transfer of property. There will be no relocation of persons or Title II costs associated with the project. Title III expenses for the areas acquired in fee will be determined after the final design plans and specifications have been completed.

13. ATTITUDE OF PROPERTY OWNERS

Although direct contact with all land owners has not taken place, based on past experience with Savannah Harbor projects, it is likely that the NFS will encounter some resistance to acquisition from some of the landowners. The USFWS is a cooperating agency on this project with approval authority.

14. ACQUISITION SCHEDULE

The NFS has indicated they will use their in house staff to acquire real estate interests required for the project. The NFS has a real estate staff that is highly capable and fully dedicated to acquisition of fee or easement real estate interests required for the project. The NFS has estimated that acquisition will take approximately twelve (12) months, and can begin when final plans and specs have been completed and the execution of the PPA. The NFS, Project Manager and Real Estate Technical Manager will formulate the milestone schedule upon project approval.

15. ESTATES FOR PROPOSED PROJECT

The following standard estates are proposed for this project

FEE

The fee simple title to (the land described in Schedule A) (Tracts Nos. , and), subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

ROAD EASEMENT

A perpetual non-exclusive and assignable easement and right-of-way in, on, over and across (the lands described in schedule A) (Tracts Nos. __, ___ and ___) for the location, construction, operation, maintenance, alteration or replacement of (a) road(s) and appurtenances thereto; together with the right to trim, cut, fell and remove therefrom all trees, underbrush, obstructions and other vegetation, structures, or obstacles within the limits of the right-of-way; (reserving, however, to the owners, their heirs and assigns, the right to cross over or under the right-of-way as access to their adjoining land at the locations indicated in Schedule B); subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

UTILITY AND/OR PIPELINE EASEMENT

A perpetual and assignable easement and right-of-way in, on, over and across (the land described in Schedule A) (Tracts Nos._____),for the location, construction, operation, maintenance, alteration; repair and patrol of an underground pipeline; together with the right to trim, cut, fell and remove therefrom all trees, underbrush, obstructions and other vegetation, structures, or obstacles within the limits of the right-of-way; reserving, however, to the land owners, their heirs and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

The following non-standard estate is required for project purposes and was approved for use by memorandum dated October 27, 2010 by Ralph J. Werthmann, Chief, Real Estate Division. The Memorandum is attached as Exhibit D. The estate is derived from the standard Channel Improvement Easement adding the words "saturate, erode and slough said land" and "Slough" to the title. This estate serves the intended project purpose, substantially conforms with and does not materially deviate from the corresponding standard estate contained in Chapter 5 of ER 405-1-12, and does not increase the costs nor potential liability of the Government.

NON-STANDARD CHANNEL IMPROVEMENT/SLOUGH EASEMENT

A perpetual and assignable right and easement to construct, operate, and maintain channel improvement works on, over and across the herein described land in connection with the operation and maintenance of the Savannah Harbor, including the right to clear, cut, fell, remove and dispose of any and all timber, trees, underbrush, buildings, improvements and/or other obstructions therefrom; to excavate: dredge, cut away, and remove any or all of said land; saturate, erode and slough said land; and to place thereon dredge or spoil material; and for such other purposes as may be required in connection with said work of improvement; reserving, however, to the Grantor, its successors and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

16. INDUCED FLOODING

There will be no induced flooding as a result of this project.

17. ZONING

There are no zoning issues associated with this project.

18. REAL ESTATE ESTIMATE

The values contained in this report were determined using data from public records, and from interviews with local professionals. The sales of comparable properties that are used in the valuation represent the best available comparisons in terms of physical proximity, location, access and highest and best use. A number of bona fide vacant land sales for each property type were compiled to offer reasonable support for unit land values used in calculating gross real estate costs for the project. The estimated real estate costs for the Selected NED plan of 47' (Table 18-1) includes land and improvement values, damages, mineral rights, resettlement cost, and federal as well as non-federal administrative costs. A 25% contingency is applied to the estimate total of these items. The Chart of Accounts for the Selected NED plan is at Table 19-1. All land values are based on June 2011 price level and the dollars are constant.

Table 18-1
Selected NED Plan

Savannah Harbor Expansion Project 47' Depth

a. Lands				
	Fee	12 Tracts / 12 Owners	$	14,275,500
	Easement	3 Tracts / 3 Owners	$	138,000
	Permit	7 Tracts / 1 Owner	$	-
b. Improvements			$	-
	Residential		$	-
	Commercial		$	-
c. Mineral Rights			$	-
d. Damages			$	-
e. P. L.. 91-646			$	-
f. Acquisition cost - Admin			$	476,000
	Federal	$ 61,000.00		
	Non-Federal	$ 415,000.00		
		$ 476,000.00		
Sub-Total			$	14,889,500
	25% contingencies		$	3,722,375
TOTAL			$	18,611,875
		ROUNDED	**$**	**18,600,000**

19. CHART OF ACCOUNTS

The cost estimate for all Federal and non-Federal real estate activities necessary for implementation of the project after completion of the feasibility study for land acquisition, construction, LERRDs, and other items are coded as delineated in the Cost Work Breakdown Structure (CWBS). This real estate cost estimate is then incorporated into the Total Current Working Estimate utilizing the Microcomputer Aided Cost Engineering System (MCACES). The costs shown in Table 19-1 are actual estimated cost to be incurred by the Federal and NFS for LERRD acquisition. The costs reflected in these estimates do not necessarily represent the LERRD credit the NFS will receive in accordance with CECW-P/CECC-G Memorandum for Subordinate Commands dated September 19, 2006 which states that LERRD acquired for mitigation for Fish & Wildlife will be credited as part of the total project cost. See Cost Allocation Table 15-6 in the GRR for cost sharing allocations in accordance with this memorandum.

