ISLAND CREEK LOCAL PROTECTION PROJECT AT LOGAN, WEST VIRGINIA GENERAL REEVALUATION REPORT

COMMUNICATION

FROM

THE ASSISTANT SECRETARY OF THE ARMY (CIVIL WORKS), THE DEPARTMENT OF THE ARMY

TRANSMITTING

A REPORT ON THE BUDGETING FOR THE ISLAND CREEK LOCAL PROTECTION PROJECT, LOGAN, WEST VIRGINIA

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

JAN 15 2009

HOUSE DOCUMENT NUMBER 111-15

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

2009 JAN 26

Dear Madam Speaker:

This letter is to inform you of the Administration's position on the budgeting for the Island Creek Local Protection Project, Logan, West Virginia. Section 401 of the Water Resources Development Act (WRDA) of 1986 authorized the flood damage reduction project, at an estimated total cost of $86,000,000, in accordance with the Report of the Chief of Engineers, dated April 25, 1986. At the time of the authorization, the local sponsor did not have the available funding to proceed with the project. In 1999, the Logan County Commission, acting as non-Federal sponsor with financial support from the West Virginia Conservation Agency requested that the Corps of Engineers reevaluate the authorized project. House Report 106-253 of the Energy and Water Development Appropriations Act of 2000 directed the Corps to prepare a General Reevaluation Report (GRR) to modify the project and to reaffirm the project justification and submitted the GRR for review and approval. The Corps of Engineers provided the GRR for my review as the supporting documentation for the project modification.

The authorized project consists of a 100-foot wide channel improvement along 3,700 feet of Island Creek upstream of its confluence with the Guyandotte River, 1,000 feet of which is lined with concrete. The improvements would have the effect of reducing the damages of a 100-year event to that of a 2- to 11-year event. In addition, a significant non-structural component was recommended within the Island Creek 500-year floodplain consisting of the acquisition of 265 residential and commercial properties, flood proofing for approximately 1,200 structures and the relocation of 150 mobile homes.

The plan recommended in the GRR consists of an 80-foot wide channel improvement for a distance of 3,600 feet along Island Creek. The modified plan would not include the concrete lining provided for in the original authorization. Along the channel reach, post and panel retaining walls, mechanically stabilized earth, sloped bank lined with stone slope protection and a concrete revetment will be constructed to stabilize the creek bank behind the commercial structures. The project also includes removal of an existing sandbar and implementation of a flood warning system. Reevaluation of other authorized non-structural features is being deferred to a later date. There would be a 62 percent chance that the project would contain a flood with a 10 percent chance of occurring in any year (10-year event). Similarly, the project would reduce the damages of the 100-year event to that of a 6- to11-year event. The GRR contains a letter from the non-Federal sponsor acknowledging the level of flood protection that would be provided by the proposed improvements.

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The recommended plan is the locally preferred plan (LPP) of the non-Federal sponsor. Although it is not technically the National Economic Development (NED) plan, it is less costly, and is superior to the NED Plan (which is the 100-Foot Plan) for minimizing a number of potentially negative social, economic and environmental impacts, and forgoes a small percentage in net benefits in comparison with the NED plan. Since the sponsor has identified physical and financial constraints in selecting the NED plan and net benefits are increasing for the smaller project as the constraints are reached, the need to recommend the NED plan is suspended. The LPP qualifies for a categorical to the NED plan and does not require a waiver from the Secretary.

The recommended plan has a total project first cost of about $33,660,000 at October 2008 prices. This amount includes $7,974,000 for land, easements, rights-of-way, relocations, and disposal areas and $150,000 to implement the proposed flood warning system. Cost sharing for the authorized project is in accordance with Section 103 of the WRDA of 1986 which is 75 percent Federal and 25 percent non-Federal. As the recommended plan requires no Congressional modification, it is subject to the original cost sharing. Based on a 4.625 percent discount rate and a 50-year period of economic evaluation, equivalent annual benefits are cited as $4,333,000. Equivalent annual costs are estimated as $1,735,000, including $68,000 in average annual operation, maintenance, repair, replacement, and rehabilitation costs. Indicated equivalent annual net benefits are $2,598,000. The resultant benefit cost ratio is 2.5 to 1.

An environmental assessment (EA) was prepared in accordance with the National Environmental Policy Act. The EA concluded that the project would not have significant impacts on biological, social, and cultural resources of the area and a Finding of No Significant Impact (FONSI) was signed on December 11, 2001 for the authorized project. A second FONSI was signed for the GRR on January 22, 2008.

My office has completed its review and I have determined that the recommended project is technically sound, environmentally acceptable and economically justified. I submitted the report to the Office of Management and Budget (OMB) on August 1, 2008 to seek Administration budgetary support. OMB advises in the attached letter, dated January 12, 2009 that the project is eligible for funding. I am providing a copy of this transmittal and the OMB letter, to the House Subcommittees on Energy and Water Development, and Water Resources and Environment.

Very truly yours,

John Paul Woodley, Jr.

John Paul Woodley, Jr.
Assistant Secretary of the Army
(Civil Works)

Enclosures

Enclosures

1. OMB Clearance Letter, dated January 12, 2009
2. Island Creek Logan West Virginia, Illinois – General Reevaluation Report – Flood Damage Reduction Project, dated March 2002

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

January 12, 2009

The Honorable John Paul Woodley, Jr.
Assistant Secretary of the Army (Civil Works)
108 Army Pentagon
Washington D.C. 20310-0108

Dear Mr. Woodley:

As required by Executive Order 12322, the Office of Management and Budget has completed its review of your recommendation for the Island Creek Local Protection Project Logan, West Virginia.

Our review concluded that your recommendation for this project is consistent with the policy and programs of the President. The Office of Management and Budget does not object to you submitting this report to Congress.

Sincerely,

Richard A. Mertens
Deputy Associate Director
Energy, Science, and Water

Encl 1

CELRH-PM-PD-F (1110-2-1150a) M:/nmckinley/island creek/GRR 6-1-01/guidance memo JUL 0 9 2002
Ext. 56563

MEMORANDUM FOR Deputy Commanding General For Civil Works, ATTN: George N. Fach, Jr., CECW-PM, 441 G Street, NW, Washington, DC 20314

SUBJECT: Island Creek Local Protection Project at Logan, West Virginia, General Reevaluation Report (PWI: 075456)

1. Submitted for your review and approval are 10 copies of the Policy Compliance Documentation Memorandum and an Addendum to the General Reevaluation Report for the Island Creek Local Protection Project at Logan, West Virginia, Main Report and the Environmental Assessment. The addendum contains the revised pages to the report.

2. As you are aware, the District is attempting to include the recommended project as a new construction start in the FY03 budget.

3. The POC for this action is Ms. Amy Frantz, Project Manager. If you have any questions regarding the subject report, she may be reached at phone number (304) 528-7444.

Encls

S. MICHAEL WORLEY
Chief, Planning Branch

Miller PM-PD-F
Borda PM-PD
Frantz PM-M

CELRH-PM-PD **9 July 2002**

SUBJECT: Island Creek Local Protection Project, Logan, West Virginia, General Reevaluation Report – Policy Compliance Documentation

1. **SUMMARY OF THE REVIEW PROCESS**. The subject report was transmitted for Headquarters review via memorandum, CELRH-PM-PD-F, undated, subject: Island Creek Local Protection Project at Logan, West Virginia, General Reevaluation Report (PWI: 075456). Headquarters policy compliance review comments were transmitted by electronic mail message, CECW-PM (George N. Fach, Jr.), 25 October 2001, subject: Island Creek, Logan, WV, GRR. A conference call was held on 9 January 2002 among Headquarters, Division, and District staff to discuss the actions required to resolve the identified policy issues. By electronic mail message, CECW-PM (George N. Fach, Jr.), 10 January 2002, subject: Island Creek Flood Warning System (FWS) Measures, Headquarters provided clarification of policy concerning the classification of FWS as structural or nonstructural measures. District responses to the Headquarters policy review comments were provided by electronic mail message, CELRH-PM (Natalie J. McKinley), 4 February 2002, subject: Island Creek Responses. Headquarters assessment of the District's responses and further guidance on the actions required to be taken to resolve the identified policy issues are documented in paragraph 3. Paragraph 2 provides background information on the study and project. CELRH-PM final resolution to the CECW-PM guidance is documented in paragraph 3 and an addendum is enclosed with the corrected report pages.

2. **STUDY / PROJECT BACKGROUND.**

a. Study Area Location. The Island Creek Basin is about 105 square miles of rugged mountainous terrain located in southwestern West Virginia. Three major streams drain the basin—Island Creek, Copperas Mine Fork, and Mud Fork. The study area encompasses the 500-year floodplain of Island Creek at the community of Logan, Logan County, West Virginia.

b. Problem. The project area has experienced numerous damaging floods in the past. A flood with a 1-percent chance of occurring in any year on the 10.4 miles of Island Creek originally under study would inundate approximately 950 residences and 255 commercial structures. Under present conditions, flood damages that would be caused by the 1-percent chance event would exceed $40.5 million (October 2000 prices). The current report focuses on the 500-year floodplain adjacent to Island Creek upstream of its confluence with the Guyandotte River. The GRR cites expected annual damages in the current study area of $6,500,000 under existing conditions.

c. Authorized Project. The project was authorized by Section 401 of the Water Resources Development Act of 1986 (PL 99-662). The authorized project addresses flooding adjacent to a total of about 19 miles of Island Creek (10.4 miles), Copperas Mine Fork (5.1 miles), and Mud Fork (3.9 miles). The plan includes both structural and non-structural components. The structural component of the plan provides for a channel with a 100-foot wide bottom on Island Creek for a distance of 0.7 miles upstream of its confluence with Guyandotte Creek. The lower 1,000 feet was to be a concrete-lined channel. The project area adjacent to remaining 9.3 miles of Island Creek, and both Copperas Mine Fork and Mud Fork, would be treated with a variety of non-structural measures. Non-structural plans call for raising over 1,200 residential structures, flood proofing about 80 non-residential structures in-place, and relocating over 500 other structures to flood-free housing and community development sites. The project was authorized at a cost $86 million (October 1984 Prices).

d. Study Authority. The project was authorized by Section 401 of the Water Resources Development Act of 1986. PED was initiated in 1989. It was found that the non-structural costs included in the project had been significantly under estimated in the feasibility phase. The inclusion of the non-structural features would have led to an uneconomical project; therefore, they were dropped from consideration. The sponsor, the Logan County Commission, subsequently concluded in 1993 that they were unable to financially support the project at that time; consequently, PED studies were suspended. In 1998, PED resumed with the financial sponsorship of the West Virginia Soil Conservation Agency resulting in the current General Reevaluation Report and Environmental Assessment. The current report documents the reevaluation of the authorized project features to confirm economic feasibility and document the NED plan.

District Response/Clarification – During the early stages of PED (1990), it was determined that the actual costs associated with raising structures in place were significantly higher than those used during the Feasibility Phase to estimate project costs for the authorized project. This determination was based on the District's experience with other ongoing nonstructural projects. However, no detailed reevaluation or determination of economic feasibility of the nonstructural component of the authorized project was completed at that time because no qualified non-Federal sponsor who supported implementation of the nonstructural component had been identified. The decision was made to defer reevaluation of the nonstructural component until a future date when such updated information would be needed to make decisions regarding implementation of this component. There was recommendation to modify the authorized project at that time, and ORD concurred with the decision to defer this reevaluation.

The Logan County Commission had expressed interest in the implementation of the structural component (0.7 mile of channel modification) of the authorized project. PED efforts during this time period consisted of a reevaluation and preliminary design of the structural component of the authorized project. In 1993 the Logan County Commission formally notified the District that they were unable to financially support the project at that time and requested that project implementation be deferred until they could identify additional funding assistance. All PED activities were suspended at that time.

In 1998, at the request of the Logan County Commission with financial support from the West Virginia Soil Conservation Agency (WVSCA), PED activities were resumed. The WVSCA and the Logan County Commission requested that PED activities be directed toward the reevaluation of the structural component of the authorized project and that reevaluation of nonstructural measures continue to be deferred until additional funding sources could be identified. The *current GRR presents a reevaluation of only the structural component documenting economic feasibility, optimization of project scope, NEPA compliance and minor design changes. The report concludes that the deferral of the reevaluation of the nonstructural component should continue and does not recommend any significant changes to the Island Creek Local Protection Project authorized in WRDA 1986.*

e. Recommended Plan. [Note: This paragraph was modified by the District as follows: *additions*, ~~deletions~~]. The recommended improvements are slightly smaller in scope than the project authorized by WRDA 1986. The recommended plan provides for trapezoidal channel with an 80-foot bottom width on Island Creek for a distance of 0.7 miles upstream of its confluence with the Guyandotte River. The ~~plan~~ *channel configuration* includes two discontinuous post and panel wall segments totaling 1,290 linear feet, to ~~protect specific commercial structures~~ *minimize impacts to existing commercial development.* An existing sand bar located approximately 400 feet upstream of the confluence of Island Creek and Copperas Mine Fork would be removed. Additional plan components include a flood warning system (FWS) and aquatic and terrestrial ~~mitigation~~ *environmental design* features. One commercial structure and an outbuilding on the property of an existing business would be removed ~~and another relocated~~ to accomplish the required channel widening. The total length of the project is about 4,500 feet. The report indicates that the channel widening would allow this stream segment to handle runoff from storms with an average recurrence interval of 10 to 20 years. Nine new gages and one upgraded gage would be associated with the proposed FWS. These gages would be located on Island Creek (4), Copperas Mine Fork (3), Trace Fork, Mud Fork, and the Guyandotte River. The Logan County Commission will serve as the non-Federal Project sponsor. The West Virginia Soil Conservation Agency will provide the non-Federal share of project costs.

f. Economic Evaluation. The estimated initial cost of the project is $20,774,000 at October 2000 prices. This amount includes $6,933,000 for LERRD and $227,000 to implement the proposed FWS. Based on a 6.375 percent discount rate and a 50-year period of economic evaluation, equivalent annual benefits are cited as $3,830,000. Equivalent annual costs are estimated as $1,690,000, including $73,000 in equivalent annual OMRR&R costs. Indicated equivalent annual net benefits are $2,140,000. The indicated ratio of benefits-to-costs ratio is 2.3 to 1.

3. GUIDANCE.

a. Comment: **Project Description.** Inconsistent descriptions of the project are cited throughout the GRR. Portions of the report indicate that two commercial structures would be "removed"; other sections cite one commercial relocation. The GRR should be revised to consistently describe the recommended plan throughout the report.

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Response: The proposed project will require acquisition/removal of one commercial structure (Super 8 Motel) and a small outbuilding located near the stream on the property of an existing business (Baisden Hardware Store). Text will be revised throughout the report for consistency and to accurately describe commercial acquisitions.

Assessment: The issue will be resolved by revising the report to provide consistent descriptions of the recommended plan.

Resolution: Text has been revised throughout the report with the first reference occurring on page 22 of the main report.

b. Comment: **Post Authorization Changes.** There is no evaluation of post authorization changes in the GRR; however, the recommended plan appears to have a significantly different scope, output, and cost from the authorized project, due to the elimination of the flood proofing and raising features and reduction in channel width from 100 to 80 feet. The Ohio River Division gave its approval to defer the evaluation of the uneconomical non-structural components in 1991. However, the revised GRR should present sufficient information to address the significance of the post authorization changes and to determine the appropriate authority for approval of changes, including the decrease in project costs relative to Section 902.

Response: The GRR does not recommend any significant changes to the Island Creek Local Protection Project authorized in WRDA 1986. The authorized project consists of both structural and nonstructural components. This report recommends implementation of the structural component (0.7 mile of channel modification) of the authorized project as a separable element and a flood warning system (non-structural). The structural component recommended in this report differs slightly from the original structural component identified in the Island Creek Feasibility Report dated March 1985. The design of the channel modification has been refined in response to changes in the project area and the availability of additional engineering data. Changes to the scope, costs and outputs related to the structural component are relatively minor and are primarily related to design refinements. At the request of the local sponsor and with the concurrence of LRD, the evaluation of the nonstructural components of the authorized project has been deferred. Any discussion of post authorization changes and appropriate authority for approval should be postponed until such time that entire project has been reevaluated and significant changes identified.

Assessment: The issue will be resolved by revising the report to include an evaluation of the post authorization changes in the project features being recommended for implementation.

Resolution: The differences in the authorized project and the recommended project are as shown in the response above. Specifically in the report, the authorized project features are outlined on pages 4-6 in the main report and the text in the response above is summarized in Section XV Conclusions in the main report on pages 46 and 47 and included in the Addendum.

The differences have resulted from design refinements and deferral of the non-structural portion (except the FWS) at the request of the sponsor.

c. Comment: **Risk And Uncertainty Analysis.** The GRR indicates that risk and uncertainty analyses as required by ER 1105-2-100 were not completed for the current proposal. The GRR should be revised to comply with current policy in regard to R&U analyses for flood damage reduction studies.

Response: The risk and uncertainty analysis required by ER 1105-2-100 will be performed for the current proposal and the results incorporated into the main report and the economic appendix of the GRR.

Assessment: The issue will be resolved by revising the report to include the required risk and uncertainty analyses.

Resolution: The required R&U analysis has been preformed and the results included in the Economic Appendix, specifically in Section VI., G. Risk and Uncertainty.

d. Comment: **Economic Evaluation.** ER 1105-2-100, appendix G, paragraph G-9.h.(3) states the following: "Detailed economic data and any derivations from that data to support plan formulation, forecasts, and detailed explanations of benefits should be provided. Describe the with and without project physical, biological and economic conditions of the study area and how each category of benefits was computed." The GRR does not include an economics appendix. There is only minimal information on the derivation of flood damage reduction benefits claimed. The main report provides some information about the substantially larger project area that was associated with authorized project. However, there is no information on the numbers and types of structures subject to flooding in the current evaluation. There is no information on structure and content value assumptions, etc. Absent this information, the reasonableness of the evaluation can not be assessed. Additionally, Table 10 of the GRR indicates that without-project damages are 9.7 million while table 12 indicates "base condition" damages as $6.5 million. Details of the economic evaluation should be included in the revised GRR.

Response: An economic appendix will be prepared to provide detailed information about the flood damage analysis. *Resolution: An economic appendix is included under its own tab and provides the requested detailed information.* A summary of the economic evaluation will also be incorporated in the main report. *Resolution: Results from the economic analysis presented in the Economic Appendix are summarized in the main report.* Text will be added to the main report and the economic appendix to clarify the difference between the authorized project area and the area impacted in the current analysis. *Resolution: Text has been added throughout the report to provide clarity regarding the authorized project area and the area impacted from the currently proposed projects.* Table 10 results will be modified so that existing damages match with Table 12. *Resolution: The existing damage figures match in Table 10 and Table 14 (formerly Table 12) as well as throughout the report.*

Assessment: The issue will be resolved by revising the report to include the required information .

Resolution: Each item in the response is addressed individually in italics above.

e. Comment: **Post And Panel Wall Segments.** Notes to the M-CACES estimate state that the two post and panel wall segments are included in the plan to avoid acquisition of two commercial structures on the left descending bank of Island Creek. The revised GRR should document that the cost of each wall segment is less than the cost of structure acquisition. Verify that the recommended plan is the NED plan.

Response: Noted. The statement in the M-CACES is inaccurate and will be deleted. The recommended project (with the two post and panel walls) produces the greatest net benefits when compared to other plans with and without the walls as shown in Table 10. Clarification: Post and panel walls as presented in the report represent segments of the channel configuration not a flood wall type structure.

Assessment: The issue will be resolved by revising the report to clarify the purpose of the post and panel wall features.

Resolution: The incorrect statement has been removed and the revised M-CACES summary sheets included as the "ETA – Tab VII, Cost Estimate, Section C".

f. Comment: **Flood Warning System.** A flood warning system is included in the final array of alternatives leading to the selection of the recommended plan. However, it is not evident that there was an explicit analysis of the benefits and costs of the system or whether it would reduce the benefits attributed to the structural features by increasing the time available for temporary evacuation of damageable property from the flood plain. The GRR should demonstrate that the FWS is economically justified.

Response: The FWS will be considered a nonstructural component of the recommended project. An analysis will be prepared to demonstrate that the FWS is justified based on its cost and the estimated reduction to residual damages within the project area.

Assessment: The issue will be resolved by revising the report to document the economic justification and the cost sharing of the FWS as a separable nonstructural element.

Resolution: The FWS analysis was completed as outlined above in the response and is included in the Economic Appendix under Section VI., C. The summary of the results are included in the economic analysis portion of the main report.

g. Comment: **Sunk PED Costs.** The M-CACES estimate shows $2,000,000 assigned to "post feasibility studies." Verify that all past PED expenditures have been included in the estimate of total project costs to be apportioned. Note that sunk PED expenditures should not be included in the current economic evaluation of alternatives.

Response: The sunk PED expenditures will be removed from the economic evaluations and the correct results incorporated into the GRR.

Assessment: The issue will be resolved by revising the report to exclude sunk PED costs from the economic analysis.

Resolution: The sunk PED expenditures were removed from the economic evaluation. Evidence of this action can be found in the Economic Appendix in Section VI., E., Table 12.

h. Comment: **Cost Sharing.** Since the project was authorized in WRDA 1986, cost sharing as specified in section 103(a) of this Act appears to be applicable. The project proposal includes both structural and non-structural components. Cost sharing requirements are slightly different for these components—the minimum 5 percent cash requirement is not applicable to non-structural flood control features. Verify that cost sharing shown in the report is correct.

Response: As stated in comment f., the FWS will be considered a non-structural component and the appropriate language regarding cost sharing will be added to the text.

Assessment: The issue will be resolved by revising the report to document cost sharing of the FWS as a separable nonstructural element.

Resolution : The revised cost sharing requirements for the structural and non-structural elements are discussed on page 36 and shown on Table 16 of the main report and included in the Addendum.

i. Comment: **Mitigation Versus "Sound Environmental Design Practice."** The report consistently points out that project will have minimal environmental impacts; however the Executive Summary also states that aquatic and terrestrial mitigation features will be constructed. In paragraph 2.5 (*Environmental Design Measures*), of the Environmental Assessment various "mitigation" elements such as riffle/pool complexes, planting of native vegetation, etc. are proposed. Several plates included in the EA identify "deciduous tree planting area for on-site mitigation" and "typical section" for riffle structures. These measures are proposed to mitigate for loss of riparian habitat, loss of upland and bottomland hardwoods, and for disturbance of aquatic and benthic life. How were these measures selected and what coordination took place to decide which measures would be appropriate? The remainder of the report (text, cost estimates, etc) is virtually silent on mitigation. Recommended mitigation features need to be fully justified. Such justification must be based on determination of significance of losses, incremental analysis, and cost effectiveness, etc. See ER 1105-2-100, Appendix C, paragraph e., beginning on page C-15. Based on the scant information provided in the GRR, in this instance, rather than mitigation, this appears to be a case of "sound environmental design". The report needs to be modified to both fully describe and justify any mitigation features or reflect that these features are simply sound environmental design features.

Response: During 1993, the project recommended implementation of the structural component as a separate element and the non-structural element was deferred. The structural component consisted of construction of channel modifications along the 0.7 mile of lower Island Creek and a spoil area at Wilkinson. At that time, a draft EA was circulated to the resource agencies but was not completed with a FONSI. A planning aid letter (PAL) was received from the USFWS during this time.

In 2000, the project was looked at again and it was decided by the District that the impacts were not significant enough to warrant mitigation measures, but that environmental features, developed in cooperation with resource agencies, were incorporated into the design. Also, in late 2000, the decision was made to utilize an existing disposal site at Schoolhouse Hollow rather than using the Wilkinson site. This change decreased the environmental impacts of the project. The report will be changed to reflect that these features are simply sound environmental design features.

The EA will reference that the PAL and coordination letters may be found in Appendix C

Assessment: The issue will be resolved by revising the report to document measures incorporated in the project to minimize environmental impacts as sound environmental design.

Resolution: Beginning on page 6, the FEA has been revised to document that environmental measures have been incorporated in the project to minimize environmental impacts as sound environmental design.

j. Comment: **Coordination**. The report references (See FONSI and USFWS letter dated February 6, 2001) a December 1993 USFWS Planning Aid Letter (PAL). The PAL should be included in the report. On page 15 under Public and Agency Coordination, it is stated that agencies would receive documents. At this stage of project planning, coordination should be in its final or completed stages. Has a Public Notice (PN) gone out for public review and comment?

Response: The PAL will be included in the report. The tense of the sentence is incorrect. Public Notice (PN) may be found in Appendix A labeled as Notice of Availability (NOA). The NOA advised the public that the document was available for review and comment from January 5, 2001 through February 5, 2001.

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Assessment: The issue will be resolved by revising the report to include the PAL and accurately describing the status of coordination.

Resolution: The document has been revised to incorporate the environmental design features beginning on page 6 of the FEA. On page 15, the tense of the sentence was changed to reflect that the agencies have received a copy of the plans and NEPA documents. The Notice of Availability is found in Appendix A. The PAL and coordination letters may be found in Appendix C.

k. Comment: **Status of Environmental Compliance**. Several statements are made on pages 7 and 8 of the Environmental Assessment (EA), dated May 2001, that coordination will or would be obtained for Water Quality Certification and the Fish and Wildlife Coordination Act. The EA also states that if significant historic properties are encountered then appropriate mitigation measures will be incorporated, and the Corps will fully comply with Section 106 consultation. Since this is the Final EA, coordination and compliance with appropriate agencies should be completed and not deferred to a later time. The Coordination Act Report from the US Fish and Wildlife Service should be included, as well as responses to recommendations resulting for Federal and state agency comments resulting from the coordination (see ER 1105-2-100, Appendix C, paragraph c.(1)(a), as an Appendix to the Final EA

Response: Coordination with the US Fish and Wildlife has occurred since the beginning of this project. Please refer to the PAL (1993) and two supporting letters received by this district within the last year. A Coordination Act Report was not prepared by the USFWS since the project to be implemented was not found to significantly impact the resources. The PAL and the correspondence letters may be found in Appendix C. *Resolution: The tense of the sentences on pages of 7 and 8 has been changed and the PAL and coordination letters may be found in Appendix C. A Coordination Act Report was not prepared by the USFWS since the project to be implemented was not found to significantly impact the resources. The PAL may be found in Appendix C of the Final EA.*

The 404(b)(1) analysis has been completed and is located in Appendix B. The State 401 Water Quality Certification dated May 17, 2001, has been received and is included in Appendix B. *Resolution: The Section 401 Water Quality Certification and the Section 404 (b) (1) Analysis may be found in Appendix B.*

Coordination with the State Historic Preservation Office has occurred. The EA will have a reference to the location of the coordination letters dated January 31 and April 27, 2001 and the Cultural Resources Reconnaissance Report for the Island Creek LPP dated April 2001. All references are located in Appendix C. *Resolution: The text has been modified to reflect a change in verb tense and changes may be found starting on pages 7 and 8.*

The EA will be revised to reflect the completion of the compliance issues referenced in the comment.

CELRH-PM-PD **9 July 2002**
SUBJECT: Island Creek Local Protection Project, Logan, West Virginia, General Reevaluation Report – Policy Compliance Documentation

Assessment: The issue will be resolved by revising the report to accurately reflect the status of environmental compliance actions.

Resolution: Each item in the response is addressed individually in italics above.

l. Comment: **Water Quality**. Page 11 of the EA mentions that water quality is poor in the study area and that "Abandoned deep mines are a major source of acid mine drainage" and that "Untreated domestic sewage is a serious problem". These issues, as well as, siltation and turbidity concerns should be addressed for the Water Quality Certification. There is a statement that an erosion control plan would be prepared. The GRR should address the state of erosion control or other plans that have been prepared or that are in preparation.

Response: The WV Water Quality Certification was received by this district on May 17, 2001. The 404 (b)(1) Analysis addressed the issue of erosion control plans by using Best Management Practices. The EA will reference the location of the 404(b)(1) Analysis in Appendix B.

Assessment: The issue will be resolved by revising the report to address the status of erosion control plans and State Water quality Certification requirements.

Resolution The 404 (b) (1) Analysis addresses the issue of erosion control plans and the document may be found in Appendix B along with the WV 401 State Water Quality Certification. The document has been modified to reflect the tense of the sentences on pages 7 and 11.

m. Comment: **Endangered Species Act Compliance**. Page 12 under Endangered Species, the EA mentions effects to the Indiana bat and its habitat "would have an infinitesimally small chance of resulting in direct or indirect take". Has a Biological Assessment been made, as required by ER 1105-2-100, Appendix C paragraph .c.(2)(a)(1) and has the US Fish and Wildlife Service issued a Biological Opinion, or a letter of concurrence with a finding of "no adverse effect" as described in paragraph c.(2)(b)(2)?

Response: The February 6, 2001 letter received from the Fish and Wildlife Service indicated in paragraph two that "We indicated that projects disturbing less than 17 acres of potential Indiana bat summer foraging and roosting habitat were considered by the Service to have a very small chance (at the 98% confidence level) of resulting in direct or indirect take." Also, in the third paragraph the FWS stated "Therefore, *the Service considers the proposed action discountable and unlikely to adversely affect the Indiana bat*. Therefore, no further Section 7 consultation under the Endangered Species Act (87Stat. 884, as amended; 16 U.S.C. 1531 et seq.) is required."

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Assessment: The issue will be resolved by revising the report to document the status of compliance requirements.

Resolution: Page 12 of the document has been revised to reflect the completion of compliance requirements of the Endangered Species Act.

n. Comment: **Cultural Resources**. Page 12 under Sensitive Cultural Resources, there is no discussion. Page 14 under Cultural Resources, there is mention of a literature investigation. A literature search is only the beginning of the compliance process, further investigations are required to locate, identify and evaluate historic properties that will be impacted by project construction. This should include historic assessments and determinations of eligibility for the buildings and structures that will be removed or altered by project activities. The EA also states that, "If significant historic properties are encountered during construction, appropriate mitigation measures will be incorporated". The National Historic Preservation Act requires agencies to locate and evaluate historic properties and to mitigate for potential impacts before construction starts. The report should include documentation of concurrence of findings from SHPO.

Response: A discussion under Sensitive Cultural Resources will be written to explain briefly what is considered sensitive cultural resources. *Resolution: Text has been added on page 12 to clarify the definition of Sensitive Resources as meant under Section 3.3. Sensitive Resources in the LPP can be described as Socio-economic Factors, Education, Recreation, Aesthetics, Cultural Resources, Air Quality and Noise Impacts.* The Island Creek Cultural Resources Report (located in Appendix C) was performed by this district in April 2001. Correspondence with WVSHPO indicated their concurrence with the findings of the report. Both entities concluded that two historically significant structures (Appalachian Power Company building and the CSX railroad bridge) were located adjacent to the project but will not be affected by the project. An April 27, 2001 letter from the WVSHPO concluded that the proposed activities would have *No Adverse Effect* on these two structures. The correspondence with the WVSHOP is located in Appendix C. *Resolution: The report has been revised (page 14) to reflect documentation of concurrence of findings WVSHPO and the Island Creek Cultural Resources Report and other coordination letters may be found in Appendix C.*

Assessment: The issue will be resolved by revising the report to accurately reflect the status of coordination and compliance requirements.

Resolution: Each item in the response is addressed individually in italics above.

o. Comment: **FONSI**. The FONSI states under section 2.b. that "No archeological resources are recorded in the project area". As commented above, a literature search is only the beginning of the cultural resources compliance process. The appropriate investigations should be completed and coordinated with the State Historic Preservation Officer (SHPO). Under section 2.d. of the FONSI, reference to the proper citation should be Section 106 and 32 CFR Part 800.

Response: The proper documentation of investigation was recorded in the Island Creek Local Protection Plan Cultural Resources Reconnaissance Report. The report was provided to the WVSHPO and this district received a response concerning the Reconnaissance Report on April 27, 2001 that indicated no further action was necessary.

Assessment: The issue will be resolved by revising the report to document the completion of the required coordination. The FONSI should be revised to cite Section 106 and 32 CFR Part 800.

Resolution: The report has been revised to document the completion of the required coordination beginning on page. Section 2.d of the FONSI, has been revised to include the proper citation of Section 106 and 32 CFR, Part 800.

p. Comment: **Cultural Resources**. The Cultural Resources Reconnaissance Report does not mention the buildings and bridges that will be altered or removed, and therefore, impacted by project activities.

Response: The Super 8 Motel and the outbuilding on the Baisden Hardware Store property were not included in the Cultural Resources Reconnaissance Report because both building are less than 50 years old and are obviously not eligible for inclusion in the National Register.

Assessment: The issue will be resolved by revising the report to clarify that the buildings to be removed are not eligible for inclusion in the National Register.

Response: The FEA on pages 7-8 was revised documenting that the building to be removed are not eligible for inclusion in the National Register.

q. Comment: **District Legal Review**. The subject report was submitted without evidence that the District Office of Counsel has certified it as legally sufficient. This certification is required in order for the Office of the Chief Counsel to complete its review. Certification of legal review should be submitted with the revised GRR.

Response: A signed certification sheet will be added to the GRR.

Assessment: The issue will be resolved by including District legal review certification with the revised report to be submitted to HQ.

Resolution: A legal certification sheet signed on 3 April 2002 is included under the tab labeled "Legal Certification, ITR(2), HQ Comment/LRH Responses"

r. Comment: **Multiple Sponsors.** The report identifies the Logan County Commission, West Virginia as the local sponsor with financial support from the West Virginia Soil Conservation Agency. Current Corps policy places a high preference on implementing a project through a secure partnership with a single sponsor. It is not uncommon for sponsors to enter into cooperative arrangements or sub-agreements with other entities to enable it to provide all aspects of its required cooperation. However, the Corps normally prefers to avoid the additional burden of reviewing the capabilities and commitment of such third parties and relying upon cooperation among various parties during project implementation. If multiple sponsorship is deemed to be absolutely necessary, the report should document whether and in what manner any local cooperation requirements will be divided among multiple parties, including assignment of liability risk.

Response: A single agreement is anticipated with the Logan County Commission.

Assessment: The issue will be resolved by revising the report to clarify the roles and responsibilities of the State and County.

Resolution: The information can be found in the main report under Section XIII., C.

s. Comment: **Items Of Local Cooperation.** Pages 35 to 38 of the report contain an inaccurate and incomplete description of local cooperation requirements for the project. A complete and accurate list is required. The Office of Chief Counsel, HQUSACE offers the following draft list. The District should review this list carefully, with the assistance of its Office of Counsel, and revise it further as needed to address the needs or the current project.

a. Provide a minimum of 25 percent, but not to exceed 50 percent of total project costs as further specified below:

(1) Enter into an agreement which provides, prior to execution of the project cooperation agreement, 25 percent of design costs;

(2) Provide, during construction, any additional funds needed to cover the non-federal share of design costs;

(3) Provide, during construction, a cash contribution equal to 5 percent of total project costs assigned to structural flood control;

(4) Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations determined by the Government to be necessary for the construction, operation, and maintenance of the project;

(5) Provide or pay to the Government the cost of providing all retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring features and stilling basins, that may be required at any dredged or excavated material disposal areas required for the construction, operation, and maintenance of the project; and

(6) Provide, during construction, any additional costs as necessary to make its total contribution equal to at least 25 percent of total project costs.

b. Give the Government a right to enter, at reasonable times and in a reasonable manner, upon land which the local sponsor owns or controls for access to the project for the purpose of inspection, and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the project.

c. Assume responsibility for operating, maintaining, replacing, repairing, and rehabilitating (OMRR&R) the project or completed functional portions of the project, including mitigation features without cost to the Government, in a manner compatible with the project's authorized purpose and in accordance with applicable Federal and State laws and specific directions prescribed by the Government in the OMRR&R manual and any subsequent amendments thereto.

d. 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 non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element.

e. Hold and save the Government free from all damages arising for the construction, operation, maintenance, repair, replacement, and rehabilitation of the project and any project-related betterments, except for damages due to the fault or negligence of the Government or the Government's contractors.

f. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project to the extent and in such detail as will properly reflect total project costs.

g. Perform, or cause to be performed, 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 USC 9601-9675, that may exist in, on, or under lands, easements or rights-of-way necessary for the construction, operation, and maintenance of the project; except that the non-Federal sponsor shall not perform such investigations on lands, easements, or rights-of-way that the Government determines to be subject to the navigation servitude without prior specific written direction by the Government.

h. Assume complete financial responsibility 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 Government determines necessary for the construction, operation, or maintenance of the project.

i. Agree that, as between the Federal Government and the non-Federal sponsor, the non-Federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and, to the maximum extent practicable, operate, maintain, repair, replace, and rehabilitate the project in a manner that will not cause liability to arise under CERCLA.

j. Prescribe and enforce regulations to prevent obstruction of or encroachment on the Project that would reduce the level of protection it affords or that would hinder operation or maintenance of the Project.

k. 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 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR part 24, in acquiring lands, easements, and rights-of-way, and performing relocations for construction, operation, and maintenance of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act.

l. Comply with all applicable Federal and State laws and regulations, including Section 601 of the Civil Rights Act of 1964, Public Law 88-352, 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 Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), requiring non-Federal participation and implementation of floodplain management plans;

m. 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, in accordance with the cost sharing provisions of the agreement;

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n. Participate in and comply with applicable Federal floodplain management and flood insurance programs;

o. Do not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is authorized.

p. Inform affected interests, at least annually, regarding the limitations of the projection afforded by the project.

Response: The GRR will be revised accordingly.

Assessment: As documented in paragraph 3.f., the project features being recommended for implementation include a separable nonstructural element (i.e.; flood warning system). The list of items of local cooperation provided in the Headquarters policy review comments did not address nonstructural features. The following items are offered for consideration to replace the original draft item a. The District should review this list carefully, with the assistance of its Office of Counsel, and revise it further as needed to address the needs or the current project. The issue will be resolved by revising the report to include the proper items of local cooperation.

Resolution: The original revised list from HQ is provided in the current version of the report sent on 10 April 2002. The District reviewed the newly provided list and the applicable structural/non-structural cost sharing requirements and made no changes to what was provided. The District has provided revised pages 37-40 to the main report in the Addendum.

a. Provide a minimum of 25 percent, but not to exceed 50 percent of total project costs allocated to structural flood control as further specified below:

(1) Enter into an agreement which provides, prior to execution of the project cooperation agreement, 25 percent of design costs allocated to structural flood control;

(2) Provide, during construction, any additional funds needed to cover the non-federal share of design costs allocated to structural flood control;

(3) Provide, during construction, a cash contribution equal to 5 percent of total project costs assigned to structural flood control;

(4) Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations determined by the Government to be necessary for the construction, operation and maintenance of the structural flood control features;

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(5) Provide or pay to the Government the cost of providing all retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring features and stilling basins, that may be required at any dredged or excavated material disposal areas required for the construction, operation, and maintenance of the structural flood control features; and

(6) Provide, during construction, any additional costs as necessary to make its total contribution equal to at least 25 percent of total project costs allocated to structural flood control.

b. Provide a minimum of 25 percent of total project costs allocated to nonstructural flood control as further specified below:

(1) Enter into an agreement which provides, prior to execution of the project cooperation agreement, 25 percent of design costs allocated to nonstructural flood control;

(2) Provide, during construction, any additional funds needed to cover the non-federal share of design costs allocated to nonstructural flood control;

(3) Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations determined by the Government to be necessary for the construction, operation and maintenance of the nonstructural flood control features;

(4) Provide or pay to the Government the cost of providing all retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring features and stilling basins, that may be required at any dredged or excavated material disposal areas required for the construction, operation, and maintenance of the nonstructural flood control features; and

(5) Provide, during construction, any additional costs as necessary to make its total contribution equal 25 percent of total project costs allocated to nonstructural flood control.

t. Comment: **Relocations Assistance**. Paragraph 8 of the Real Estate Plan refers to Public Law 91-646 Relocation Data. Although it would have been more accurate to title it "Relocation Assistance Data", the paragraph correctly describes the types of benefits that are available to persons displaced from businesses and residences. However, the summary version found in paragraph B of Page 30 of the main report is misleading. Residences are not relocated and neither are businesses. In the second paragraph, the sentences should read, "No residences are to be acquired. There is one commercial acquisition."

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Response: The text in the main report will be revised as suggested.

Assessment: The issue will be resolved by revising the report to clarify that only one commercial property will be acquired for the project.

Resolution: The suggested change was made to the main report and can be found in Paragraph B of page 33 in the main report.

u. Comment: **Design Documents.** The text indicates that the reevaluation report contains sufficient detail to eliminate the need for a GDM and proceed with the preparation of project plans and specifications. Note that ER 1110-2-1150 replaces the General Design Memorandum with an Engineering Documentation Report (EDR), which is a living document that continues through the preparation of Plans and Specifications. The revised text should state that the PED will consist primarily of the preparation of Plans and Specifications and that documentation in the EDR would be minimized based on the detail contained in the GRR.

Response: Text will be revised to indicate that a Design Documentation Report (DDR) will be prepared. Upon approval of the design, we will proceed with Plans and Specifications and update the DDR as these develop.

Assessment: The original Headquarters comment was incorrect in stating that an EDR should be prepared. The District's response cites the correct document – a DDR. The issue will be resolved by revising the report to indicate that a DDR will be prepared.

Resolution: Reference to a GDM has been removed from the first paragraph of the report and a statement added about proceeding directly to plans and specifications.

v. Comment: **Authorized Project.** The subject GRR makes many references to the "authorized" project. Recommend revising these references to the "original" project. Thus, the report will distinguish between the two plans as the original project and the recommended project.

Response: As previously stated, the GRR does not recommend any significant changes to the Island Creek Local Protection Project authorized in WRDA 1986. The report recommends implementation of the structural component of the authorized project (0.7 mile of channel modification) as a separable element and deferral of the implementation of nonstructural measures. The structural component recommended in this report differs slightly from the structural component presented in the Feasibility Report due to design refinements. The report will be revised to distinguish between the "original" structural component and the "recommended" structural component. A discussion of the changes will be included in the report.

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Assessment: The issue will be resolved by revising the report to clearly define the scope of the original structural and nonstructural (i.e.; floodproofing and acquisition) features of authorized project and the scope of the structural and nonstructural (i.e.; Flood Warning System) features being recommended for implementation

Resolution: Changes where made throughout the main report to clarify the differences between the authorized project and the recommended project (see resolution to Comment b. above).

ADDENDUM

TO

GENERAL REEVALUATION REPORT

MAIN REPORT AND
ENVIRONMENTAL ASSESSMENT

ISLAND CREEK
LOCAL PROCTECTION PROJECT
LOGAN, WEST VIRGINIA

JULY 2002

H. NED Plan and Project Economics

The 100-Foot Channel Plan has been designated as the NED plan. However, the 80-Foot Channel Plan has been selected as the recommended plan for the following reasons:

1) statistically the same net benefits as the NED plan,
2) less impact to existing commercial development,
3) less social and environmental impacts than the NED plan, and
4) the 80-Foot Channel is the locally preferred plan.

The 80-Foot channel plan has expected annual benefits of $3.9 million, expected annual costs of $1.5 million, net benefits of $2.6 million and a benefit cost ratio of 2.63 to 1.

I. Cost Sharing

For the structural elements, the non-Federal sponsor will be responsible for all lands, easements, rights-of-way, relocations, and disposal areas (LERRD). The sponsor must also provide a minimum of five percent of the project cost in cash. The total non-Federal share must be at least 25 percent and not more than 50 percent of the total project cost. If the non-Federal share including the items above should be less than 25 percent, the sponsor must pay any additional amounts necessary for the non-Federal share to equal 25 percent. The cost share requirements reflect the requirement, which existed at the time of original project authorization. The details regarding cost share and sponsor responsibilities can be found in Section XIV., B. Division of Plan Responsibilities.

For the non-structural element (the flood warning system), the sponsor has a cost share requirement of 25%. Since no LERRD is necessary for the flood warning system, the entire 25% will be in the form of cash.

Table 16 shows the break out of the project cost and the Federal and non-Federal share. Total project cost is $23.8 million with $15.0 million being the Federal responsibility and $8.8 million as the non-Federal share. This non-Federal share represents approximately 37 percent of total project cost. These figures are based on costs contained in the fully funded baseline cost estimate.

TABLE 16 – COST SHARE REQUIREMENTS (FULLY FUNDED)
(in $1,000s)

Total Project Cost		**$23,805.5**	
Federal Share		**$14,931.7**	
Non Federal Share		**$8,873.9**	
Non-Federal Share		Structural Element	Non-Structural Element
	01 Lands & Damages	$6,461.0	
	02 Relocations	$1,153.0	
	5% of Structural Project in Cash	$1,172.9	09 Channels & Canals 25% of $348.1
Non-Federal Share		$8,786.9	$87.0

XII. PLAN ACCOMPLISHMENTS

The implementation of the recommended plan (80-Foot Channel Plan) would result in a project that would provide reductions in flooding depths along the lower portion of Island Creek. Specifically for a 100-yr flood the flooding depths would be reduced 4.4 ft., 6.6 ft., and 6.3 ft. at 1,000 ft., 2,000 ft., and 3,000 ft. upstream of the mouth respectively. For more detailed information on the flood reductions at other frequencies and locations, see Exhibit A-II-10 in Tab II, Hydrology and Hydraulics Section of the Engineering Technical Appendix. The project would prevent $3.9 million or about 58% of the Without Project expected annual damages estimated to occur under existing conditions. The plan has net benefits of $2.58 million and has a benefit-to-cost ratio of 2.6 to 1. The project avoids detrimental social, environmental, and economic impacts and provides a betterment of public safety through reduced flooding and warning.

XIII. PLAN IMPLEMENTATION

A. Institutional Requirements

Prior to initiation of construction, Congress must appropriate funds for the Federal share of project costs. Requirements for non-Federal participation must also be met prior to initiation of construction. This includes the execution of a Project Cooperation Agreement (PCA) between the local sponsor and the Federal government and the provision of all funds and/or work necessary to satisfy the cost sharing requirements in effect at the time of PCA execution. Upon completion of construction, the project will be turned over to the local sponsor for operation and maintenance.