Table 19-1
Selected NED Plan

Savannah Harbor Expansion Project - Chart of Accounts - 47' Depth

		FEDERAL CONST.	FEDERAL MITIGATION	NON-FEDERAL CONST.	NON-FEDERAL MITIGATION	TOTALS
01A	PROJECT PLANNING					
	Other					
	Project Cooperation Agreement	$0			$0	$0
01AX	Contingencies (25%)	$0			$0	$0
	Subtotal	$0			$0	$0
01B	LANDS AND DAMAGES					
01B40	Acq/Review of PS	$55,000	$6,000	$0	$0	$61,000
01B20	Acquisition by PS	$0		$360,000	$55,000	$415,000
01BX	Contingencies (25%)	$13,750	$1,500	$90,000	$13,750	$119,000
	Subtotal	$68,750	$7,500	$450,000	$68,750	$595,000
01H	AUDIT					
01H10	Real Estate Audit	$0			$0	$0
01HX	Contingencies (15%)	$0			$0	$0
	Subtotal	$0			$0	$0
01R	REAL ESTATE LAND PAYMENTS					
01R1B	Land Payments by PS	$0		$4,311,000	$10,102,500	$14,413,500
01R2B	PL91-646 Relocation Pymt by PS	$0			$0	$0
01R2D	Review of PS	$0			$0	$0
01RX	Contingencies (25%)	$0		$1,077,750	$2,525,625	$3,603,375
	Subtotal	$0		$5,388,750	$12,628,125	$18,016,875
	TOTALS	$68,750	$7,500	$5,838,750	$12,696,875	$18,611,875
	ROUNDED TO					**$18,600,000**

AUTHORIZATION FOR ENTRY FOR CONSTRUCTION

I, *(name of accountable official)*, *(title)* for *(name of non-Federal sponsor)*, do hereby certify that the *(name of non-Federal sponsor)* has acquired the real property interests required by the Department of the Army, and otherwise is vested with sufficient title and interest in lands to support construction of *(project name, specifically identified project features, etc.)*. Further, I hereby authorize the Department of the Army, its agents, employees and contractors, to enter upon *(identify tracts)* to construct *(project name, specifically identified project features, etc.)* as set forth in the plans and specifications held in the U. S. Army Corps of Engineers' _____ District Office, *(city and state)*

WITNESS my signature as *(title)* for *(name of non-Federal sponsor)* this _____ day of _____, 20____.

BY: *(name)*

(title)

ATTORNEY'S CERTIFICATE OF AUTHORITY

I, *(name)*, *(title of legal officer)* for *(name non-Federal sponsor)*, certify that *(name of non-Federal sponsor)* has authority to grant Authorization for Entry; that said Authorization for Entry is executed by the proper duly authorized officer; and that the Authorization for Entry is in sufficient form to grant the authorization therein stated.

WITNESS my signature as *(title)* for *(name of non-Federal sponsor)*, this _____ day of _____, 20____.

BY: *(name)*

(title)

EXHIBIT A

Assessment of Non-Federal Sponsor's
Real Estate Acquisition Capability

I. Legal Authority:

a. Does the sponsor have legal authority to acquire and hold title to real property for project purposes? **Yes**

b. Does the sponsor have the power to eminent domain for this project? **Yes**

c. Does the sponsor have "quick-take" authority for this project? **Yes**

d. Are any of the land/interests in the land required for this project located outside the sponsor's political boundary? **Yes**

e. Are any of the lands/interests in land required for the project owned by an entity whose property the sponsor cannot condemn? ***Yes***
(Federal Lands within the Savannah National Wildlife Refuge)

II. Human Resource Requirements:

a. Will the sponsor's in-house staff require training to become familiar with the real estate requirements of Federal projects including P. L. 91-646, as amended? **No**

b. If the answer to II.a. is "yes", has a reasonable plan been developed to provide such training? **N/A**

c. Does the sponsor's in-house staff have sufficient real estate acquisition experience to meet its responsibilities for the project? **Yes**

d. Is the sponsor's projected in-house staffing level sufficient considering its other work load, if any, and the project schedule? **Yes**

e. Can the sponsor obtain contractor support, if required in a timely fashion? **Yes**

f. Will the sponsor likely request USACE assistance in acquiring real estate? **No**