B. Division of Plan Responsibilities

The implementation of the recommended plan of development is the joint responsibility of the Corps of Engineers (representing the Federal government) and the Logan County Commission, West Virginia (the local sponsor) with financial support from the West Virginia Soil Conservation Agency (WVSCA). The Corps of Engineers will complete the plans and specifications, provide funds for project construction, construct the project, and make an annual inspection of the conditions of the project. The following is a list of the non-Federal sponsor's required responsibilities for the project (Logan County Commission along with WVSCA):

a. Provide a minimum of 25 percent, but not to exceed 50 percent of total project costs allocated to structural flood control as further specified below:

(1) Enter into an agreement which provides, prior to execution of the project cooperation agreement, 25 percent of design costs allocated to structural flood control;

(2) Provide, during construction, any additional funds needed to cover the non-federal share of design costs allocated to structural flood control;

(3) Provide, during construction, a cash contribution equal to 5 percent of total project costs assigned to structural flood control;

(4) Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations determined by the Government to be necessary for the construction, operation and maintenance of the structural flood control features;

(5) Provide or pay to the Government the cost of providing all retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring features and stilling basins, that may be required at any dredged or excavated material disposal areas required for the construction, operation, and maintenance of the structural flood control features; and

(6) Provide, during construction, any additional costs as necessary to make its total contribution equal to at least 25 percent of total project costs allocated to structural flood control.

b. Provide a minimum of 25 percent of total project costs allocated to nonstructural flood control as further specified below:

(1) Enter into an agreement which provides, prior to execution of the project cooperation agreement, 25 percent of design costs allocated to nonstructural flood control;

(2) Provide, during construction, any additional funds needed to cover the non-federal share of design costs allocated to nonstructural flood control;

(3) Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations determined by the Government to be necessary for the construction, operation and maintenance of the nonstructural flood control features;

(4) Provide or pay to the Government the cost of providing all retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring features and stilling basins, that may be required at any dredged or excavated material disposal areas required for the construction, operation, and maintenance of the nonstructural flood control features; and

(5) Provide, during construction, any additional costs as necessary to make its total contribution equal 25 percent of total project costs allocated to nonstructural flood control.

c. Give the Government a right to enter, at reasonable times and in a reasonable manner, upon land which the local sponsor owns or controls for access to the project for the purpose of inspection, and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the project.

d. Assume responsibility for operating, maintaining, replacing, repairing, and rehabilitating (OMRR&R) the project or completed functional portions of the project, including mitigation features without cost to the Government, in a manner compatible with the project's authorized purpose and in accordance with applicable Federal and State laws and specific directions prescribed by the Government in the OMRR&R manual and any subsequent amendments thereto.

e. 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 non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element.

f. Hold and save the Government free from all damages arising for the construction, operation, maintenance, repair, replacement, and rehabilitation of the project and any project-related betterments, except for damages due to the fault or negligence of the Government or the Government's contractors.

g. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project to the extent and in such detail as will properly reflect total project costs.

h. Perform, or cause to be performed, 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 USC 9601-9675, that may exist in, on, or under lands, easements or rights-of-way necessary for the construction, operation, and maintenance of the project; except that the non-Federal sponsor shall not perform such investigations on lands, easements, or rights-of-way that the Government determines to be subject to the navigation servitude without prior specific written direction by the Government.

i. Assume complete financial responsibility 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 Government determines necessary for the construction, operation, or maintenance of the project.

j. Agree that, as between the Federal Government and the non-Federal sponsor, the non-Federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and, to the maximum extent practicable, operate, maintain, repair, replace, and rehabilitate the project in a manner that will not cause liability to arise under CERCLA.

k. Prescribe and enforce regulations to prevent obstruction of or encroachment on the Project that would reduce the level of protection it affords or that would hinder operation or maintenance of the Project.

l. 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 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR part 24, in acquiring lands, easements, and rights-of-way, and performing relocations for construction, operation, and maintenance of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act.

m. Comply with all applicable Federal and State laws and regulations, including Section 601 of the Civil Rights Act of 1964, Public Law 88-352, 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 Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), requiring non-Federal participation and implementation of floodplain management plans;

n. 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, in accordance with the cost sharing provisions of the agreement;

o. Participate in and comply with applicable Federal floodplain management and flood insurance programs;

p. Do not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is authorized.

q. Inform affected interests, at least annually, regarding the limitations of the projection afforded by the project.

Preliminary discussions were held with the Logan County Commission concerning their legal capability to sponsor, ability to acquire real estate and PL 91-646 requirements as well as documentation of LERRD costs. The PCA specifying the responsibilities of the two parties must be consummated prior to the initiation of construction. The estimated Federal cost of construction is $15.0 million. The estimated non-Federal first cost is $8.8 million and the estimated cost of operation and maintenance is $67,700 annually.

C. Views of the Non-Federal Sponsor

During the course of the study, the Logan County Commission has demonstrated an interest and support in the development and implementation of a project that would reduce flood damages in the Island Creek area. However, at a meeting attended by the three Logan County Commissioners on 13 October 1993, the Commission President explained that Logan County was in no position to finance their share of construction costs. While they were unable to financially

XV. CONCLUSIONS

This report does not recommend any significant changes to the Island Creek Local Protection Project authorized in WRDA 1986. The authorized project consists of both structural and nonstructural components. This report recommends implementation of the structural component (0.7 mile of channel modification) of the authorized project as a separable element and a flood warning system (non-structural). The structural component recommended in this report differs slightly from the original structural component identified in the Island Creek Feasibility Report dated March 1985. The design of the channel modification has been refined in response to changes in the project area and the availability of additional engineering data. Changes to the scope, costs and outputs related to the structural component are relatively minor and are primarily related to design refinements. At the request of the local sponsor and with the concurrence of LRD, the evaluation of the nonstructural components of the authorized project has been deferred. Authority for post authorization changes for approval should be postponed until such time that entire project has been reevaluated and significant changes identified.

The reevaluation studies contained herein have concluded that the recommended plan (80-Foot Channel Plan) a 0.7 mile long channel modification project to reduce flood damages is in the federal interest and is economically feasible with a benefit-to-cost ratio of 2.63 to 1. The recommended channel plan provides protection for approximately a 10-year event for most structures in the project area and produces expected annual net benefits of $2.6 million. The recommended plan also includes a basin-wide flood warning system that has been found to be incrementally justified. Although the recommended plan is not the NED plan, it produces statistically the same amount of net benefits and because of environmental and social considerations documented in this report is clearly the superior plan. The 80-Foot Channel Plan is also the non-Federal sponsor's preferred plan. For these reasons, the 80-Foot Channel Plan is the recommended plan for water resources development in the Island Creek area.

The Logan County Commission has stated that it is financially unable at this time to meet the cost sharing requirements for the additional nonstructural components (excluding the flood warning system) of the authorized plan. Therefore, it is further concluded that reevaluation of the nonstructural component of the authorized plan should be deferred until such time as a willing and capable nonfederal sponsor expresses interest in the implementation of such measures.

XVI. RECOMMENDATION

Based upon findings contained herein and the Environmental Assessment, I recommend that the 80-Foot Channel Plan be implemented as a separable element pursuant to the authorization contained in the 1986 Water

Resources Development Act (P.L. 99-662). I further recommend that the nonstructural component of the authorized plan be deferred at this time.

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 state, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

JOHN D. RIVENBURGH
COLONEL, Corp of Engineers
Commanding

Finding of No Significant Impact
Island Creek Basin
Local Protection Project
Logan, West Virginia

1. I have conducted an environmental assessment in the overall public interest concerning implementation of the Island Creek Basin Local Protection Plan. The purpose of this project is to reduce flooding damages with the Island Creek Basin and to improve response time of the community in the event of a flood situation as authorized in Section 202 of PL 96-367.

2. The possible consequences of the project have been studied for environmental, cultural and social impacts. Another factor bearing on my assessment was the capability of the project to meet the public needs for which it was proposed. The following references the assessment:

a. Environmental Considerations. The Huntington District has taken reasonable measures to assemble and present the known or foreseeable environmental impacts of the project in the environmental assessment. These impacts involve biological and human resources. All adverse effects of project implementation are considered insignificant or will be avoided through best management techniques.

b. Social Well-Being Considerations. The proposed project will provide reduced flooding damages with the Island Creek Basin and improve response time of the community in the event of a flood situation. No significant economic or social well-being impacts are forseen as a result of the proposed project. No archeological resources are recorded in the project area. There would be temporary visual and noise impacts associated with construction, however these are considered minor and will cease once project is constructed.

c. Coordination with Resource Agencies. Pursuant to the Fish and Wildlife Coordination Act (FWCA) of 1958, coordination with the U.S. Fish and Wildlife Service and the West Virginia Department of Natural Resources has been maintained throughout the study. Appropriate measures and best management practices have been identified and incorporated into the plan. Also, in accordance with the Endangered Species Act, as amended, the recommended plan would not impact listed species.

d. Other Pertinent Compliance. No prime or unique farmland under the Farmland Protection Policy Act will be involved. The proposed action is also in compliance with the National Historic Preservation Act, (Section 106 32 CFR 800), Executive (EO) 11988 (Floodplain Management) and EO 11990 (Protection of Wetlands).

ISLAND CREEK LOCAL PROTECTION PROJECT AT LOGAN, WV GENERAL REEVALUATION REPORT

EXECUTIVE SUMMARY

This report has been prepared as a reevaluation of the Island Creek Local Protection Project that was authorized in the Section 401 of the Water Resources Development Act of 1986 (PL 99-662). This reevaluation confirms economic feasibility and re-affirms the National Economic Development (NED) plan.

The Island Creek project area includes the 500-year floodplain along Island Creek from its confluence with the Guyandotte to a point approximately 9,000 feet upstream. This area has experienced numerous damaging floods during the past. Flood damages caused by the occurrence of a 100-year flood event of Island Creek under existing conditions would exceed $40.5 million (October 2000 price level).

The recommended plan is a channel modification consisting of widening the channel to 80 feet beginning at the confluence of the Guyandotte River and Island Creek and continuing 3, 600 feet upstream. The plan includes two post and panel walls constructed in locations to protect specific commercial structures, removal of an existing sand bar, a flood warning system (FWS), and aquatic and terrestrial mitigation features. This plan provides between a 10- and 20-year level of protection and has annual net benefits of $2.14 million. The benefit-to-cost ratio is 2.3 to 1. Based upon additional analysis of the nonstructural component of the authorized plan, it has been concluded by this reevaluation study and affirmed by the Division Office, that the nonstructrural component is not economically justified at this time. Therefore the nonstructural component of the authorized plan has been deferred until such time as it can be justified for implementation.

The Logan County Commission will serve as the non-Federal sponsor for the project and the West Virginia Soil Conservation Agency (WVSCA) has agreed to provide non-Federal financial support. The cost share requirement for this project is 25% of the total project cost with a minimum of 5% of the total project cost being paid in cash in addition to being responsible for all lands, easements, rights-of-way, relocations, and disposal areas (LERRD). The estimated total project cost for the recommended plan is $23.4 million (fully funded) which includes Preconstruction, Engineering, and Design (PED). The non-Federal share including the LERRD requirement is $8.8 million or about 38% of the total project cost. The Logan County Commission will also satisfy the operation and maintenance (O&M) requirements of the project including the FWS.

An Environmental Assessment (EA) has been prepared and implementation of the project is considered to have insignificant environmental impacts. The EA has been circulated for public and agency review and was received favorably by all entities. The District Engineer has executed a Finding of No Significant Impact (FONSI).

Borden, Andrew D LRH

From: Worley, Stephen M LRH
Sent: Thursday, November 01, 2001 8:25 AM
To: Borden, Andrew D LRH; Borda, Ben LRH; Edwards, Rick LRH; McKinley, Natalie J LRH; Frantz, Amy K LRH; Weekley, William R LRH; Huff, Fred E LRH; Ramey, Julia G LRH
Cc: Twohig, James B JR LRH; Mullins, Ginger LRH
Subject: RE: Decisions from Island Creek Meeting (31 Oct 01) draft

Andy:

I have 3 comments.

1. Under #4, I would eliminate any discussion in the comment response that the nonstructural components are not economically feasible. I do not know if we have investigated the costs thoroughly enough (which would be a structure-by-structure analysis) to make that statement. Let's just leave it that we are recommending implementation of the channel at this time.

2. In #11.a., upon our evaluation as to whether an environmental feature is sound design or mitigation, we may or may not need to go back to the resource agencies. We'll just have to compare what mitigation is required as a result of our analysis and the PAL. We only need to go back to the resource agencies if we change mitigation features.

3. For #17, I don't think we concur in this comment. We are still building the authorized project – only a portion of it (incrementally justified, separable element) at this time. The remaining authorized project is being deferred until a later date.

These are for your and the team's consideration.

Mike

-----Original Message-----
From: Borden, Andrew D LRH
Sent: Wednesday, October 31, 2001 5:51 PM
To: Worley, Stephen M LRH; Borda, Ben LRH; Edwards, Rick LRH; McKinley, Natalie J LRH; Frantz, Amy K LRH; Weekley, William R LRH; Huff, Fred E LRH; Ramey, Julia G LRH; Borden, Andrew D LRH
Cc: Twohig, James B JR LRH
Subject: Decisions from Island Creek Meeting (31 Oct 01) draft

PLEASE REVIEW AND PROVIDE ANY CHANGES YOU SEE NECESSARY

THANKS,

ANDY

1. On 31 October 2001 the follow met to discuss the policy review comments received from HQ concerning the Island Creek GRR.

Andy Borden (PM-P)
Fred Huff (EC-TC)
Bill Weekley (EC-DC)
Grace Ramey (PM-P)
Amy Frantz (PM-PD-R)

Ben Borda (PM-PD)
Natalie Mckinley (PM-PD-F)
Mike Worley (PM-PD)
Rick Edwards (PM-PD-F)

2. Each of the following comments were discussed and individuals were tasked to prepare written responses. Bolded (red) text indicates element responsible for addressing comment followed by brief summary of discussion.

3. **PROJECT DESCRIPTION**. Inconsistent descriptions of the project are cited throughout the GRR. Portions of the report indicate that two commercial structures would be "removed"; other sections cite one commercial relocation. The GRR should be revised to consistently describe the recommended plan throughout the report. **(PM-PD-F) Decision was made to concur and make necessary changes.**

discuss 4. **POST AUTHORIZATION CHANGES**. There is no evaluation of post authorization changes in the GRR; however, the recommended plan appears to have a significantly different scope, output, and cost from the authorized project, due to the elimination of the flood proofing and raising features and reduction in channel width from 100 to 80 feet. The Ohio River Division gave its approval to defer the evaluation of the uneconomical non-structural components in 1991. However, the revised GRR should present sufficient information to address the significance of the post authorization changes and to determine the appropriate authority for approval of changes, including the decrease in project costs relative to Section 902. **(PM-PD-F) Decision was made to discuss this issue with LRD and HQ prior to submitting a written response. However, the district's position remains the same - The recommended project is not a post authorization change, but rather a separable element of the authorized project.** ~~**Non-structural measures are not incrementally justified and recommendations to implement this element have been deferred.**~~

discuss 5. **RISK AND UNCERTAINTY ANALYSIS**. The GRR indicates that risk and uncertainty analyses as required by ER 1105-2-100 were not completed for the current proposal. The GRR should be revised to comply with current policy in regard to R&U analyses for flood damage reduction studies. **(PM-PD-F) Decision was made to discuss this issue with LRD and HQ prior to submitting a written response. Natalie believes this effort will involve collecting and analyzing additional field data as well as re-running the water surface profiles. This effort could be time consuming and costly. A suggestion was made to contact Louisville District for an approved example of a R&U analysis.**

discuss 6. **ECONOMIC EVALUATION**. ER 1105-2-100, appendix G, paragraph G-9.h.(3) states the following: "Detailed economic data and any derivations from that data to support plan formulation, forecasts, and detailed explanations of benefits should be provided. Describe the with and without project physical, biological and economic conditions of the study area and how each category of benefits was computed." The GRR does not include an economics appendix. There is only minimal information on the derivation of flood damage reduction benefits claimed. The main report provides some information about the substantially larger project area that was associated with authorized project. However, there is no information on the numbers and types of structures subject to flooding in the current evaluation. There is no information on structure and content value assumptions, etc. Absent this information, the reasonableness of the evaluation can not be assessed. Additionally, Table 10 of the GRR indicates that without-project damages are 9.7 million while table 12 indicates "base condition" damages as $6.5 million. Details of the economic evaluation should be included in the revised GRR. **(PM-PD-F) Decision was made to discuss this issue with LRD and HQ prior to submitting a written response. Depending upon the level of detail and type of information required, an economic appendix could be prepared as backup to the current plan formulation and benefit analysis. It was agreed that further description was required in the text to clarify the difference between numbers presented in tables 10 and 12.**

7. **POST AND PANEL WALL SEGMENTS**. Notes to the M-CACES estimate state that the two post and panel wall segments are included in the plan to avoid acquisition of two commercial structures on the left descending bank of Island Creek. The revised GRR should document that the cost of each wall segment is less than the cost of structure acquisition. Verify that the recommended plan is the NED plan. **(EC-DC, EC-TC, PM-PD-F) Decision was made to concur by incrementally showing the difference in cost between the wall segments and acquisition. Furthermore, research formulation of the walls to see**

if they were intended to provide additional benefits (better hydraulics, avoid HTRW contaminated soils, slope stability issues, locally preferred...). It was also suggested that reference should be made to the table in the main report that shows the array of alternatives with respective net benefits. This table compares alternatives with and without the retaining walls and clearly shows that the alternative with the wall yielded higher net benefits.

discuss

8. **FLOOD WARNING SYSTEM**. A flood warning system is included in the final array of alternatives leading to the selection of the recommended plan. However, it is not evident that there was an explicit analysis of the benefits and costs of the system or whether it would reduce the benefits attributed to the structural features by increasing the time available for temporary evacuation of damageable property from the flood plain. The GRR should demonstrate that the FWS is economically justified. **(PM-PD-F) Decision was made to discuss this issue with LRD and HQ prior to submitting a written response. However, it appeared there would be little problem in incrementally justifying a $200k FWS as part of a $24M project. The district needs further guidance on how much analysis is required to show in GRR.**

discuss

9. **SUNK PED COSTS**. The M-CACES estimate shows $2,000,000 assigned to "post feasibility studies." Verify that all past PED expenditures have been included in the estimate of total project costs to be apportioned. Note that sunk PED expenditures should not be included in the current economic evaluation of alternatives. **(PM-PD-F) Decision was made to discuss this issue with LRD and HQ prior to submitting a written response. Further clarification of comment is needed before a response can be made. Not clear if "sunk PED expenditures" refer to all post feasibility costs prior to 1999 or if they include current efforts to update 1993 GRR. The district has always assumed that all PED cost are rolled into total project cost and cost shared. Are "sunk PED expenditures" also exempt from cost sharing?**

Concur

10. **COST SHARING**. Since the project was authorized in WRDA 1986, cost sharing as specified in section 103(a) of this Act appears to be applicable. The project proposal includes both structural and non-structural components. Cost sharing requirements are slightly different for these components—the minimum 5 percent cash requirement is not applicable to non-structural flood control features. Verify that cost sharing shown in the report is correct. **(PM-PD-F) Decision was made to concur and verify that cost sharing requirements for non-structural features (FWS) is correct.**

11. **ENVIRONMENTAL POLICY COMPLIANCE REVIEW.**

a. Mitigation Versus "Sound Environmental Design Practice." The report consistently points out that project will have minimal environmental impacts; however the Executive Summary also states that aquatic and terrestrial mitigation features will be constructed. In paragraph 2.5 (*Environmental Design Measures*), of the Environmental Assessment various "mitigation" elements such as riffle/pool complexes, planting of native vegetation, etc. are proposed. Several plates included in the EA identify "deciduous tree planting area for on-site mitigation" and "typical section" for riffle structures. These measures are proposed to mitigate for loss of riparian habitat, loss of upland and bottomland hardwoods, and for disturbance of aquatic and benthic life. How were these measures selected and what coordination took place to decide which measures would be appropriate? The remainder of the report (text, cost estimates, etc) is virtually silent on mitigation. Recommended mitigation features need to be fully justified. Such justification must be based on determination of significance of losses, incremental analysis, and cost effectiveness, etc. See ER 1105-2-100, Appendix C, paragraph e., beginning on page C-15. Based on the scant information provided in the GRR, in this instance, rather than mitigation, this appears to be a case of "sound environmental design". The report needs to be modified to both fully describe and justify any mitigation features or reflect that these features are simply sound environmental design features. **(PM-PD-R) Decision was made to concur by including the 1993 PAL, which specifies suggested mitigation features. However, a determination must be made on whether or not all or some of the specified "mitigation" could be considered "sound environmental design practice." ~~This determination should be coordinated with respective resource agencies.~~**

b. Coordination. The report references (See FONSI and USFWS letter dated February 6, 2001) a December 1993 USFWS Planning Aid Letter (PAL). The PAL should be included in the report. On page 15 under Public and Agency Coordination, it is stated that agencies would receive documents. At this stage of project planning, coordination should be in its final or completed stages. Has a Public Notice (PN) gone out for public review and comment? **(PM-PD-R) Decision was made to concur by including**

the 1993 PAL and referencing included coordination documentation.

c. Status of Environmental Compliance. Several statements are made on pages 7 and 8 of the Environmental Assessment (EA), dated May 2001, that coordination will or would be obtained for Water Quality Certification and the Fish and Wildlife Coordination Act. The EA also states that if significant historic properties are encountered then appropriate mitigation measures will be incorporated, and the Corps will fully comply with Section 106 consultation. Since this is the Final EA, coordination and compliance with appropriate agencies should be completed and not deferred to a later time. The Coordination Act Report from the US Fish and Wildlife Service should be included, as well as responses to recommendations resulting for Federal and state agency comments resulting from the coordination (see ER 1105-2-100, Appendix C, paragraph c.(1)(a), as an Appendix to the Final EA. **(PM-PD-R) Decision was made to concur by changing text accordingly.**

d. Water Quality. Page 11 of the EA mentions that water quality is poor in the study area and that "Abandoned deep mines are a major source of acid mine drainage" and that "Untreated domestic sewage is a serious problem". These issues, as well as, siltation and turbidity concerns should be addressed for the Water Quality Certification. There is a statement that an erosion control plan would be prepared. The GRR should address the state of erosion control or other plans that have been prepared or that are in preparation. **(PM-PD-R) Decision was made to concur by referencing the included water quality certification. It was also decided to state that erosion control measures have been considered and will be fully developed during preparation of the DDR and P&S.**

e. Endangered Species Act Compliance. Page 12 under Endangered Species, the EA mentions effects to the Indiana bat and its habitat "would have an infinitesimally small chance of resulting in direct or indirect take". Has a Biological Assessment been made, as required by ER 1105-2-100, Appendix C paragraph .c.(2)(a)(1) and has the US Fish and Wildlife Service issued a Biological Opinion, or a letter of concurrence with a finding of "no adverse effect" as described in paragraph c.(2)(b)(2)? **(PM-PD-R) Decision was made to concur by referencing the included 2001 letter from USFWS.**

f. Cultural Resources. Page 12 under Sensitive Cultural Resources, there is no discussion. Page 14 under Cultural Resources, there is mention of a literature investigation. A literature search is only the beginning of the compliance process, further investigations are required to locate, identify and evaluate historic properties that will be impacted by project construction. This should include historic assessments and determinations of eligibility for the buildings and structures that will be removed or altered by project activities. The EA also states that, "If significant historic properties are encountered during construction, appropriate mitigation measures will be incorporated". The National Historic Preservation Act requires agencies to locate and evaluate historic properties and to mitigate for potential impacts before construction starts. The report should include documentation of concurrence of findings from SHPO. **(PM-PD-R) Decision was made to concur by summarizing results of cultural resources analysis and include references to included coordination letters from SHPO.**

g. FONSI. The FONSI states under section 2.b. that "No archeological resources are recorded in the project area". As commented above, a literature search is only the beginning of the cultural resources compliance process. The appropriate investigations should be completed and coordinated with the State Historic Preservation Officer (SHPO). Under section 2.d. of the FONSI, reference to the proper citation should be Section 106 and 32 CFR Part 800. **(PM-PD-R) Decision was made to concur by summarizing results of cultural resources analysis and include references to included coordination letters from SHPO.**

h. Cultural Resources. The Cultural Resources Reconnaissance Report does not mention the buildings and bridges that will be altered or removed, and therefore, impacted by project activities. **(PM-PD-R) Decision was made to concur by summarizing results of cultural resources analysis and include references to included coordination letters from SHPO.**

12. **DISTRICT LEGAL REVIEW**. The subject report was submitted without evidence that the District Office of Counsel has certified it as legally sufficient. This certification is required in order for the Office of the Chief Counsel to complete its review. Certification of legal review should be submitted with the revised GRR. **(PM-PD-F) Decision was made to concur by including a legal certification signature page in the GRR.**

13. **MULTIPLE SPONSORS**. The report identifies the Logan County Commission, West Virginia as the local sponsor with financial support from the West Virginia Soil Conservation Agency. Current Corps policy places a high preference on implementing a project through a secure partnership with a single sponsor. It is not uncommon for sponsors to enter into cooperative arrangements or sub-agreements with other entities to enable it to provide all aspects of its required cooperation. However, the Corps normally prefers to avoid the additional burden of reviewing the capabilities and commitment of such third parties and relying upon cooperation among various parties during project implementation. If multiple sponsorship is deemed to be absolutely necessary, the report should document whether and in what manner any local cooperation requirements will be divided among multiple parties, including assignment of liability risk. **(PM-PD-F) Decision was made to concur by clearly stating that Logan County Commission will be the sole sponsor.**

14. **ITEMS of LOCAL COOPERATION**. Pages 35 to 38 of the report contain an inaccurate and incomplete description of local cooperation requirements for the project. A complete and accurate list is required. The Office of Chief Counsel, HQUSACE offers the following draft list. The District should review this list carefully, with the assistance of its Office of Counsel, and revise it further as needed to address the needs or the current project. **(PM-PD-F) Decision was made to ask RE to review list of requirements and provide concurrence.**

a. Provide a minimum of 25 percent, but not to exceed 50 percent of total project costs as further specified below:

(1) Enter into an agreement which provides, prior to execution of the project cooperation agreement, 25 percent of design costs;

(2) Provide, during construction, any additional funds needed to cover the non-federal share of design costs;

(3) Provide, during construction, a cash contribution equal to 5 percent of total project costs assigned to structural flood control;

(4) Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations determined by the Government to be necessary for the construction, operation, and maintenance of the project;

(5) Provide or pay to the Government the cost of providing all retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring features and stilling basins, that may be required at any dredged or excavated material disposal areas required for the construction, operation, and maintenance of the project; and

(6) Provide, during construction, any additional costs as necessary to make its total contribution equal to at least 25 percent of total project costs.

b. Give the Government a right to enter, at reasonable times and in a reasonable manner, upon land which the local sponsor owns or controls for access to the project for the purpose of inspection, and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the project.

c. Assume responsibility for operating, maintaining, replacing, repairing, and rehabilitating (OMRR&R) the project or completed functional portions of the project, including mitigation features without cost to the Government, in a manner compatible with the project's authorized purpose and in accordance with applicable Federal and State laws and specific directions prescribed by the Government in the OMRR&R manual and any subsequent amendments thereto.

d. 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 non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element.

e. Hold and save the Government free from all damages arising for the construction, operation, maintenance, repair, replacement, and rehabilitation of the project and any project-related betterments, except for damages due to the fault or negligence of the Government or the Government's contractors.

f. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project to the extent and in such detail as will properly reflect total project costs.

g. Perform, or cause to be performed, 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 USC 9601-9675, that may exist in, on, or under lands, easements or rights-of-way necessary for the construction, operation, and maintenance of the project; except that the non-Federal sponsor shall not perform such investigations on lands, easements, or rights-of-way that the Government determines to be subject to the navigation servitude without prior specific written direction by the Government.

h. Assume complete financial responsibility 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 Government determines necessary for the construction, operation, or maintenance of the project.

i. Agree that, as between the Federal Government and the non-Federal sponsor, the non-Federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and, to the maximum extent practicable, operate, maintain, repair, replace, and rehabilitate the project in a manner that will not cause liability to arise under CERCLA.

j. Prescribe and enforce regulations to prevent obstruction of or encroachment on the Project that would reduce the level of protection it affords or that would hinder operation or maintenance of the Project.

k. 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 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR part 24, in acquiring lands, easements, and rights-of-way, and performing relocations for construction, operation, and maintenance of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act.

l. Comply with all applicable Federal and State laws and regulations, including Section 601 of the Civil Rights Act of 1964, Public Law 88-352, 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 Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), requiring non-Federal participation and implementation of floodplain management plans;

m. 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, in accordance with the cost sharing provisions of the agreement;

n. Participate in and comply with applicable Federal floodplain management and flood insurance programs;

o. Do not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is authorized.

p. Inform affected interests, at least annually, regarding the limitations of the projection afforded by the project.

15. **REAL ESTATE**.

a. General. The Real Estate Plan submitted as a part of the General Reevaluation Report meets the requirements of Chapter 12, section of ER 405-1-12. The district has done a thorough job in determining the acquisition criteria for the project.

b. Relocations Assistance. Paragraph 8 of the Real Estate Plan refers to Public Law 91-646 Relocation Data. Although it would have been more accurate to title it "Relocation Assistance Data", the paragraph correctly describes the types of benefits that are available to persons displaced from businesses and residences. However, the summary version found in paragraph B of Page 30 of the main report is misleading. Residences are not relocated and neither are businesses. In the second paragraph, the sentences should read, "No residences are to be acquired. There is one commercial acquisition." **(PM-PD-F) Decision was made to concur by clarifying text in main report as suggested.**

16. **DESIGN DOCUMENTS**. The text indicates that the reevaluation report contains sufficient detail to eliminate the need for a GDM and proceed with the preparation of project plans and specifications. Note that ER 1110-2-1150 replaces the General Design Memorandum with an Engineering Documentation Report (EDR), which is a living document that continues through the preparation of Plans and Specifications. The revised text should state that the PED will consist primarily of the preparation of Plans and Specifications and that documentation in the EDR would be minimized based on the detail contained in the GRR. **(EC-DC) Decision was made to concur by eliminating all references to a GDM and include suggested text. However, verify that a EDR is the same as a DDR.**

17. **AUTHORIZED PROJECT**. The subject GRR makes many references to the "authorized" project. Recommend revising these references to the "original" project. Thus, the report will distinguish between the two plans as the original project and the recommended project. **(PM-PD-F)** ~~**Decision was made to concur as long as it is understood and made very clear that the "recommended project" is a separable element of the "original project" (compared to the 202 authorization) requiring no post authorization change.**~~ Do not concur Will address intent of Comment

NOTICE

ISLAND CREEK, WV

Since Congress has authorized the project, the Army Corps of Engineers does not request that the report be printed. If there are any questions about this, please call Mr. Hannon at Corps Headquarters. You can reach Mr. Hannon at (202) 761-1983.

US Army Corps
of Engineers
Huntington District

ISLAND CREEK
LOCAL PROTECTION PROJECT
AT LOGAN, WEST VIRGINIA

GENERAL REEVALUATION REPORT

MAIN REPORT
ENVIRONMENTAL ASSESSMENT
ENGINEERING TECHNICAL APPENDIX

MAY 2001

ISLAND CREEK AT LOGAN, WEST VIRGINIA, LOCAL PROTECTION PROJECT

GENERAL REEVALUATION STUDY

MAIN REPORT/EA

LIST OF TABLES

LIST OF EXHIBITS

ISLAND CREEK AT LOGAN, WEST VIRGINIA, LOCAL PROTECTION PROJECT

GENERAL REEVALUATION STUDY

MAIN REPORT

I. PURPOSE AND SCOPE

The purpose of this report is to conduct a reevaluation of the Island Creek Local Protection Project that was authorized in the Water Resources Development Act of 1986. Further, this reevaluation is to confirm the economic feasibility of the project; to re-affirm the National Economic Development (NED) plan; and to ensure conformity with current criteria, policy, and guidelines. It is intended that this reevaluation report will provide sufficient detail to allow the District to eliminate the need for a General Design Memorandum and to proceed directly to plans and specifications.

II. AUTHORIZATION

The Island Creek local protection project for flood control was authorized in Section 401 of the Water Resources Development Act of 1986 (P.L. 99-662). Pertinent sections of that authorization are quoted below:

(a) Authorization of Construction. – The following works of improvement for the control of destructive floodwaters are adopted and authorized to be prosecuted by the Secretary substantially in accordance with the plans and subject to the conditions recommended in respective reports designated in this subsection, except as otherwise provided in this subsection:

ISLAND CREEK BASIN, WEST VIRGINA

The project for flood control, Island Creek Basin in and around Logan, West Virginia; Report of the Chief of Engineers dated April 25, 1986, at a total cost of $86,000,000 with an estimated first Federal cost of $62, 200,000 and an estimated first non-Federal cost of $23, 800,000.

STUDY AREA

The original project study area as defined in the Interim Report, Island Creek Basin, Guyandotte Rover Basin Study, dated March 1985 feasibility report, lies within the Island Creek sub-basin of the Guyandotte River Basin (see map on Exhibit 1). This sub-basin drains about 105 square miles of rugged, mountainous terrain and is composed of three major streams – Island Creek, Copperas Mine Fork and Mud Fork.

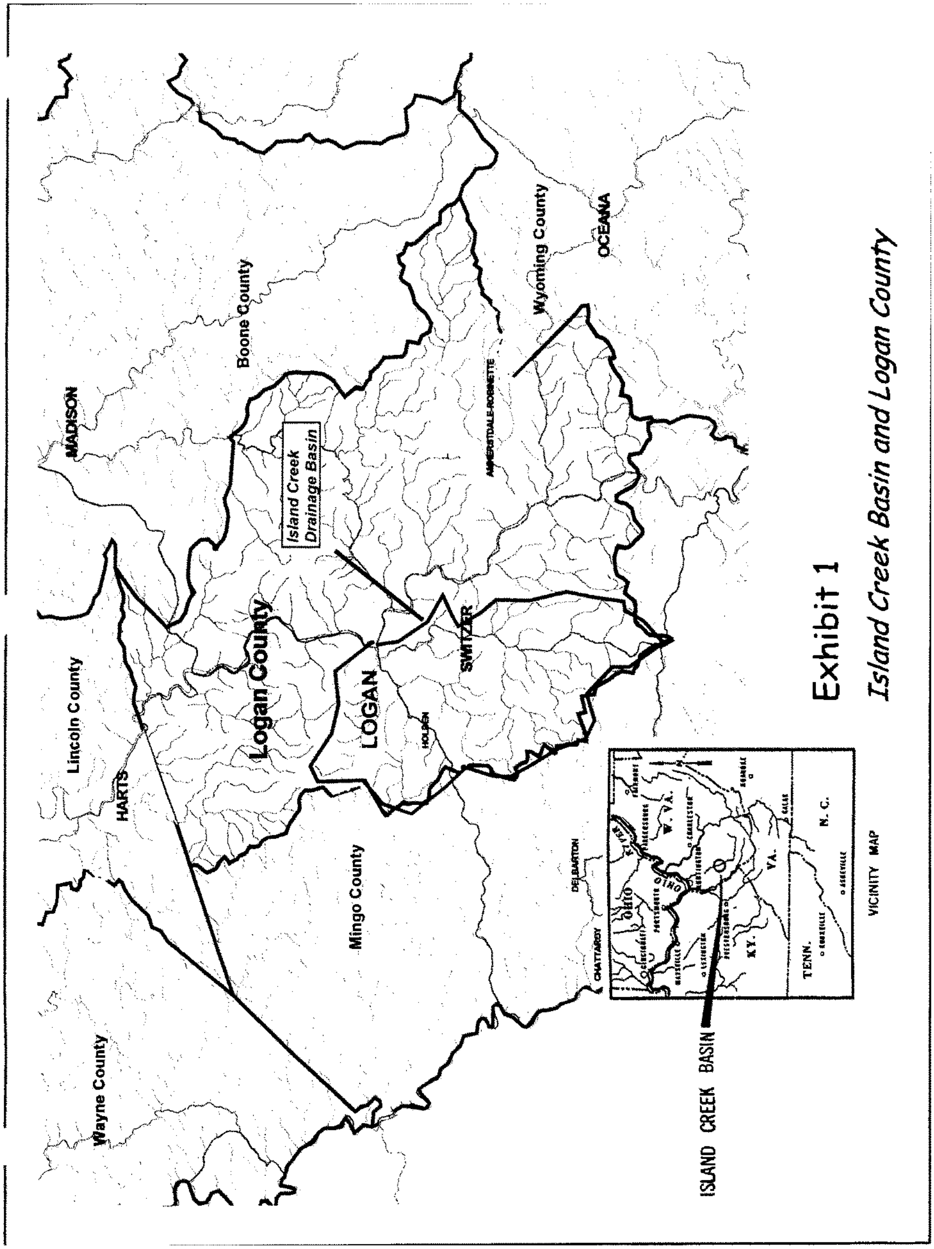


Exhibit 1

Island Creek Basin and Logan County

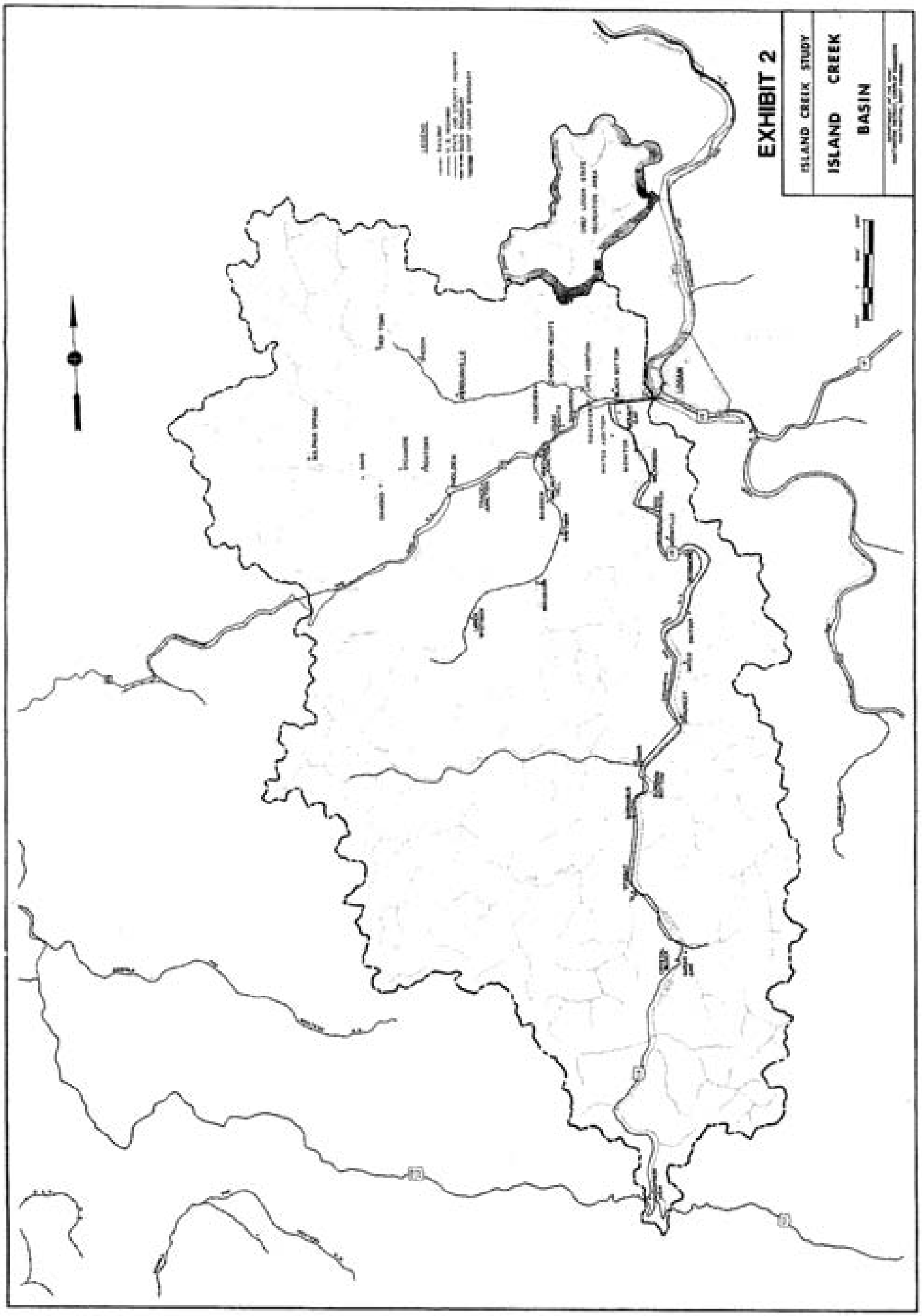


EXHIBIT 2
ISLAND CREEK STUDY
ISLAND CREEK BASIN

This study area was approximately 19 miles long and consisted of heavily developed areas within the 500-year floodplain along Island Creek from its mouth at Logan to a point upstream near Barnabus (about 10 miles); Copperas Mine Fork from its mouth to a point upstream near Davis (5.1 miles); and Mud Fork to a point upstream near Shegon (3.9 miles).

Subsequent reevaluation efforts narrowed the study area to the Island Creek sub-basin (see the map on Exhibit 2). The current report focuses on the area impacted by the proposed alternatives. This area includes the 500-year floodplain along Island Creek from its confluence with the Guyandotte River to a point approximately 9,000 feet upstream.

III. PRIOR STUDIES AND REPORTS

A. Feasibility

Interim Report, Island Creek Basin, Guyandotte River Basin Study, West Virginia," U.S. Army Corps of Engineers, Huntington District, dated March 1985. The preauthorization studies of the water and related land resources problems and needs of the Island Creek area of Logan County, West Virginia, were undertaken as a result of the Senate Public Works Committee Resolution dated 2 June 1976.

This report recommended a combination of channel and non-structural measures to alleviate the flooding problems experienced in the Island Creek Basin. As described in the feasibility report, the first 0.7 mile of Island creek would be structurally modified by widening the stream channel to 100 feet, with the lower 1,000 feet being a concrete-lined channel. Flood damages along the remainder of Island Creek, Copperas Mine Fork, and Mud Fork (a total length of 20 miles) would be reduced by non-structural measures. Over 1,200 residential structures would be raised in place and almost 80 non-residential structures would be floodproofed by raising in place or other means. As part of this project, a total of 146 residential and 116 non-residential structures would be relocated from the floodway and 149 mobile homes from the floodplain to flood-free housing and community development sites. Also it was recommended that a flood warning system must be established as part of the non-structural program to give flood plain occupants sufficient time to evacuate the affected area. The benefit-to-cost ratio for this project was 1.7 to 1 and resulted in the current authorization as cited above.

B. Preconstruction Engineering and Design (PED) Studies

1. PED

Following authorization, funding for PED was received and studies were initiated in 1989. Preliminary analyses conducted during the early stages of PED identified the potential for substantial increases in the project costs due to an underestimate of costs used for the nonstructural portions of the project. Implementation of similar nonstructural projects in the neighboring region of Tug Fork Valley provided the experience of actual costs. The actual costs for raising in place in the Tug Fork basin showed a substantial increase above what was estimated for the Island Creek feasibility study. For example, in the Island Creek feasibility study, the cost to raise one residential structure in place was estimated at an average of $25,000 where actual costs being experienced in the Tug Fork basin were at an average of $89,600 (costs being experienced in 1989). The resulting increase in cost potentially made some elements of the project economically infeasible. Based on this information, it was concluded that a general reevaluation of the economic feasibility of the Island Creek Local Protection Project would be conducted as a part of PED.

2. Re-Analysis of Costs to Perform Non-Structural Floodproofing Measures, April 1991

This effort used the actual costs being experienced in the Tug Fork basin as described above and concluded that the non-federal share of the non-structural alternative was beyond the fiscal means of the local sponsor. Therefore the nonstructural component was removed from consideration as a cost-shared flood protection measure in the Island Creek basin. The data presented in the re-analysis demonstrated that costs for the nonstructural portion would make the authorized Island Creek project infeasible.

3. Draft General Reevaluation Report and Environmental Assessment, December 1993.

A draft report was prepared in December 1993 that presented findings and conclusions of a re-determination of Federal interest. This report concluded that the recommended plan (80-foot wide channel) was in the Federal interest and was economically feasible. However, at that time, the Logan County Commission did not have the financial ability to finance the non-Federal share of construction and asked that the project remain active while it explored other funding options. Therefore all reevaluation efforts were terminated and USACE notified.

4. Current Investigation

In 1998 the West Virginia Soil Conservation Agency agreed to provide funding to assist the local sponsor with the project. In a resolution passed 9 January 1998 the Logan County Commission requested for the Corps to proceed with the reevaluation. This General Reevaluation report presents the findings and conclusions based upon a review of plan formulation, an update of the project economics and project modifications that have occurred since the project was authorized.

IV. NEEDS AND OPPORTUNITIES

A. General

Logan County, located in the southwestern portion of West Virginia, was formed in 1824 from parts of Giles, Tazewell, Cabell, and Kanawha Counties, in what was then Virginia. The county seat, Logan, is situated in the central portion of the county, at an elevation of 682 feet, m.s.l. (see map on Exhibit 1). The topography of the county, which measures 456 square miles, is steep and rugged, as streams have cut their channels deep through the surface rocks, making sharp V-shaped valleys. Surface elevations vary from 600 feet above sea level at Big Creek on the Guyandotte River at the Lincoln County line to 2,750 feet, m.s.l., at the corner where Logan, Boone, and Wyoming Counties meet.