III. Other Project Variables:

a. Will the sponsor's staff be located within reasonable proximity to the project site? **Yes**

b. Has the sponsor approved the project/real estate schedule/milestones? **No – Real Estate Schedule and Milestone will be developed upon project approval as a joint effort with RE, project manager and sponsor.**

47

EXHIBIT B

IV. Overall Assessment:

a. Has the sponsor performed satisfactory on other USACE projects? **Yes**
GADOT has been the sponsor for previous projects located within the Savannah and Brunswick Harbors. Based on their past performance, their RE Staff is considered highly capable.

b. With regard to the project, the sponsor is anticipated to be: **Highly Capable**

V. Coordination:

a. Has this assessment been coordinated with the sponsor? **Yes**

b. Does the sponsor concur with this assessment? **Yes**

John S. Hinely
Realty Specialist

Ralph J. Werthmann
Chief, Real Estate Division

EXHIBIT B

DEPARTMENT OF THE ARMY
SAVANNAH DISTRICT, CORPS OF ENGINEERS
100 W. OGLETHORPE AVENUE
SAVANNAH, GEORGIA 31401-3640

April 7, 2011

Real Estate Division

Subject: Savannah Harbor Expansion Project

Vance C. Smith, Jr.
Commissioner
Georgia Department of Transportation
600 West Peachtree Street
Atlanta, Georgia 30308

Dear Mr. Smith:

The intent of this letter is to formally advise the State of Georgia, as the potential non-Federal sponsor for the proposed project, of the risks associated with land acquisition prior to the execution of the Project Partnership Agreement (PPA) or prior to the Government's formal notice to proceed with acquisition. If a non-Federal sponsor deems it necessary to commence acquisition prior to an executed PPA for whatever reason, the non-Federal sponsor assumes full and sole responsibility for any and all costs, responsibility, or liability arising out of the acquisition effort.

Generally, these risks include, but may not be limited to, the following:

(1) Congress may not appropriate funds to construct the proposed project;

(2) The proposed project may otherwise not be funded or approved for construction;

(3) A PPA mutually agreeable to the non-Federal sponsor and the Government may not be executed and implemented;

(4) The non-Federal sponsor may incur liability and expense by virtue of its ownership of contaminated lands, or interests therein, whether such liability should arise out of local, state, or Federal laws or regulations including liability arising out of CERCLA, as amended;

(5) The non-Federal sponsor may acquire interests or estates that are later determined by the Government to be inappropriate, insufficient, or otherwise not required for the project;

(6) The non-Federal sponsor may initially acquire insufficient or excessive real property acreage which may result in additional negotiations and/or benefit payments under P.L. 91-646 as well as the payment of additional fair market value to affected landowners which could have been avoided by delaying acquisition until after PPA execution and the Government's notice to commence acquisition and performance of LERRD; and

EXHIBIT C

(7) The non-Federal sponsor may incur costs or expenses in connection with its decision to acquire or perform LERRD in advance of the executed PPA and the Government's notice to proceed which may not be creditable under the provisions of Public Law 99-662 or the PPA.

We appreciate the State's participation in this project. A copy of this letter will be furnished to Mr. Curtis J. Foltz, Executive Director, Georgia Ports Authority. Should you have questions or concerns pertaining to this letter please feel free to contact Mr. John S. Hinely at (912) 652-5207.

Sincerely,

Ralph J. Wershmann,
Savannah District
Chief, Real Estate Division
Real Estate Contracting Officer

EXHIBIT C

CEMSAS-RE 27 October 2010

MEMORANDUM FOR FILE

SUBJECT: Savannah Harbor Expansion Project

The following non-standard estates is approved for use on the subject project: in accordance with ER 405-1-12, paragraph 12-10c, This estate is derived from the standard Channel Improvement Easement adding the words "saturate, erode and slough said land" and "Slough" to the title. This estate serves the intended project purpose, substantially conform with and does not materially deviate from the corresponding standard estate contained in Chapter 5, and does not increase the costs nor potential liability of the Government.

CHANNEL IMPROVEMENT/SLOUGH EASEMENT

A perpetual and assignable right and easement to construct, operate, and maintain channel improvement works on, over and across the herein described land in connection the operation and maintenance of the Savannah Harbor, including the right to clear, cut, fell, remove and dispose of any and all timber, trees, underbrush, buildings, improvements and/or other obstructions therefrom; to excavate: dredge, cut away, and remove any or all of said land; saturate, erode and slough said land; and to place thereon dredge or spoil material; and for such other purposes as may be required in connection with said work of improvement; reserving, however, to the to the owners, their heirs and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements far public roads and highways, public utilities, railroads and pipelines.

RALPH T. WERTHMANN
Chief, Real Estate Division

EXHIBIT D

FOR CONTINUATION OF HOUSE DOCUMENT 112-153

SAVANNAH HARBOR EXPANSION PROJECT
CHATMAN CO., GEORGIA & JASPER CO., S. CAROLINA:
FINAL GENERAL RE-EVALUATION REPORT AND
ENVIRONMENTAL IMPACT STATEMENT

SEE PART 2