The Guyandotte River largely drains the county. The Guyandotte, having a drainage area of 1,670 square miles, originates in Raleigh County and flows in a general northwesterly direction through Raleigh, Wyoming, Mingo, Logan, Lincoln, and Cabell counties to the Ohio River, near Huntington, West Virginia.

B. History of Flooding

<u>Storm and flood of July 1875</u>. The flood was caused by a series of summer-type storms beginning about 25 July and ending 6 August. A crest stage of 27.3 feet was reached at Logan, the seventh highest of record.

<u>Storm and flood of January 1918</u>. The storm, which caused this flood, was preceded by snow, sleet and freezing temperatures, all of which assisted in causing excessive runoff. The heavy precipitation together with melted snow produced a crest stage of 26.3 feet at Logan, the ninth highest of record.

<u>Storm and flood of January 1957</u>. Rainfall from 27 January to 1 February averaged 5.1 inches over the basin above Logan. The flood on the Guyandotte River reached a stage of 28.2 feet at Logan, the fifth highest of record. The historical crest stage at Logan was one foot higher than July 1875. The volume of runoff from the drainage area above Logan amounted to approximately 4.1 inches.

<u>Storm and flood of March 1963</u>. A succession of storms associated with low-pressure systems moved northeastward from northern Alabama to West Virginia and Ohio during the period 2-19 March 1963. On the 5th and 6th of March, two to three inches of rain fell over the Guyandotte River Basin. On the 11th and 12th of March, the second storm moved over the basin, producing rainfall amounts of three to three and a half inches in twenty-two hours. The rains that occurred on the fifth and sixth of March primed the basin for the second storm which produced

the highest known flooding along the main stem of the Guyandotte River, and along most tributaries. This flood produced a crest stage of 34.90 feet at Logan, the highest of record.

Storm and flood of January 1974. On 3-5 January, the first storm moved over the Guyandotte Basin and released slightly more than 1.0 inch of rainfall. The second storm period, 9-12 January, produced about 3.5 inches in the upper portion of the basin and approximately 3.15 inches in the lower part of the basin. The Guyandotte River reached a crest stage of 31.1 feet at Logan, the third highest stage of record.

Storm and flood of April 1977. Precipitation began on the evening of 2 April. This set the stage for increased runoff when the rain began again Sunday evening, 3 April. A series of disturbances, with heavy rainfall, moved from the southern plains states into the Appalachians late Sunday, 3 April and Monday, 4 April. From 7 a.m. on 2 April to 7 a.m. on the 5th, a total of 3.14 inches of rainfall was recorded at Logan, WV. This flood produced the fourth highest stage of record.

Storm and flood of May 1984. Contrasting temperatures associated with this front produced an unstable atmospheric condition resulting in heavy precipitation that began on the 2nd of May and continued through the 9th of May. Most stations recorded flood waters cresting during the day of 8 May and returning to near normal stages by 20 May. Preliminary field investigation of flood marks in the Island Creek basin indicated normal water elevations were exceeded by as much as 16 feet. Lesser flooding occurred downstream on the Guyandotte River due to the impounding of floodwater behind the R.D. Bailey Dam and also due to the reduced amounts of rainfall over the lower Guyandotte River Basin. A crest stage of 23.3 feet was reached at the Guyandotte River at the Logan stream gaging station, the twelfth highest of record.

Storm and flood of May 1996. The flooding in Logan County on May 16, 1996 was a result of persistent frontal boundaries over the State of West Virginia. The frontal boundaries were persistent for the entire month. This weather produced the wettest conditions for the month in the history of several stations in West Virginia. The monthly averages for the Guyandotte Basin were 9-10 inches at the mouth of the Guyandotte River. A crest stage of 25.7 feet was reached at the Guyandotte River at Logan stream gaging station.

C. Summary

The Island Creek Basin (map on Exhibit 2) has experienced numerous damaging floods. The flood of record in the Basin occurred in March 1963. During the March 1963 flooding, the area's residences, and commercial and industrial establishments were flooded to a depth of up to 15 feet. Other major floods have occurred in January 1957, January 1974, April 1977, May 1984, and May 1996. Flooding along Island Creek and its tributaries is a continuing problem. Due to the steepness of terrain and the scarcity of land suitable for building, extensive development has occurred on the relatively flat flood plains of the basin. Residential and commercial structures, highways, and railroads occupy the flood plains along the major streams almost entirely. As a result, almost all development within the basin is susceptible to damage by even moderate flood events.

The occurrence of a 100-year flood event on Island Creek (10.4 miles) under existing conditions would inundate approximately 950 residential structures and 225 commercial structures. Flood damages caused by this event would exceed $40.5 million (October 2000 price level). In addition to the financial burden caused by flooding, major floods result in hazards to health and even loss of life. The threat of flooding to floodplain land prevents economic development and increases the cost of land preparation and building construction.

V. EXISTING CONDITIONS

A. General

There are no other flood protection systems currently in place in the Island Creek basin. However, since the completion in 1980 of the R. D. Bailey Lake on the Guyandotte River, about 35 miles upstream at Justice, backwater flooding problems from the Guyandotte River at the mouth of Island Creek have significantly been reduced; but that project does not eliminate the potential for headwater flooding in the Island Creek basin.

Since the Island Creek LPP project was authorized in 1986, some additional economic development has occurred in the lower 0.7 mile section of Island Creek. On the Guyandotte River, just below the mouth of Island Creek, there is a new fast-food restaurant. From that point upstream on Island Creek for a distance of over 600 feet, and interceptor sewer system has been installed. Just above the U.S. Rt. 119/St. Rt. 10 bridge over Island Creek, two new restaurants and a motel have been built on fill material. However, the impact from the declining coal industry and recurrent flooding is evident in the study area by the number of commercial structures standing vacant and in disrepair.

B. Population

During the 20th century, Logan County has experienced dramatic population changes, increasing from 6,955 in 1900 to 77,391 in 1950, decreasing to 46,269 in 1970, increasing again to 50,511 in 1980, decreasing to 43,032 in 1990 and again in 2000 to 37,710 people. The wide fluctuations of population in Logan County, as well as in the southern West Virginia region, over the last 99 years can be attributed to the boom or bust economy of the coal industry.

While most of the inhabitants of the study area do not live in cities or towns, a high percentage do live in dense settlement clusters or ribbons along the three major streams. These clusters often approach urban density without urban service availability.

C. Commercial Development

The proposed project area is largely comprised of a commercial district. Most of the establishments are located along Riverview Avenue, the main street through the study area. A variety of business types are represented including service, health services, pre-owned auto dealers, gas stations, eating and drinking establishments, special trade contractors, and hardware stores.

VI. FUTURE WITHOUT PROJECT CONDITIONS

In the absence of project implementation, the future land use and related conditions within the project area are forecast to remain comparable to conditions as they currently exist. The study area entered the flood insurance program in April 1972; flood insurance, therefore, continues to be available to residents of the area.

VII. AUTHORIZED PROJECT

The authorized local protection project included a channel on Island Creek from the mouth to a point 0.7 mile upstream. The channel would have been 100 feet wide, with the lower 1,000 feet being concrete-lined. Flood damages along the remainder of Island Creek, Copperas Mine Fork, and Mud Fork (a total length of 20 miles) would have been reduced by non-structural measures such as raising structures in place and other floodproofing measures. The first cost of the authorized project was estimated to be $86 million (October 1984 prices). The authorized project plan is shown on Exhibit 3 and a detailed description of project features as presented in the March 1985 Final Feasibility Report is included as Exhibit 4.

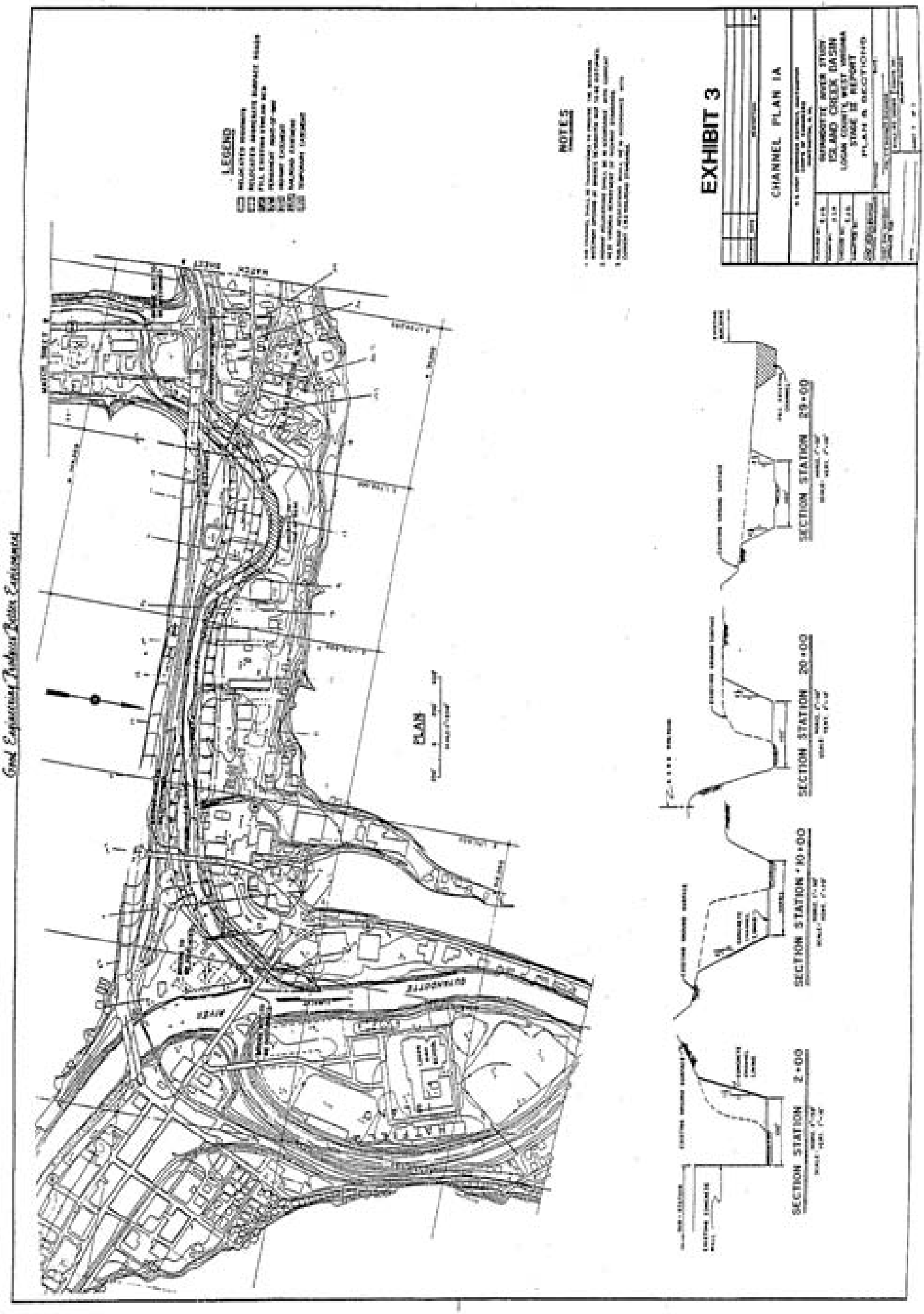


EXHIBIT 3
CHANNEL PLAN IA
ISLAND CREEK BASIN
LEGEND
NOTES
PLAN
GUYANDOTTE
RIVER
SECTION STATION 2+00
SECTION STATION 10+00
SECTION STATION 20+00
SECTION STATION 29+00
Good Engineering Produces Better Environments

EXHIBIT 4 - AUTHORIZED PLAN – PROJECT FEATURES

The Island Creek Local Protection Project authorized by the Water Resources Development Act of 1986 included a combination of structural and non-structural measures. The project plan is shown on Exhibit 3. The authorized plan is about nineteen miles in length: Island Creek – 10 miles, Copperas Mine Fork – 5.1 miles, and Mud Fork – 3.9 miles. The first 0.7 miles of Island Creek, from its confluence with the Guyandotte River upstream, would be structurally modified by widening the stream channel to a width of 100 feet. The lower 1,000 feet of this area would be concrete-lined. The remainder of Island Creek (9.3 miles) and both Copperas Mine Fork and Mud Fork would be treated with a variety of non-structural measures.

Because of the scarcity of available housing, a provision of a housing program would be an integral component of project construction to accommodate those who must be relocated. Project construction requires the relocation of 146 families and 116 non-residential structures. Three sites along the Guyandotte River above Logan will be developed to accommodate relocates. The structures to be raised in the fringe area amount to 1,226, and 77 would have floodproofing techniques applied to reduce damages. In addition, 149 mobile home owners would be required to evacuate the fringe area of the flood plain.

Day use recreation facilities will also be developed as an integral part of the plan. These facilities generally consist of play areas, trails and tot lots. There will be eight of these facilities located throughout the project area on evacuated flood plain land to satisfy the local need for day use facilities.

Environmental management and design considerations would be an integral part of the plan. The evacuated floodway will be graded and seeded, and stream banks will be stabilized as necessary. The evacuated floodway and stream will be maintained as a green belt area with land uses that are compatible with flooding.

Construction would occur in four phases requiring a total of 8 ½ years to complete. Phase 1 of the plan, channel work on Island Creek, will require 1 year to construct. Phase 2 Mud Fork non-structural; will require 1 year to complete. Phase 3, Copperas Mine Fork non-structural, will require 1 ½ years to complete; and the final phase, Phase 4, Island Creek non-structural, will require 5 years to complete.

Estimated first cost (October 1984 price level) for the Island Creek basin project is $86 million of which $66.4 million is the Federal share and $19.6 million is the non-Federal share. Average annual costs are $4.5 million compared to average annual benefits of $7.5 resulting in a benefit-cost ratio of 1.7 to 1.

VIII. REEVALUATION EFFORTS

A. General

A draft report was prepared in December 1993 that presented findings and conclusions of a re-determination of Federal interest. This report concluded that the recommended plan (80-foot wide channel) was in the Federal interest and was economically feasible. However, at that time, the Logan County Commission did not have the financial ability to finance the non-Federal share of construction and asked that the project remain active while it explored other funding options. Therefore all reevaluation efforts were terminated. In 1998, a new funding source was identified and the project was re-initiated in 1999. The current reevaluation was necessary due to the lapse in time since the 1993 Draft Reevaluation Report was completed.

This investigation is a general reevaluation endeavor specifically addressing project economics and formulation. Field investigations were conducted to determine existing conditions in the project reach under current conditions and criteria, and additional channel alternatives were also formulated and evaluated. Flood damage surveys were updated and project benefits calculated for each of the new alternatives. Potential social and environmental impacts were also assessed. A channel optimization was conducted to ensure that the NED plan had been properly identified. An Environmental Assessment was prepared for the selected plan and is included in this report.

B. Non-structural Formulation

Early in the PED phase, which began in 1989, there was uncertainty about the economic efficiency of the non-structural portion especially with regard to the costs used to formulate that portion of the authorized project. In the feasibility report, the cost to raise one residential structure in place was estimated at about $25,000. The cost to raise 1,200 structures was estimated at $30,000,000. At the time the Island Creek PED effort began, the average cost to raise a house in the Tug Fork basin was $89,600 (1989). Using this figure, the cost to raise 1,200 structures in the Island Creek basin would be as much as $107,520,000.

Therefore, one of the first efforts of the PED phase was a re-analysis of the costs to perform non-structural floodproofing measures. The results of that re-analysis were presented in a report, (on file in the Huntington District office), submitted to the Ohio River Division for approval in April 1991. The conclusion reached was that the non-structural alternative was too costly to be considered as a cost-shared flood protection measure in the Island Creek basin. Non-structural flood protection must be cost-shared at a rate of 75 percent Federal and 25 percent non-Federal and must meet the test of economic feasibility.

The Ohio River Division office gave its approval in a letter dated 25 April 1991, to defer evaluation of the non-structural component of the authorized plan. To date, the District has not identified an economically justified nonstructural project; therefore, the nonstructural alternative has not been reevaluated.

C. Structural Formulation

In 1991, concurrent with approval to defer the non-structural component of the authorized plan, approval was given to proceed with preparation of a General Reevaluation Report (GRR) for the authorized structural project only. The 1993 Draft GRR reaffirmed the structural component of the authorized project (0.7 mile channel).

The major issue of concern at the onset of the 1993 reevaluation, as well as the current reevaluation was whether or not the authorized 100-foot wide channel was still the NED plan. Since authorization of the project in 1986, land use changes along the 0.7 mile area have occurred. When considering channel width and alignment, a storm sewer and three new structures built on fill material on the left descending bank have been taken into account.

Initial efforts were directed toward identification and evaluation of a viable channel project. Primary emphasis was placed on identifying a channel alignment alternative that would provide reductions in flooding, prevent acquisition of as many structures as possible, and reduce project costs.

Several alternatives, consisting of combinations and modifications of a number of basic channel widths, were identified and evaluated during this phase. The alternatives included a variation of the authorized channel (100-foot wide). More detailed information about the plan selection process in included in the Plan Selection section of this report.

D. National Economic Development (NED) Evaluations

The reevaluation process identified the NED plan by determining the optimum channel for the 0.7 mile channel project at Island Creek. Details of this process are contained in the Plan Formulation section of this report.

E. Project Economics Update

The flood damage survey used in preparing the 1985 feasibility report was conducted in October 1978. The survey included a detailed inventory, mapping and assessment of all structures in the 20-mile study area located within the limits of the 500-year flood. Each structure included in the inventory was assigned a unique identification number and located on detailed maps; classified according to category of use (e.g., residential, commercial, industrial, and other properties); and surveyed to determine the first floor elevation. The damage survey was previously updated to incorporate the change in damageable improvements that occurred in the study area between 1978 and 1991. The price level was also updated to an October 1992 (FY 1993) level. The flood survey information was further updated to October 2000 (FY 2001) price levels through field verification and new commercial damage surveys where necessary. Computation of project benefits was affected by several factors including change in price level, revised flood frequency profiles, and changes in the without-project condition. A description of the development of the new flood frequency profiles is presented in the Engineering Technical Appendix Tab II.

Table 1 summarizes the 100-year frequency flood damages for Island Creek (10.4 miles) presented in the 1985 feasibility report and the results from the current analysis.

TABLE 1 - COMPARISON OF FLOOD DAMAGES AT 100-YR. FREQUENCY FEASIBILITY REPORT AND REEVALUATION REPORT ISLAND CREEK (10.4 miles)

Category	**Feasibility Report** 1985 prices	**Reevaluation Report** Oct 2000 prices
Residential	$15,681,000	$13,477,000
Commercial-Industrial	20,010,000	24,645,000
Utilities	729,000	763,000
Transportation	1,208,000	1,223,000
Emergency Costs	1,471,000	2,207,000
TOTALS	**$39,164,000**	**$42,315,000**

The 100-year frequency flood damages in real dollar terms have increased only slightly in the 16 years since the feasibility report was published. The variables impacting this result include: low increase in residential structure values; decrease in number of residential structures; and changes in the composition and number of commercial structures.

Table 2 presents a comparison of average annual damages under existing conditions presented in the feasibility report for the Island Creek (10.4) with those computed during the reevaluation study. The updated average annual damages for the project area are estimated at $10.8 million. This represents an increase of approximately 20 percent of the average annual damages (real dollars) presented in the March 1985 feasibility report. This increase results from the same factors discussed above regarding Table 1.

TABLE 2 - FEASIBILITY/REEVALUATION COMPARISON OF AVERAGE ANNUAL DAMAGES
EXISTING CONDITIONS FOR ISLAND CREEK (10.4 miles)

Category	**Feasibility Report** 1985 prices	**Reevaluation Report** Oct 2000 prices
Residential	$3,157,000	$3,206,000
Commercial-Industrial	4,287,000	6,503,000
Utilities	64,000	70,000
Transportation	497,000	514,000
Emergency Costs	369,000	550,000
TOTALS	**$8,374,000**	**$10,843,000**

F. Environmental Impact Reassessment

The National Environmental Policy Act (NEPA) compliance document for the 1985 Feasibility Report included a final Environmental Impact Statement. This document was reviewed during the preparation of the reevaluation report to determine its applicability to the current project proposal. Also, coordination with the U. S. Fish and Wildlife Service (USFWS) was maintained throughout the study. For the 1993 reevaluation study, an Environmental Assessment (EA) and a Finding of No Significant Impact (FONSI) was completed. This EA was circulated but the FONSI remained unsigned due to termination of the reevaluation effort.

An EA and FONSI have been prepared to assess the plan recommended in this document and are included.

G. HTRW Investigations

A Phase I HTRW (Hazardous, Toxic, and Radioactive Waste) assessment of the study area was completed in May 1991. The assessment consisted of a physical investigation of the study area, a research of the historical land use and ownership, and a regulatory record review. From this investigation, four Areas of Concern (AOC) were identified. A Phase II investigation was conducted by personnel from the Nashville District Corps of Engineers.

The project was terminated due to lack of sponsor funds in December 1993. Because of the amount of time lapsed between the previous Phase II HTRW investigation and the present, the project site was revisited in November 1999 by personnel from the Huntington District (LRH) to visually observe any changes in site conditions since 1991. From this revisit, a decision was made to perform additional Phase II HTRW investigations on two of the previous sites to determine extents of potential contamination. The supplemental Phase II investigation revealed that one area does not require treatment and further defined the depth and extent of soil needing to be removed in the remaining site. The revisit also concluded that site conditions at the other two AOCs had not changed from the 1991 investigation.

The spoil site for the LPP was changed to an alternate location along State Route 73. A Phase I HTRW investigation was conducted in accordance with established ACOE HTRW policies. Based on the findings from the investigation, the spoil site was determined to contain no potential HTRW concerns, nor were any adjacent properties observed to contain any HTRW concerns that would impact the tract. Therefore, no further HTRW investigations on the spoil site are warranted.

Additional details can be found in the Engineering Technical Appendix, Section 11 and the HTRW reports on file in the Huntington District Office, Environmental & Remediation Section.

IX. PLAN FORMULATION

During the revaluation process a number of channel plans were analyzed in an effort to identify the plan that would maximize net benefits (NED plan).

A. Initial Assessment

As a first step, to determine whether the authorized 0.7 mile channel project was still feasible, it was analyzed together with five other channel plans – two plans using a 100-foot width, three plans using an 80-foot width, and one snagging and clearing plan. These are described in Table 3.

TABLE 3 - INITIAL PLAN ASSESSMENT

PLAN	DESCRIPTION
PLAN A	Authorized 100-foot wide channel plan. Concrete-lined channel from mouth to U.S. 119/S.R. 10 bridge. Then 100 feet wide channel with 2.5 to 1 slopes up to mouth of Copperas Mine Fork.
PLAN B	Concrete-lined 100-foot wide channel from mouth to CSX railroad bridge.
PLAN C	Concrete-lined, U-framed channel with 80-foot width from mouth to U.S. 119/S.R. 10 bridge. Then 80-foot wide channel from bridge upstream to end of project with 2.5 to 1 side slopes.
PLAN D	Snagging and clearing for entire 0.7 mile length.
PLAN E	Snagging and clearing from mouth to U.S. 119/S.R. 10 bridge. Remainder of project has 80-foot channel width with 2.5 to 1 side slopes.
PLAN F	Concrete-lined, U-framed channel with 80-foot wide channel from mouth up to U.S. 119/S.R. 10 bridge. Then 80-foot wide channel from bridge upstream to end of project with 2.5 to 1 side slopes.

A plan selection matrix was developed in which the plans were rated from best to worst (1 being best and 6 being worst). The plans were evaluated on reductions in water surface profiles, estimated costs, benefits, relocations requirements, environmental impacts, HTRW impacts and real estate impacts.

At this point in the study, a decision was made to alter the channel design. This change concerned the U-frame channel design. Studies revealed that in order to construct a U-frame channel for a 100- foot wide channel, properties on both sides of the stream would have to be acquired, the stability of the U.S. Rt. 100/St. Rt. 10 bridge piers would be undermined, and the CSX Railroad tracks on the right descending bank would have to be relocated. Therefore, post and panel wall configurations were substituted in subsequent plan analyses.

Plans C and D were selected to be carried forward for further evaluation as well as two variations of Plan C. The intermediate plans were redesignated as Alternatives 1 through 4. Descriptions of the four alternatives are provided in Table 4.

**TABLE 4 - INTERMEDIATE PLAN ASSESSMENT
VENTURE-LEVEL COSTS
(Oct 92 prices)**

PLAN	DESCRIPTION
Alternative 1	Channel width 80 feet with post and panel wall from mouth up to U.S. 119/S.R. 10 bridge. Remainder of project 2.5 to 1 side slopes. Estimated cost of project was $13.2 million.
Alternative 2	Snagging and clearing from mouth to U.S. 119/S.R. 10 bridge. Remainder of project to be 80 feet with 2.5 to 1 side slopes. Estimated cost of project was $9.9 million.
Alternative 3	Channel width 80 feet with post and panel wall from mouth to just past Super 8 motel. A second post and panel wall at Baisden Hardware, the third post and panel wall at Honeycutt body shop, and a fourth wall at the Chevron station. Estimated cost of project was $12.1 million.
Alternative 4	Channel width 80 feet with post and panel wall from mouth to behind Baisden Hardware, and a second at Honeycutt body shop, and a third at the Chevron station. Estimated cost of project was $15.3 million.

Venture-level cost estimates were provided and average annual costs were computed for the four plans described above. Table 5 displays the residual annual damages, the damages prevented, the average annual costs, the net benefits, and the benefit-cost ratio.

**TABLE 5 - BENEFIT-COST COMPARISON OF INTERMEDIATE PLANS
($1,000's in Oct 92 prices)**

	ALT 1	ALT 2	ALT 3	ALT 4
Existing Damages	$ 6,975.0	$ 6,975.0	$ 6,975.0	$ 6,975.0
Residual Avg Ann Damages	$ 4,669.0	$ 5,065.0	$ 4,674.0	$ 4,658.0
Damages Prevented (Avg Ann Benefits)	$ 2,306.0	$ 1,910.0	$ 2,301.0	$ 2,317.0
Avg Ann Costs	$ 1,253.0	$ 949.0	$ 1,153.0	$ 1,453.0
Net Benefits	$ 1,053.0	$ 961.0	$ 1,148.0	$ 864.0
Benefit-Cost Ratio	1.84	2.01	2.00	1.59

The above analysis shows that Alternative 3 (80-foot side channel with four post and panel walls to protect the motel, the hardware, body shop, and the Chevron station) produces the most net benefits.

After venture level estimates were prepared for Alternatives 1 through 4, another alternative (Alt. 5) was considered which was a refinement of the best features of Alternatives 2 and 3. Alternative 5 consisted of snagging and clearing from the mouth of Island Creek to the U.S. Route 119/State Route 10 bridge, with a post and panel wall on the right descending bank at the Logan Concrete complex (opposite bank from all the plans presented thus far). This wall would protect the concrete business and prevent taking the motel on the opposite bank. Post and panel walls also would be constructed to protect the hardware store and the Chevron station.

At the Technical Review Conference (TRC) held in October 1992, all five alternatives were presented. During the presentation of the alternatives and their formulation, the question was raised of how and why the authorized 100-foot channel was changed to an 80-foot wide channel. It was felt by the CELRD personnel attending the TRC that the reasons for changing from a 100-foot wide channel as authorized by Congress to an 80-foot wide channel were not adequately addressed. Therefore, the decision was made and agreed upon to conduct a project optimization study to clearly identify the NED plan and therefore a new formulation of alternatives was created.

B. Channel Optimization

For the channel width optimization process, three channel widths were chosen – 60-feet, 80-feet, and 100-feet. All channel plans would begin at the confluence of the Guyandotte River and end 0.7 mile upstream. Generally, channel widening would occur only on one side of the channel in any area for all plans. In addition, each plan included removal of a sandbar located underneath the County Route 119-26 bridge. Channel excavation then continues along the same bank, with a side slope of 1 V to 2.5 H. Just past Baisden Hardware, the cut transitions to the right descending bank. The excavation continues on this side and ends just short of the CSX railroad bridge. Sandbar removal is a feature of all base designs.

Next various retaining walls and/or an upstream extension (from the railroad bridge to the mouth of Copperas Mine Fork) were added as features to all three of the channel width base designs making a total of 28 design variations to be analyzed. All variations are shown in matrix form in Tables 6, 7, 8 and 9.

TABLE 6 - PLAN MATRIX 60 Foot Channel Alt. A-J

Features	60 Foot Channel Alts. A-J									
	A	B	C	D	E	F	G	H	I	J
Base Design	X	X	X	X	X	X	X	X	X	X
Super 8 Motel Wall		X		X					X	X
Super 8 Motel Bldg Removed	X		X		X	X	X	X		
Baisden Hardware Wall			X	X						
Baisden Building Removed	X	X			X	X	X	X	X	X
Kennel/Pump House Removed	X	X	X	X	X	X	X	X	X	X
Upstream Extension					X	X	X	X	X	X
Honeycutt Auto Body Shop Wall						X		X		X
Honeycutt Building Removed					X		X		X	
S. Public Utilities Bldg Removed					X	X	X	X	X	X
Compton's Chevron Wall							X	X		
Compton's Building Removed					X	X			X	X

TABLE 7 - PLAN MATRIX 60 Foot Channel Alt. K-T

Features	60 Foot Channel Alts. K-T									
	K	L	M	N	O	P	Q	R	S	T
Base Design	X	X	X	X	X	X	X	X	X	X
Super 8 Motel Wall	X	X					X	X	X	X
Super 8 Motel Bldg Removed			X	X	X	X				
Baisden Hardware Wall			X	X	X	X	X	X	X	X
Baisden Building Removed	X	X								
Kennel/Pump House Removed	X	X	X	X	X	X	X	X	X	X
Upstream Extension	X	X	X	X	X	X	X	X	X	X
Honeycutt Auto Body Shop Wall		X		X		X		X		X
Honeycutt Building Removed	X		X		X		X		X	
S. Public Utilities Bldg Removed	X	X	X	X	X	X	X	X	X	X
Compton's Chevron Wall	X	X			X	X			X	X
Compton's Building Removed			X	X			X	X		

TABLE 8 - PLAN MATRIX 80 Foot Channel Alternatives

Features	80 Foot Channel Alts.					
	A	B	C	D	E	F
Base Design	X	X	X	X	X	X
Super 8 Motel Wall						
Super 8 Motel Bldg Removed	X	X	X	X	X	X
Baisden Hardware Wall		X			X	X
Baisden Building Removed	X		X	X		
Kennel/Pump House Removed	X	X	X	X	X	X
Upstream Extension			X	X	X	X
Honeycutt Auto Body Shop Wall				X		X
Honeycutt Building Removed			X		X	
S. Public Utilities Bldg Removed			X	X	X	X
Compton's Chevron Wall						
Compton's Building Removed			X	X	X	X

TABLE 9 - PLAN MATRIX 100 Foot Channel Alternatives

Features	100 Foot Channel Alts.	
	A	B
Base Design	X	X
Super 8 Motel Wall		
Super 8 Motel Bldg Removed	X	X
Baisden Hardware Wall		
Baisden Building Removed	X	X
Kennel/Pump House Removed	X	X
Upstream Extension		X
Honeycutt Auto Body Shop Wall		
Honeycutt Building Removed		X
S. Public Utilities Bldg Removed		X
Compton's Chevron Wall		
Compton's Building Removed		X

As an example, Plan 80A (shown in Table 8) consists of the base plan only. It has an 80-foot wide channel and the Super 8 Motel, Baisden Hardware, and the building behind the hardware store are removed. In Plan 60R, the channel is 60-feet side. There are walls to protect the Super 8 Motel, and Baisden Hardware. The kennel/pump house building behind the hardware store is removed. Plan 60R also has an upstream extension and wall to protect the body shop at Honeycutt Pontiac. The Southern Public Service District building and the Chevron station are removed.

Since some features (i.e., wall behind Honeycutt body shop) did not make a difference in the water surface profiles, only 17 variations were analyzed using venture level estimates. As a part of the 1993 reevaluation study, venture level cost estimates were prepared for the channel optimization. Those estimates were updated during the 2001 reevaluation and can be found in Tab VII, Section F of the Engineering Technical Appendix. These 17 plans are shown in Table 10, which follows.

The plans highlighted in Table 10 are those with the best net benefits for each of the three channel widths. Using net benefits obtained from the channel width optimization analysis, the best 100-foot, 80-foot, and 60-foot side channels were chosen, namely: Plan 100A with net benefits of $2.8 million, Plan 80B with net benefits of $2.9 million, and Plan 60E with net benefits of $2.8 million.

Based on the results of this evaluation these three plans were selected as the final array of alternatives and are discussed in further detail in the section below. These three plans will be referred to as 60, 80, and 100 Feet channels throughout the remainder of this report.

A Flood Warning System (FWS) was recommended as part of the authorized project's non-structural component, the FWS is included as part of each plan in the final array. At a public meeting held on 9 February 2000, the Local Sponsor and the residents of Island Creek requested the inclusion of FWS as part of the Island Creek LPP General Reevaluation Report.

TABLE 10 - CHANNEL WIDTH OPTIMIZATION – PLAN ALTERNATIVE
Oct 2000 prices ($1,000)

Total Average Annual Damages - Existing Conditions:						$ 9,709.0
Channel Plans	**Residual Avg. Ann. Damages**	**Damages Prevented (Avg. Ann. Benefits)**	**Total Project Cost**	**Average Annual Costs**	**Net Benefits**	**Benefit Cost Ratio**
PLAN 100A*	$5,410.6	$ 4,298.4	$ 22,973.0	$ 1,534.3	$ 2,764.1	2.80
PLAN 80A	$5,607.1	$ 4,101.9	$ 21,263.0	$ 1,420.1	$ 2,681.7	2.89
PLAN 80B*	$5,380.7	$ 4,328.3	$ 21,048.0	$ 1,405.8	$ 2,922.5	3.08
PLAN 80C	$5,316.7	$ 4,392.3	$ 23,377.0	$ 1,561.3	$ 2,831.0	2.81
PLAN 80E	$5,349.8	$ 4,359.2	$ 23,161.0	$ 1,546.9	$ 2,812.3	2.82
PLAN 60A	$5,838.0	$ 3,871.0	$ 18,541.0	$ 1,238.3	$ 2,632.7	3.13
PLAN 60B	$5,925.2	$ 3,783.8	$ 18,273.0	$ 1,220.4	$ 2,563.4	3.10
PLAN 60C	$5,847.9	$ 3,861.1	$ 18,160.0	$ 1,212.9	$ 2,648.2	3.18
PLAN 60D	$5,963.9	$ 3,745.1	$ 17,892.0	$ 1,195.0	$ 2,550.1	3.13
PLAN 60E*	$5,574.0	$ 4,135.0	$ 20,566.0	$ 1,373.6	$ 2,761.4	3.01
PLAN 60H	$5,631.4	$ 4,077.6	$ 21,004.0	$ 1,402.8	$ 2,674.7	2.91
PLAN 60I	$5,672.3	$ 4,036.7	$ 20,298.0	$ 1,355.7	$ 2,681.0	2.98
PLAN 60L	$5,747.4	$ 3,961.6	$ 20,736.0	$ 1,384.9	$ 2,576.7	2.86
PLAN 60M	$5,632.5	$ 4,076.5	$ 20,185.0	$ 1,348.1	$ 2,728.3	3.02
PLAN 60P	$5,672.3	$ 4,036.7	$ 20,623.0	$ 1,377.4	$ 2,659.3	2.93
PLAN 60Q	$5,724.2	$ 3,984.8	$ 19,917.0	$ 1,330.2	$ 2,654.6	3.00
PLAN 60T	$5,794.9	$ 3,914.1	$ 20,355.0	$ 1,359.5	$ 2,554.6	2.88

*These are the plans with the most Net Benefits for each of the three channel widths – 100 ft., 80 ft., and 60 ft.

C. Final Array of Alternatives

This section describes features of each of the three plans included in the final array and shows a comparison of the benefits and costs associated for each. This analysis provides the basis for selection of the recommended plan.

1. 60-Foot Channel

This channel plan consists of widening the channel to 60 feet beginning at the confluence of the Guyandotte River and Island Creek and continuing 3,800 feet upstream. The trapezoidal channel would have side slopes that would be laid back on a 2.5H to 1V slope. A post and panel wall would be constructed to protect the AEP facility. The plan also includes a Flood Warning System and sandbar removal.

This plan requires the demolition of six commercial structures including the Super 8 Motel, Baisden Hardware, Baisden Pump/Kennel house, Southern Public Utilities Warehouse, Honeycutt Auto Body, and Compton's Chevron. Generic drawings for the 60-Foot plans and their associated features can be found in the Engineering Technical Appendix as drawing numbers 80/11-14.

2. 80-Foot Channel

This channel plan is similar to the 60-foot design except for the channel width. This plan consists of widening the channel to 80 feet beginning at the confluence of the Guyandotte River and Island Creek and continuing 3,600 feet upstream. The trapezoidal channel would have side slopes that would be laid back on a 2.5H to 1V slope. Post and panel walls would be constructed at AEP facility and at Baisden Hardware. The plan also includes a Flood Warning System and sandbar removal.

This plan requires demolition of Super 8 Motel and Baisden's Pump/Kennel house building. Generic drawings for the 80-Foot plans and their associated features can be found in the Engineering Technical Appendix as drawing numbers 80/11-14.

3. 100-Foot Channel

This channel plan consists of widening the channel to 100 foot beginning at the confluence of the Guyandotte River and Island Creek and continuing 3,600 feet upstream. The trapezoidal channel would have side slopes that would be laid back on a 2.5H to 1V slope. A post and panel wall would be located at the AEP facility. The plan also included a Flood Warning System and sandbar removal.

This plan requires demolition of four commercial structures including Super 8 Motel, Anderson Wholesale, Baisden's Pump/Kennel building and Baisden Hardware. Generic drawings for the 100-Foot plans and their associated features can be found in the Engineering Technical Appendix as drawing numbers 80/11-14.

4. No Action Alternative.

A consideration for any Federal project is the No Action alternative. For this alternative, there would be no project implemented by the Federal government. Without intervention by another local or state agency, flooding would continue to occur as described in the without-project conditions. These conditions result in continued threat to life and property, loss of income to businesses and employees, and little incentive for economic development.

5. Project Benefits

Project benefits were calculated for each plan in the final array based on only those structures within the project impact area. The project impact area begins at the mouth of Island Creek and continues approximately 6,000 feet upstream.

Average annual benefits for the 60, 80, and 100-Foot Plans are $3.6, $3.8, and $4.0 million respectively.

6. Project Costs

Baseline cost estimates were prepared for the final array of alternatives and can be found in the Engineering Technical Appendix Tab VII.

The total project cost for the 60, 80, and 100-Foot plans are $22.1, $20.8, and $23.6 million (October 2001 price level) respectively. Average annual costs for this project are calculated based on a 50-year economic life and using a 6 3/8 percent interest rate (October 2001), and includes interest during construction an the annual operations and maintenance (O&M) cost of $73,100 (O&M is discussed in more detail in Section X. E.). The average annual costs for the 60, 80, 100-Foot plans are $1.8, $1.7, and $1.9 million respectively. Total project costs along with the average annual cost for each plan are shown in Table 11, Comparison of Alternative Plan Economics.

7. Comparison of Project Economics

The plans benefits and costs are compared in Table 11. The 80-Foot channel has the lowest project cost at $20.8 million with the highest net benefits of $2.14 million and a benefit cost ratio of 2.3 to 1. It should be noted that the 80-Foot and 100-Foot channel projects provide nearly the same net benefits, however, the 80-Foot is the NED plan.

TABLE 11 – FINAL ARRAY OF ALTERNATIVES COMPARISON OF ECONOMICS
Oct 2000 prices

	60 Foot Channel	80 Foot Channel	100 Foot Channel
Total Project Cost	$22.11 M	$20.77 M	$23.62 M
Avg Annual Cost	$1.81 M	$1.69 M	$1.92 M
Avg Annual Benefit	$3.56 M	$3.83 M	$4.05 M
Net Benefit	$1.74 M	$2.14 M	$2.13 M
BCR	2.0	2.3	2.1
Annual O& M	$73,000	$73,000	$73,000

D. Plan Selection

Although the 80-Foot channel produces the greatest net benefits, the difference in the net benefits for the 80-Foot and 100-Foot plans is marginal. Therefore, further analysis was conducted to confirm that the 80-Foot channel should be considered the recommended plan. To assist in this comparison, a matrix was prepared that includes information on the No Action Alternative and the 60-Foot, 80-Foot, and 100-Foot channels. This matrix compares all the plans in several major categories including project features, economics, project effectiveness, social considerations, environmental considerations, and real estate requirements. The categories listed were then evaluated to determine which plan had either the least impact or the greatest benefit. The matrix is included as Table 12.

The categories where the 80-Foot channel is superior to the other plans are highlighted in yellow. As can be seen in the matrix, this plan has the lowest project cost; reduces the number of businesses relocated; causes less environmental damage, requires less real estate acquisition and has the lowest overall real estate cost. For these reasons as well as the fact that the 80-Foot plan has the highest net benefits, it is the recommended plan. This selection reaffirms the alternative chosen as the selected plan in the 1993 analysis.

TABLE 12 – PLAN SELECTION

(matrix is located on following page)

TABLE 12 - PLAN SELECTION MATRIX

MAJOR CATEGORY	SUB-CATEGORY	BASE CONDITIONS	60 FOOT CHANNEL	80 FOOT CHANNEL	100 FOOT CHANNEL
PROJECT DESCRIPTION					
		NA	Trapezoidal channel 3,800 ft in length	Trapezoidal channel 3,600 ft in length	Trapezoidal channel 3,600 ft in length
		NA	134,700 cubic yards of excavation (10,000 cy HTRW)	215,700 cubic yards of excavation (11,000 cy HTRW)	270,500 cubic yards of excavation (13,600 cy HTRW)
		NA	924 linear feet of post-and-panel tied-back retaining wall	1,290 linear feet of post-and-panel tied-back retaining wall	750 linear feet of post-and-panel tied-back retaining wall
		NA	1,400 cubic yard of sand-bar removal	1,400 cubic yard of sand-bar removal	1,400 cubic yard of sand-bar removal
		NA	Demolition of Super 8 Motel, Kennel Building, Baisden Hardware, Southern Public Utilities Warehouse, Honeycutt Auto Body Shop and Compton's Chevron	**Demolition of Super 8 Motel and Kennel Building**	Demolition of Super 8 Motel, Anderson Wholesale, Kennel Building, and Baisden Hardware
		NA	UST Removal at Baisden Hardware & Compton's Chevron	UST removal at Baisden Hardware	UST removal at Baisden Hardware
		NA	Aquatic and terrestrial mitigation features	Aquatic and terrestrial mitigation features	Aquatic and terrestrial mitigation features
		NA	Flood Warning System (9 new stations max)	Flood Warning System (9 new stations max)	Flood Warning System (9 new stations max)
		NA	Spoil Site at School House Hollow (State Route 73)	Spoil Site at School House Hollow (State Route 73)	Spoil Site at School House Hollow (State Route 73)
		NA			Replacement of AEP service bridge
ECONOMIC CONSIDERATIONS					
	Total Project Cost	NA	$22.11M	**$20.77M**	$23.62 M
	Federal	NA	$12.7M	$12.8M	$14.1M
	Non-Federal	NA	$9.4M	$7.9M	$9.5M
	Avg Annual Cost	NA	$1.81M	$1.69M	$1.92M
	Avg Annual Benefit	NA	$3.56M	$3.83M	$4.05M
	Net Benefit	NA	$1.74M	**$2.14M**	$2.13M
	BCR	NA	2.0	2.3	2.1
	Annual O&M	NA	$73,000	$73,000	$73,000
PROJECT EFFECTIVENESS					
	Average Annual Flood Damages w/in project impact area (6,000 ft)	$6.5M	$3.0M	$2.7M	$2.5M
	Max Feet Reduction 100 yr frequency	0	3 feet	7 feet	9 feet
SOCIAL CONSIDERATIONS					
	Public Safety	Continued threat to life and property	Reduces threat to loss of life and property damages	Reduces threat to loss of life and property damages	Reduces threat to loss of life and property damages
	Business Activities	Business activites are constrained by repeated flooding causing loss of income to both the business and its employees. Many vacant structures and little incentive for new business to locate there.	Improved Condition for effective operation and greater portential for development.	Improved Condition for effective operation and greater portential for development.	Improved Condition for effective operation and greater portential for development.
	Community Cohesion	Typical Appalachian coal mining community. Close family relationships tie to coal industry and local business employment. Due to severe topography primary business community concentrated in floodplain.	Loss of six commercial structures due to project construction will reduce employment opportunities thereby impacting family structure in project area.	**Loss of two commercial structures due to project construction will reduce employment opportunities thereby impacting family structure in project area.**	Loss of three commercial structures due to project construction will reduce employment opportunities thereby impacting family structure in project area.
	Property Values	Future flooding will continue to decrease property values in the project area	Provides reduction of maximum of 3 ft for 100-yr and 8 ft for the 1-yr.thus increasing property values.	Provides reduction of maximum of 7 Ft for the 100-yr and 8.5 Ft for the 1-yr thus increasing property values.	Provides reduction of maximum of 9 Ft for the 100-yr and 10 Ft for the 1-yr thus increasing property values.
	Tax Base	Business may choose to relocate if subject to recurrent flooding, reducing tax base	Six commercial structures will be removed.	**Two commercial structures will be removed.**	Three commercial structures will be removed.
	Socio-Economic Factors	Living conditions and employment below national averages.	Decreased flooding will have beneficial impact, however channel will require acquisition of six businesses thereby reducing tax revenues and employment opportunities.	**Same as 60 Foot Channel except only two acquired thus minimizing impacts.**	Same as 60 Foot Channel except only three acquired thus minimizing impacts.
ENVIRONMENTAL					
	Rare and Endangered Species	None present in project area	NA	NA	NA
	Wetlands	0.2 Acre wetland in area	No impact	No impact	Possible encroachment into the wetland and/or buffer area resulting in loss of habitat and/or lower habitat quality.
	Air Quality	Average	Temporary impacts during construction	Temporary impacts during construction	Temporary impacts during construction
	Water Quality	Fair to poor throughout basin	Minor impacts during construction. Disolved oxygen expected to increase due to mitigation.	Minor impacts during construction. Disolved oxygen expected to increase due to mitigation.	Minor impacts during construction. Disolved oxygen expected to increase due to mitigation.
	HTRW	Phase I HTRW revealed one area	Petochemical & UST removal.	Petochemical & UST removal.	Petochemical & UST removal.
	Cultural Resources	None found in project area	None found in project area	None found in project area	None found in project area
	Noise	Current noise sources: commercial and residential traffic & CSX rail.	Temporary increase due to construcion	Temporary increase due to construcion	Temporary increase due to construcion
	Fishery Resources	Fair to good throughout basin, however poor in project area	Temporary impacts during construction. Mitigation would provide improved aquatic habitat.	Temporary impacts during construction. Mitigation would provide improved aquatic habitat.	Temporary impacts during construction. Mitigation would provide improved aquatic habitat.
	Wildlife Resources	Habitat generally good throughout basin. Populations below carrying capacity, riparian habitat sparse in project area	Extensive riparian losses, however lost habitat will be mitigated.	**Some riparian losses, however lost habitat will be mitigated.**	Some riparian losses, however lost habitat will be mitigated. Additional habitat may be impacted beyond riparian zone.
ENGINEERING					
	Major Design Features	NA	924 linear feet of post-and-panel tied-back retaining wall	1,290 linear feet of post-and-panel tied-back retaining wall	750 linear feet of post-and-panel tied-back retaining wall
		NA			Single lane AEP service bridge, 165 ft in length
REAL ESTATE					
	Acres Acquired	NA	17.5	**16.6**	18.98
	Costs	NA	$8.2M	**$6.0M**	$7.3M
	Number of Structures Removed	NA	5 Businesses & Pump/Kennel building	**1 Business & Pump/Kennel building**	3 Businesses & Pump/Kennel building
	Other Impacts	NA	NA	**NA**	Adverse impacts to Taco Bell and Shoney's

X. RECOMMENDED PLAN

A. Project Components

The purpose of the Island Creek Local Protection Project is to reduce flooding in the vicinity of Logan, West Virginia, and to provide reliable warnings of local flooding situations to the residents and businesses situated along Island Creek. The recommended project consists of approximately 3,600 feet of channel modification and installation of a flood warning system. These components are described below.

1. Channel Modification

The method of flood reduction chosen was to widen the existing streambed to a trapezoidal channel with an 80-foot bottom width and 2.5H:1V side slopes, where feasible. Special features of the project include two post and panel walls, structure removal, removal of a sand bar, permanent channel access for maintenance purposes, mitigation plantings and riffle structures. The project begins at the confluence of the Guyadotte River and Island Creek and terminates with the sandbar removal located approximately 400 feet upstream of the confluence of Island Creek and Copperas Mine Fork. The project's total length is approximately 4500 feet. The project plan is shown on Exhibit 5. A detailed description of all project features and project drawings is included in the Engineering Technical Appendix.

2. Spoil Site

The proposed spoil disposal site is located in Logan, WV at School House Hollow, an area adjacent to and to the east of Milkhouse Hollow. The site is on the north side of State Route 73, approximately 0.35 miles from its intersection with Old U.S. Route 119 and State Route 44. A 12-foot wide paved road provides access to the site from State Route 73. This site is identified on Exhibit 5.

The spoil site is a valley containing approximately 105 acres of moderate to steep hillside with upland hardwood vegetation. Approximately 12 acres of the valley portion of the site has previously been used as a spoil disposal site during the construction of U.S. Route 119 and State Route 73 in the mid-1990's. The previous fill material consists of rock and soil and is configured in two flat benches with fill slopes of approximately 2.5 to 1. These 12 acres are vegetated with tall grasses and low growing brush. Within the valley, a dirt haul road provides access along the west side of the fill. A shallow ditch around the perimeter of the existing fill collects storm water surface runoff from the hillsides and carries it to the base of the fill where it flows under the access road and State Route 73 via concrete culverts.

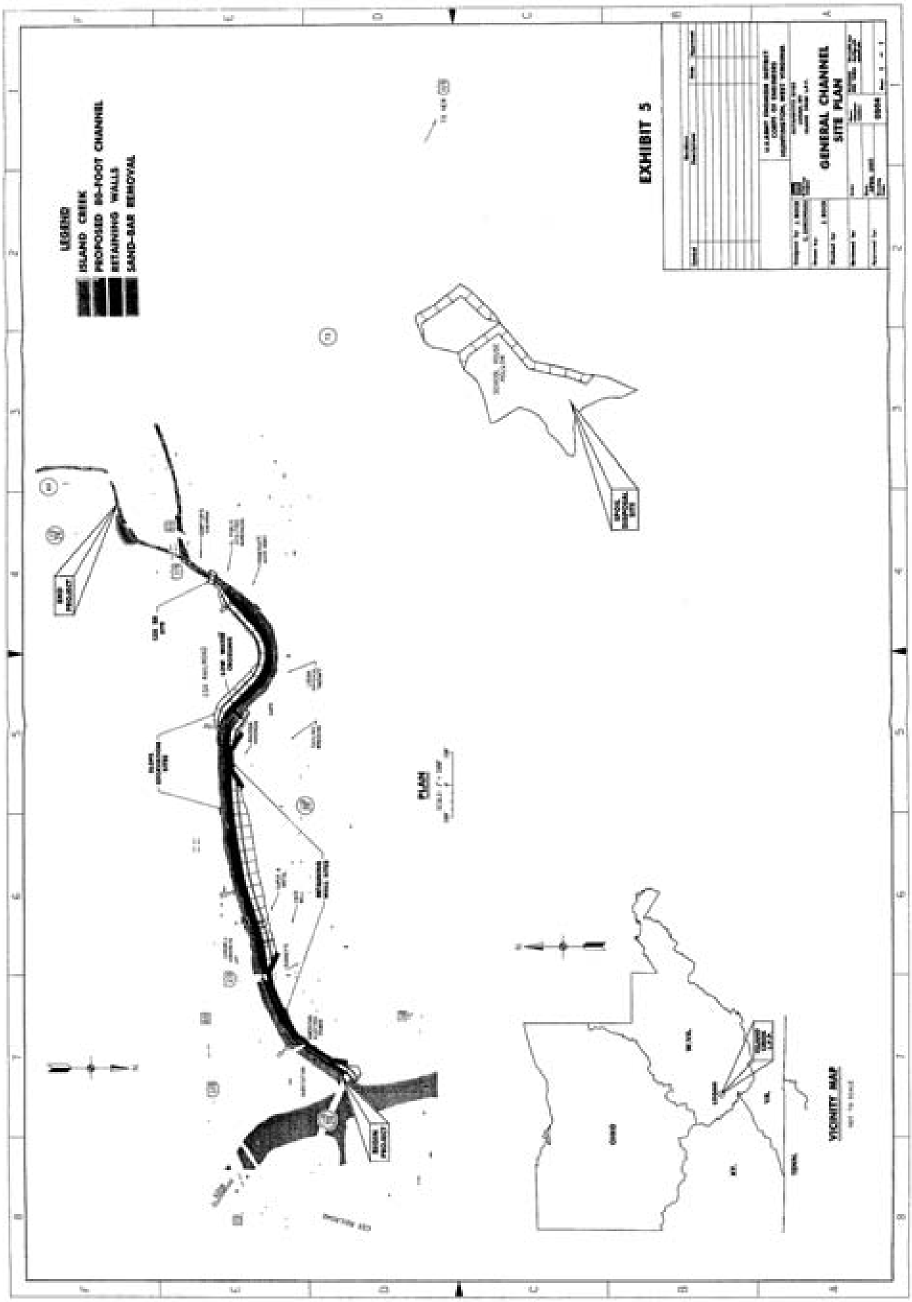
Material excavated from the Island Creek channel will be placed over the 6.5 acres of existing fill. The spoil site will also be used by the local sponsor for future disposal of channel sediment.

3. Flood Warning System

A Flood Warning System (FWS) is recommended for the Island Creek Basin allowing continual direct access to flood/storm data. Community access to this data would significantly improve response time of the communities in the event of a flooding situation. The recommended system would be a state-of-the-art integration of new stream and precipitation gages, radio repeater sites and dedicated computer workstations running software with forecast capability. The system would provide additional warning time for the small communities upstream of Logan. The system would also be beneficial for communities located downstream on the Guyandotte River. The recommended FWS would expand the Integrated Flood Observing and Warning System (IFLOWS) to meet the basin-wide requirement of providing flood warning to the Office of Emergency Service (OES), Directors of Logan County, and possibly some of the surrounding counties. By including stream gauge data into the forecast model, the reliability of flood height predictions and warning times would improve current capability considerably.

A maximum of nine (9) new river gages would be installed to forecast flooding upstream of Logan. The location of the stations was determined during field investigations and took into account recommendations of the Logan County Office of Emergency Services. Equipment to be installed would provide all the functions including satellite communications, data collection, telephone, and IFLOWS transmission capabilities.

Addition details about the FWS and a location map are contained in the Engineering Technical Appendix, Tab II, Section B.


LEGEND
ISLAND CREEK
RETAINING WALLS
SAND-BAR REMOVAL
EXHIBIT 5
GENERAL CHANNEL
SITE PLAN
PLAN
VICINITY MAP

B. Real Estate Acquisition

Acquisition of lands, easements, rights-of-ways, relocations and disposal lands (LERRD) is the responsibility of the non-Federal sponsor. For this project, the proposed sponsor is the Logan County Commission. A determination of the Commission's land acquisition experience and ability has been made. It is assumed that the sponsor will request the Corps to accomplish acquisitions/relocations of all necessary interests in lands on their behalf due to their limitations. Following execution of the Project Cooperation Agreement (PCA), a Memorandum of Agreement (MOA) will be entered into between the Corps and the Commission that will specify the details of this service. Generally, all project lands will be acquired in the name of the Commission.

The proposed acquisition limits conform to currently identified construction and operation and maintenance requirements. The required area is comprised of 93 tracts, containing approximately 125 acres. No residences are to be relocated. There is one commercial relocation (Super 8 Motel). The proposed Flood Warning System has minimal real estate requirements. See the Engineering Technical Appendix Tab V for the Real Estate Plan for a more complete discussion of real estate requirements.

The estimated cost to acquire the real estate required for this project is approximately $5.9 million. Acquisition or real estate will be accomplished over a period of 42 months. Real estate acquisitions would be initiated after execution of the PCA and entering into an MOA for acquisition services.

C. Relocations

Construction of the proposed channel improvement will affect facilities owned by Pure Water Company of Logan, Allegheny Power Company, City of Logan, American Electric Power Company CSX Railroad, West Virginia Department of Highways, and Verizon. The estimated cost to complete the relocations is approximately $1.0 million. The Logan County Commission, as the proposed sponsor, will be responsible for all relocations and adjustments to the facilities. The Engineering Technical Appendix Section 8 contains a description of affected facilities. Drawings showing the facilities are shown in Engineering Technical Appendix Tab III.

D. Environmental Impacts

The potential impacts of the recommended plan remain essentially the same as the impacts associated with the authorized project. These impacts are documented in Final Environmental Impact Statement prepared in 1985. Commercial development dominates the project-affected area. Land use patterns in the project area virtually preclude natural areas. To mitigate for the loss of riparian habitat within the project area, the upper slopes of the stream bank will be reseeded with deep rooting grasses and non-woody annuals and perennials. To mitigate for the disturbance of the aquatic and benthic life, riffle/pool complexes would be constructed intermittently along the 0.7-mile of Island Creek to be widened. The riffle structures, consisting of stone similar in size to the stone slope protection, would be approximately 25 feet wide and extend across the width of the channel. The riffle structures would be anchored approximately 1 foot into the streambed and rise approximately 1.5 foot above the streambed. To mitigate for this loss of upland and bottomland hardwood trees and shrubs present at the disposal site and for the 1.5 acres of bottomland hardwoods not replaced along Island Creek, the 6.5 acres of new fill would be seeded with native grass, annual and perennial mix and planted with upland deciduous trees and shrubs. The planting would be maintained as a successional plant community requiring no maintenance such as mowing or herbicide use. The spoil disposal site would be acquired in fee to insure control and management of mitigation. Refer to the Environmental Assessment for further details of project mitigation.

E. Cultural Resources

No National Register sites will be directly impacted and the design of the project will be coordinated with the West Virginia Division of Culture and History. Implementation of the recommended plan would not have an effect on cultural resources of the area. If significant archeological or historical resources are encountered during construction, appropriate mitigative measures will be incorporated.

F. O&M Considerations

The non-Federal sponsor will be responsible for the operation and maintenance of the project and all associated costs thereof after the completion and acceptance of the project as well as the operation and maintenance of the project and all associated costs thereof after the completion and acceptance of the project. The operation and maintenance of the project will be in accordance with Federal regulations and the Project Cooperation Agreement. The sponsor will be required to do the following: keep the right-of-way free of all unauthorized encroachments; inspect the post and panel walls on a prescribed basis and make any necessary repair; mow (both with trimmer and by mower) the grass on a predetermined average per season; inspect the stone slope protection; make repairs to the project when required; and submit annual reports to the District Engineer. An operation and maintenance manual will be prepared by the Corps and provided to the Sponsor and will contain detailed requirements and information regarding all project mitigation, including an erosion control plan for all construction work. The Corps of Engineers will, annually, inspect the condition of the project including all mitigation features, both along Island Creek

A. Detailed Mapping

During the early stages of PED, detailed topographical mapping was obtained for the entire structural project area. This mapping was prepared from aerial photography flown in 1991. Mapping was developed at a scale of 1-inch equal 50 feet.

B. Geotechnical Investigations

The subsurface explorations program consisted of a review of existing data and the evaluation of 13 sample borings drilled throughout the length of the project (0.7 mile). Soil and rock foundation conditions were evaluated as well as the availability of construction materials. Expanded information is available in the Engineering Technical Appendix Tab IV.

C. Hydrology & Hydraulics Studies

The frequency of flooding analysis was updated and water surface profiles for existing and modified conditions were computed based on current conditions and criteria. Expanded information on these studies is contained in the Engineering Technical Appendix Tab II.

D. Detailed Design

During the general reevaluation study, preliminary design concepts were developed for numerous alternatives as a basis for estimating costs and evaluating impacts. A design concept was developed for the recommended plan. Constructibility aspects of all project features were also addressed during the development of the design concept. Detailed information regarding the design of the recommended plan is contained in the Engineering Technical Appendix.

E. Real Estate

A detailed reevaluation of real estate requirements and costs was conducted on the new construction work limits for the final array of plans. A real estate plan is included in the Engineering Technical Appendix Tab V.

XII. PLAN ACCOMPLISHMENTS

The implementation of the recommended plan (80-foot wide channel) would result in a project that would provide reductions in flooding depths along the lower portion of Island Creek. Specifically for a 100-yr flood the flooding depths would be reduced 4.4 ft., 6.6 ft., and 6.3 ft. at 1,000 ft., 2,000 ft., and 3,000 ft. upstream of the mouth respectively. For more detailed information on the flood reductions at other frequencies and locations, see Exhibit A-II-10 in Tab II, Hydrology and Hydraulics Section of the Engineering Technical Appendix.

The project would prevent $3.8 million or about 40 percent of the average annual damages estimated to occur under existing conditions. The plan maximizes net benefits at $2.1 million and has a benefit-to-cost ratio of 2.3 to 1. It would prevent about $5,460,000 in damages if a 100-yr flood were to occur. The project avoids detrimental social, environmental, and economic impacts and provides a betterment of public safety through reduced flooding and warning.

XIII. PLAN IMPLEMENTATION

A. Institutional Requirements

Prior to initiation of construction, Congress must appropriate funds for the Federal share of project costs. Requirements for non-Federal participation must also be met prior to initiation of construction. This includes the execution of a Project Cooperation Agreement (PCA) between the local sponsor and the Federal government and the provision of all funds and/or work necessary to satisfy the cost sharing requirements in effect at the time of PCA execution. Upon completion of construction, the project will be turned over to the local sponsor for operation and maintenance.

B. Division of Plan Responsibilities

The implementation of the recommended plan of development is the joint responsibility of the Corps of Engineers (representing the Federal government) and the Logan County Commission, West Virginia (the local sponsor) with support from the West Virginia Soil Conservation Agency (WVSCA). The Corps of Engineers will complete the plans and specifications, provide funds for project construction, construct the project, and make an annual inspection of the conditions of the project. The following is a list of the non-Federal sponsor's required responsibilities for the project (Logan County Commission along with WVSCA):

a. Provide a minimum of 25 percent, but not to exceed 50 percent of total project costs as further specified below:

(1) Enter into an agreement which provides, through execution of the Project Cooperation Agreement, 25 percent of preconstruction engineering and design (PED) costs;

(2) Provide, during construction, any additional funds needed to cover the non-Federal share of PED costs;

(3) Provide, during construction, a cash contribution equal to 5 percent of total project costs;

(4) Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations determined by the Government to be necessary for the construction, operation, and maintenance of the project;

(5) Provide or pay to the Government the cost of providing all retaining dikes, waste weirs, bulkheads, and embankments, including all monitoring features and stilling basins, that may be required at any dredged or excavated material disposal areas required for the construction, operation, and maintenance of the project; and

(6) Provide, during construction, any additional costs as necessary to make its total contribution equal to 25 percent of total project costs.

b. For so long as the project remains authorized, operate, maintain, repair, replace, and rehabilitate the completed project, or functional portion of the project, at no cost to the Government, in accordance with applicable Federal and State laws and any specific directions prescribed by the Government.

c. Give the Government a right to enter, at reasonable times and in a reasonable manner, upon land which the local sponsor owns or controls for access to the project for the purpose of inspection, and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the project.

d. Assume responsibility for operating, maintaining, replacing, repairing, and rehabilitating (OMRR&R) the project or completed functional portions of the project, including mitigation features without cost to the Government, in a manner compatible with the project's authorized purpose and in accordance with applicable Federal and State laws and specific directions prescribed by the Government in the OMRR&R manual and any subsequent amendments thereto.

e. 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 non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element.

f. Hold and save the Government free from all damages arising for the construction, operation, maintenance, repair, replacement, and rehabilitation of the project and any project-related betterments, except for damages due to the fault or negligence of the Government or the Government's contractors.

g. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project to the extent and in such detail as well properly reflect total project costs.

h. Perform, or cause to be performed, 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 USC 9601-9675, that may exist in, on, or under lands, easements or rights-of-way necessary for the construction, operation, and maintenance of the project; except that the non-Federal sponsor shall not perform such investigations on lands, easements, or rights-of-way that the Government determines to be subject to the navigation servitude without prior specific written direction by the Government.

i. Assume complete financial responsibility for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or right-of-way that the Government determines necessary for the construction, operation, or maintenance of the project.

j. To the maximum extent practicable, operate, maintain, repair, replace, and rehabilitate the project in a manner that will not cause liability to arise under CERLCA.

k. Prevent future encroachments on project lands, easements, and rights-of-way which might interfere with the proper functioning of the project.

l. 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 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR part 24, in acquiring lands, easement, and rights-of-way, and performing relocations for construction, operation, and maintenance of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act.

m. Comply with all applicable Federal and State laws and regulations, including Section 601 of the Civil Rights Act of 1964, Public Law 88-352, 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 Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), requiring non-Federal preparation and implementation of flood plain management plans.

n. Provide 25 percent of that portion of total cultural resource preservation mitigation and data recovery costs attributable to structural flood control that are in excess of one percent of the total amount authorized to be appropriate for structural flood control.

o. Participate in and comply with applicable Federal floodplain management and flood insurance programs.

p. Not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is expressly authorized by statute.

Preliminary discussions were held with the Logan County Commission concerning their legal capability to sponsor, ability to acquire real estate and PL 91-646 requirements as well as documentation of LERRD costs. The PCA specifying the responsibilities of the two parties must be consummated prior to the initiation of construction. The estimated Federal cost of construction is $20. 8 million. The estimated non-Federal first cost is $7.9 million and the estimated cost of operation and maintenance is $73,100 annually.

C. Views of the Non-Federal Sponsor

During the course of the study, the Logan County Commission has demonstrated an interest and support in the development and implementation of a project that would reduce flood damages in the Island Creek area. However, at a meeting attended by the three Logan County Commissioners on 13 October 1993, the Commission President explained that Logan County was in no position to finance their share of construction costs. While they were unable to financially commit to the project at that time, the Commission did want to continue to seek potential sources of funding for the non-Federal share of the project.

Subsequent to the events above, in 1998 the West Virginia Soil Conservation Agency (WVSCA) agreed to provide funding to assist the Logan County Commission with sponsoring the project. In a resolution passed 9 January 1998, the Logan County Commission agreed to request the Corps to proceed with the study efforts. WVSCA fully supports this project and will work with the Logan County Commission to provide non-Federal financial support. The Letter of Intent and other letters of support are included as Exhibit 6.

XIV. SUMMARY OF COORDINATION

During the Reevaluation study effort, coordination was maintained with Federal, State, and local government agencies and other interested parties. Specific coordination was conducted with the U.S. Fish and Wildlife Service, the West Virginia Department of Natural Resources, the Logan County Commission and West Virginia Soil Conservation Agency.

COUNTY OF LOGAN

COMMISSIONERS:
ARTHUR E. KIRKENDOLL
PRESIDENT

DANNY R. GODBY

WILLIE D. AKERS, JR.

COUNTY ADMINISTRATOR
PAUL HARDESTY

OFFICE OF THE COUNTY COMMISSION
ROOM 103 • LOGAN COUNTY COURTHOUSE
LOGAN, WV 25601
(304) 792-8626 FAX (304) 792-8511

August 17, 2001

Col. John D. Rivenburgh, District Engineer
Huntington District
U. S. Army Corps of Engineers
502 Eighth St
Huntington, WV 25701-2070

Dear Col. Rivenburgh:

The Logan County Commission has completed its review of the model Project Cooperation Agreement and the draft General Reevaluation Report, dated May, 2001, for the Island Creek Local Protection Project. The recommended project includes widening the existing Island Creek channel to 80 feet beginning at the confluence of the Guyandotte River and continuing 3,600 feet upstream. The plan also includes two post-and-panel retaining walls constructed in locations to protect specific commercial structures, removal of an existing sandbar, installation of a flood warning system and aquatic and terrestrial mitigation features. The Logan County Commission understands that the proposed project provides between a 10 and 20 year level of flood protection. Furthermore, the Logan County Commission understands its responsibility to provide all necessary project lands, easements, rights-of-way, utility relocations and disposal sites (LERRDs) and agrees to comply with the floodplain management and insurance requirements stated in Section 402 of the Water Resources Development Act of 1986 as amended.

The estimated fully funded total project cost is $23.4 million (October, 2000 price level), which includes all post feasibility studies, pre-construction engineering and design, project construction and LERRDs costs. The Logan County Commission's share as the non-Federal sponsor is estimated at $8.8 million (38 percent of total project cost), which includes a 5 percent cash requirement ($1.2 million) and LERRDs requirement ($7.6 million). The Logan County Commission anticipates receiving financial support for its share of project costs through the West Virginia Soil Conservation Agency.

EXHIBIT 6

Col. John D. Rivenburgh
Page 2
August 17, 2001

The Logan County Commission has determined that the model Project Cooperation Agreement contains terms that are acceptable. The Logan County Commission has the ability, capability and full legal authority to fulfill all of its obligations contained in the model agreement. The Logan County Commission intends to enter into an agreement with the Department of the Army for implementation of the project and for its subsequent operation and maintenance.

It is understood that the purpose of this letter is to establish the Logan County Commission's intent and ability to serve as the non-Federal sponsor of the project, and does not financially or legally obligate the Logan County Commission or the Federal Government.

Very truly yours,

Arthur E. Kirkendoll
President, Logan County Commission

AEK/zw

EXHIBIT 6

Bob Wise
Governor

West Virginia
Soil Conservation Agency
1900 Kanawha Boulevard, East
Charleston, WV 25305-0193
Phone: (304) 558-2204
Fax: (304) 340-4839

Gus R. Douglass
Chairman

Lance Tabor
Executive Director

June 29, 2001

Colonel John D. Rivenburgh
District Engineer, Huntington District
U.S. Corps of Engineers
502 8th Street
Huntington, West Virginia 25701-2070

Dear Colonel Rivenburgh:

The West Virginia Soil Conservation Agency has completed its review of the General Reevaluation Report, dated May 2001, for the Island Creek Local Protection Project. This agency understands that the proposed project includes widening the lower 0.7 mile of Island Creek to a bottom channel width of 80 feet; construction of two post-and-panel tie-back retaining walls; removal of a sandbar; and installation of a flood warning system and various aquatic and terrestrial environmental mitigation features. The Logan County Commission would be the non-federal sponsor for this project with financial assistance being provided from the State of West Virginia being co-administered by this agency and the Guyan Soil Conservation District.

The estimated fully funded total project cost is $23.4 million, which includes all post feasibility studies, pre-construction engineering and design, project construction and LERRDs costs. The Logan County Commission's share as the non-federal sponsor is estimated at $8.8 million, which includes a 5 percent cash requirement ($1.2 million) and LERRDs requirement ($7.6 million).

It is understood that the purpose of this letter is to establish the West Virginia Soil Conservation Agency's intent and ability (dependent on appropriated state funding) to serve as a financial supporter to the Logan County Commission (non-federal sponsor) for this project, and does not financially or legally obligate this agency or the Federal Government.

Sincerely,

Lance E. Tabor
Executive Director

LT/rah

CC: Douglass, Campbell, Wolfe, Guyan SCD
Filing 390-30-118

EXHIBIT 6

Guyan Soil Conservation District
2631-5th Street Road - Huntington, WV 25701

July 23, 2001

Colonel John D. Rivenburgh
District Engineer, Huntington District
US Corps of Engineers
502 8th Street
Huntington, WV 25701-2070

Dear Colonel Rivenburgh,

The Guyan Soil Conservation District has completed its review of the Project Cooperation Agreement for the Island Creek Local Protection Project. The Guyan Soil Conservation District understands that the proposed project includes widening the lower 0.7 mile of Island Creek to a bottom channel width of 80 feet; construction of two post-and-panel tie-back retaining walls; removal of sandbar; installation of a flood warning system; and various aquatic and terrestrial environmental mitigation features. The Logan County Commission would be the non-federal sponsor for this project with financial assistance being provided from the State of West Virginia through the WV Soil Conservation Agency being administered by us, the Guyan Soil Conservation District.

The estimated fully funded total project cost is $23.4 million, which includes all post feasibility studies, pre-construction engineering and design, project construction and LERRDs costs. The Logan County Commission's share as the non-federal sponsor is estimated at $8.8 million, which includes a 5 percent cash requirement ($1.2 million) and LERRDs requirement ($7.6 million).

It is understood that the purpose of this letter is to establish the Guyan Soil Conservation District's intent and ability (dependent on appropriated state funding) to serve as a financial administrator between the WV Soil Conservation Agency (financial supporter) and the Logan County Commission (non-federal sponsor) for this project, and does not financially or legally obligate this District or the Federal Government.

Sincerely,

Jan Barry Hatfield

Jan Barry Hatfield
GSCD Sec./Treasurer

JBH/mm

Cc: Tabor, Campbell, Layman

EXHIBIT 6

XV. CONCLUSIONS

The reevaluation studies contained herein have concluded that a 0.7 mile long channel modification project (80-foot wide channel) to reduce flood damages is in the federal interest and is economically feasible with a benefit-to-cost ratio of 2.3 to 1. The recommended channel plan provides between 10 and 20-year level of protection to most structures in the project area and produces average annual net benefits of $2.1 million. The recommended plan maximizes net economic benefits and is favored by the non-Federal sponsor. For these reasons, the channel modification is the recommended plan for water resources development in the Island Creek area.

The reevaluation studies have further concluded (affirmed by the Division office) that the nonstructural component of the authorized project is not economically justified at this time. Therefore the nonstructural component of the authorized plan will be deferred until such time as implementation of that plan component can be justified.

XVI. RECOMMENDATION

Based upon findings contained herein and the Environmental Assessment, I recommend that the channel modification project be implemented under the 1986 WRDA authorization. I further recommend that the nonstructural component of the authorized plan be deferred at this time.

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 state, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

JOHN D. RIVENBURGH
COLONEL, Corp of Engineers
Commanding

US Army Corps of Engineers
Huntington District

FINAL ENVIRONMENTAL ASSESSMENT

ISLAND CREEK LOCAL PROTECTION PROJECT
LOGAN COUNTY, WEST VIRGINIA

Department of the Army
Huntington District, Corps of Engineers
Huntington, West Virginia

MAY 2001

U.S. Army Corps of Engineers
Huntington District

FINAL ENVIRONMENTAL ASSESSMENT
ISLAND CREEK LOCAL PROTECTION PROJECT
LOGAN, LOGAN COUNTY, WEST VIRGINIA

Abstract: The proposed project area is located in southern West Virginia, in Logan County, and is a part of the Island creek Local Protection Project. The proposed actions consist of widening Island Creek to approximately 80 ft. from its confluence with the Guyandotte River to approximately 0.7 miles upstream. The material excavated during the channel widening will be spoiled in School House Hollow, located off U.S. Route 119 and State Route 73. Approximately 203,000 cubic yards of material will be place on an existing 12-acre fill to a depth of 19 ft. This Environmental Assessment was undertaken to provide updated information concerning the proposed project. Huntington District's analysis for the human and natural environment and socio-economics determined the proposed action produced insignificant impacts. The action was selected because it provides benefits, is environmentally sound, is socially acceptable and is responsive to the request of the local residents and Logan County.

For Additional Information Contact:

Ginger Mullins
U.S. Army Corps of Engineers
Huntington District
502 Eighth Street
Huntington, West Virginia 25701-2070
Telephone: (304) 529-5712

EXECUTIVE SUMMARY

Introduction: This report was authorized by the Water Resources Development Act of 1986 (Public Law 99-662, dated 17 November 1986). The proposed actions consist of widening Island Creek to approximately 80 ft from its confluence with the Guyandotte River to approximately 0.7 miles upstream. The material excavated during the channel widening will be spoiled in School House Hollow, located off U.S. Route 119 and State Route 73. Approximately 203,000 cubic yards of material will be placed on an existing 12-acre fill to a depth of 19 ft.

Permit Coordination Procedures: The Corps of Engineers has obtained the 401 Water Quality Certification for the proposed fill placement in waters of the United States. The resident contractor will be responsible for obtaining all other permits necessary for completion of the proposed action.

Alternatives Considered: A number of alternatives with potential for meeting the needs of the proposed action amendments were considered. The selected alternative adequately meets the cost and minimal impact requirement as well as the desires of the local residents and citizens of Logan County.

Environmental Effects of the Action: The proposed action will not have any significant long-term or short-term impacts on the human and/or natural environment.

Mitigation: In order to mitigation for the disturbance of the aquatic and benthic life, riffle/pool complexes will be constructed intermittently along the 0.7 miles of Island Creek to be widened. Also, mitigation for the loss of upland and bottomland hardwood trees and shrubs present at the disposal site and for the 1.5 acres of bottomland hardwoods not replaced along Island Creek, the 6.5 acres of new fill will be seeded with native grass, annual and perennial mix and planted with upland deciduous trees and shrubs.

SUMMARY

(X) Environmental Assessment

Responsible Office: Environmental Analysis Section
Planning Branch
Planning, Programs, and
Project Management Division
U.S. Army Corps of Engineers
Huntington District
502 Eighth Street
Huntington, West Virginia 25701-2070

Telephone: (304) 529-5712

1. Name of Action: Island Creek Local Protection Plan, Logan, Logan County, West Virginia.

2. Description of Action: The proposed actions consist of widening Island Creek to approximately 80 ft from its confluence with the Guyandotte River to approximately 0.7 miles upstream. The material excavated during the channel widening will be spoiled in School House Hollow, located off U.S. Route 119 and State Route 73. Approximately 203,000 cubic yards of material will be place on an existing 12-acre fill to a depth of 19 ft.

3. Environmental Impacts: Impacts on flora and fauna, aquatic and terrestrial, as the result of the proposed action implementation, would result in no significant adverse long-term impacts to the resources within the action area. Endangered/Threatened species, archeological and/or historical sites and wetlands will not be adversely impacted. HTRW is not a concern at the action or spoil sites.

In summation, implementation of the proposed widening of Island Creek a Logan, Logan County, will not adversely affect the long-term quality of the human or natural environmental within the identified action area.

LOCAL PROTECTION PLAN
ISLAND CREEK BASIN, LOGAN COUNTY, WV
ENVIRONMENTAL ASSESSMENT

TABLE OF CONTENTS

1.0 PURPOSE AND NEED

1.1 **Purpose and Need**. The purpose of the Island Creek Local Protection Project at Logan, West Virginia is to reduce flooding damages within the Island Creek Basin and to improve response time of the community in the event of a flood situation. The reevaluation study of the authorized Island Creek LPP has been conducted to affirm the economic feasibility of the project, to identify the National Economic Development (NED) plan and to ensure conformity with current criteria, policy, and guidelines. The intention of the reevaluation report has been to furnish sufficient detail to proceed directly to plans and specifications for the structural portion of the project (the lower 0.7 miles channel improvement) and the Flood Warning System (FWS).

1.2 **Changes in Project Conditions.** Since completion of the authorized local protection plan at Logan in 1986, several changes have occurred for which an environmental evaluation is required. First, there has been significant reductions in size and cost for a Federal project at Logan. The project length has been shortened from 19 miles to 0.7 miles. Proposed work along Mud and Copperas Mine Fork has been eliminated, as has all non-structural work within the basin. With the authorized project, the lower 0.7 miles of Island Creek would be widened to 100 ft, the lower 1000 ft of which was to be concrete-lined. However, the 1993 General Reevaluation Study of the Island Creek Local Protection Project would minimize disturbance to the stream bed by eliminating the use of concrete and reducing the channel width to 80 ft (see Figure 1). Because of the former nonstructural component, a considerable number of housing relocation sites along the Guyandotte River floodplain were required. In addition, several spoil disposal areas would have been needed to accommodate the added excavated materials. Day use recreation facilities were also a part of the authorized plan, but they are not included in the reevaluation study.

Secondly, the project area has experienced some additional economic development since the project was authorized in 1986. On the Guyandotte River, just downstream from the mouth of Island Creek, there is a McDonald's restaurant. From that point upstream on Island Creek for a distance of over 600 feet, an interceptor sewer system has been installed. Just above the U.S. Route 119 bridge over Island Creek, a Shoney's restaurant, a Taco Bell restaurant, and a Super 8 have all been constructed on fill material. Near the upper end of the channel, the former K-City Discount store was remodeled to become the Honeycutt Pontiac dealership and since the 1996 flood has since reverted to a discount store.

Thirdly, the amount of unauthorized dumping along the lower 0.7 miles of Island Creek has increased since 1986. The streambanks contain more rubble and automobile bodies at present, suggesting no improvement in environmental awareness regarding stream corridors in the project area.

1.3 **Flood Warning System.** A state-of-the-art Flood Warning System (FWS) is recommended for the Island Creek Basin allowing continual direct access to flood/storm data. Community access to this data would significantly improve response time of the communities in the event of a flooding situation. The recommended system would be a state-of-the-art integration of new and upgraded stream and precipitation gages, radio repeater sites and dedicated computer workstations running software with forecast capability. The system would provide additional warning time for the small communities upstream of Logan. The system would also be beneficial for communities located downstream on the Guyandotte River. The recommended FWS would expand the Integrated Flood Observing and Warning System (IFLOWS) to meet the basin-wide requirement of providing flood warning to the Office of Emergency Service (OES), Directors of Logan County, and possibly some of the surrounding counties. By including stream gauge data into the forecast model, the reliability of flood height predictions and warning times would improve current capability considerably.

One of the three existing river gauge sites on the Guyandotte River that use data loggers/transmitters would be up-graded using state-of-the-art equipment. A maximum of nine (9) new river gages would be installed to forecast flooding upstream of Logan. The locations of the stations were determined during field investigations and took into account recommendations of the Logan County Office of Emergency Services. Equipment to be installed would provide all the functions including satellite communications, data collection, telephone, and IFLOWS transmission capabilities.

2.0 ALTERNATIVES

2.1 <u>Alternative Plans.</u> A number of alternatives with potential for alleviating the flooding problem in the Island Creek Basin have been considered. These include both structural and nonstructural plans. The nature of the study area and magnitude of the flooding problem limit the potential alternatives that are both effective and implementable.

2.2 <u>Plans Eliminated From Further Study.</u> All plans, except those defined subsequently, were eliminated from further consideration in the 1993 General Reevaluation Report due to the economics of the National Economic Development Plan (NED) and to ensure conformity with current criteria, policy, and guidelines. The nonstructural floodproofing and structural floodproofing along upper Island Creek, Copperas Mine Fork and Mud Fork was determined to be infeasible.

2.3 <u>Without Condition (No Federal Action).</u> In the absence of project implementation, the future land use and related conditions within the project area are forecast to remain comparable to conditions, as they currently exist. The "No Action" alternatives will be fully evaluated to comply with NEPA requirements.

2.4 <u>Plan Considered in Detail.</u> The existing Island Creek would be widened to create a trapezoidal channel using 2.5 horizontal to 1 vertical side slopes. Channel widening would begin at the confluence of Island Creek and the Guyandotte River and continue for approximately 0.7 miles. In 1993, widths for the channel were studied: to determine feasibility of 60', 80', and 100', with 80' the optimal choice, hence the preferred alternative. Post and panel walls would be constructed in certain locations to avoid the impacts associated with the acquisition of certain structures along the channel.

Attempts would be made to minimize the impacts on existing bridges along the stream. Utility lines and drainage structures would be relocated or adjusted to accommodate construction and operation of the new channel.

Generally, widening would only be accomplished on one side of the channel in any area. Clearing and grubbing would be accomplished only in those areas where walls are constructed or where earthwork cuts would be made. All other areas would remain undisturbed as much as possible. Stone slope protection would be placed along the base of the wall and at the toe of the newly excavated slope to reduce the effects of erosion in the lower level flood frequencies. The remaining area between the stone slope protection and the contractors working limits (CWL) would be seeded. The material removed during channel widening would be spoiled at a nearby site at School House Hollow. The material would be placed as upland fill over approximately 6.5 acres of the 12 acres of existing fill material that was spoiled at the site during the construction of U.S. Route 119 and State Route 73 in the mid-1990s. The material would be placed at an approximate depth of 19 feet. The final graded slopes would be properly drained and seeded and blended into the surrounding terrain. An additional 2.5 acres of the 12 acre site would be utilized by the local sponsor for future disposal of channel sediment.

Integrated Flood Observing and Warning System (IFLOWS) is a wide-area computer network of river and rain gauges with enhanced, full, two-way radio, microwave and satellite and telephone line communications. The primary responsibility for flood forecasting would remain with the National Weather Service (NWS). The real-time data from each of the gauges in the system would be relayed to the NWS forecasting center in Cincinnati, Ohio, where it would be processed by existing software to develop flood forecasts. By including stream gauge data into the forecast model, the reliability of flood height predictions and warning times would improve current capability considerably.

The typical rain gauge/river gauge consists of a 16-foot, 12-inch diameter pipe on which a small antenna, solar panel, and rain-measuring device are mounted. The entire unit, including the mounting pipe weighs 80 pounds. It is installed by setting the pipe in a 2-foot by 2-foot concrete base. In some cases, the equipment is mounted on existing towers and not on the the standard 16-foot pipe. The equipment is easily installed and removed as it is simply bolted onto the existing structures or towers. The new gauges will be located on existing State of West Virginia property (West Virginia Department of Highways (WVDOH) road right-of-way) and constructed by the Corps under a standard WVDOH permit.

The following locations were determined to be suitable for the installation of FWS stations in the Island Creek basin.

Site 1. Mount Gay/Cherry Tree
A FWS station would be located on Island Creek in the community of Mount Gay/Cherry Tree on or near a highway bridge on State Route 44 just south of the S.R. 44/S.R. 73 intersection and just west of a Kawasaki/Suzuki ATV dealership. The site is

approximately 0.9 miles upstream of the confluence of Island Creek and the Guyandotte River.

Site 2. Switzer
FWS station would be located on Island Creek just north of the community of Switzer on or near Highway Bridge Number 2946 on State Route 44. The site is approximately 5.3 miles upstream of the confluence of Island Creek and the Guyandotte River.

Site 3. Chauncey
FWS station would be located on Island Creek in the community of Chauncey on or near a timber deck bridge on County Route 119/18 at its intersection with State Route 44. The site is approximately 8.2 miles upstream of the confluence of Island Creek and the Guyandotte River.

Site 4. Omar
FWS station would be located on Island Creek in the community of Omar on or near Highway Bridge Number 3248 on State Route 44 at its intersection with Sandy Bottom Rd. The site is approximately 8.9 miles upstream of the confluence of Island Creek and the Guyandotte River.

Site 5. Cora/Whitman Junction
FWS station would be located on Copperas Mine Fork in the community of Cora on or near highway bridge number S-1810 on Old U.S. Route 119. The site is approximately 1.5 miles upstream of the confluence of Copperas Mine Fork and Island Creek.

Site 6. Trace Junction
FWS station would be located on Copperas Mine Fork in the community of Trace Junction on or near a highway bridge on Price Bottom Road (119/34) at its intersection with Old U.S. Route 119. The site is approximately 2.8 miles upstream of the confluence of Copperas Mine Fork and Island Creek.

Site 7. Holden/Copperas Mine Fork
FWS station would be located on Copperas Mine Fork in the community of Holden on or near a highway bridge on Old U.S. Route 119 adjacent to the CONSOL Coal Group, Mid-Continent Region, Bluefield Operation, Holden Complex building. The site is approximately 3.5 miles upstream of the confluence of Copperas Mine Fork and Island Creek.

Site 8. Holden/Trace Fork
FWS station would be located on Trace Fork in the community of Holden on or near highway bridge with guardrail labeled 3.29 on Old U.S. Route 119 at its intersection with Lower Trace Route A Rd. The site is approximately 0.1 miles upstream of the confluence of Trace Fork and Copperas Mine Fork.

Site 9. Verdunville
FWS station would be located on Mud Fork just east of the community of Verdunville on or near the piers of a bridge on New U.S. Route 119 at its overhead crossing with State Route 5. The site is approximately 1.9 miles upstream of the confluence of Mud Fork and Copperas Mine Fork.

Site 10. Logan
Existing FWS station on the Guyandotte River in Logan would be upgraded and incorporated into the Island Creek FWS.

2.5 Environmental Design Measures. The quality of the environment has been affected in the densely populated study area. The quality of fish and wildlife habitats in the impact area ranges from fair to very poor. Most of this results from the fact that almost all development occurs in the bottomland along the stream due to the steep topography. Most of the bottomlands along Island Creek are limited to a narrow band of riparian vegetation and small stands of hardwoods. Disturbed areas have grown up in old fields adjacent to the nearly continuous string of commercial and industrial development in the project area. Major wildlife species found in the bottomlands of the study area are resident and migrant songbirds, small mammals, amphibians, and reptiles.

The aquatic resources of the impact area are greatly stressed by dense population. Resource related problems in the area include but are not limited to acid mine drainage, siltation from logging and mining, untreated domestic sewage, trash, dredging and filling, and general stream bank disturbances such as riprap, cribwalls, gas and sewer pipes and bridges. Most of the stream reach has some snag cover and instream structure. Solid substrate is in short supply however, since much of the bottom is unconsolidated sediment. Overhanging riparian vegetation from the steep banks shade much of the stream, but the canopy rarely completely closes over the stream.

Except for the upper reaches of Island Creek, some small relatively undisturbed tributaries, and the Guyandotte River mainstem, the project area has poor water quality that is generally incapable of supporting aquatic life, or at best a depressed resemblance of what would normally occur.

The bottomland and upland habitats are interspersed with small businesses, road, railroads, and some industry throughout the project area. Quality of this habitat type ranges from good to poor. Availability of food items is fair except for the absence of some major food producers, i.e., oaks and dogwoods. Sycamore and river birch are dominant. The stands are of uneven age with most being young. There is a general lack of mast producing species and den sites. Downed logs and detritus, rock and lush vegetation offer adequate small mammal, amphibian, and reptile habitat. High human disturbance (negative interspersion) makes the area undesirable for most game species. Food, cover, and reproduction value to wildlife generally declines downstream due to the increased human population downstream.

During construction, vegetation would be snagged and cleared adjacent to the stream bank of Island Creek within the CWL. Approximately 2.5 acres of this cleared vegetation is considered to be bottomland hardwood riparian habitat, which is located along the right descending bank of Island Creek. To mitigate for the loss of riparian habitat, the upper slopes of the stream bank would be reseeded with deep rooting native grasses and non-woody annuals and perennials. Approximately 1.0 acre of native bottomland hardwood tree and shrub species would be planted along the stream leaving a 12-foot wide access road for maintenance vehicles. The native bottomland plant community would be maintained as a successional plant community requiring no maintenance such as mowing or herbicide use.

The proposed School House Hollow disposal area consists of a valley containing approximately 105 acres of moderate to steep hillside. The site is vegetated with upland hardwood vegetation. Approximately 12 acres of the valley portion of the site has previously been used as a spoil disposal site during the construction of U.S. Route 119 and State Route 73 in the mid-1990s. The previous fill material consists of rock and soil and is configured in two benches with fill slopes of approximately 2.5 to 1. The existing fill is vegetated with tall grasses and low growing brush. Within the valley, a dirt haul road provides access along the west side of the fill. A shallow ditch around the perimeter of the existing fill collects storm water surface runoff from the hillsides and carries it to the base of the fill where it flows under the access road and State Route 73 via concrete culverts. The placement of channel excavated material over 6.5 acres of the spoil site would require the removal of approximately 1.5 acres of upland and bottomland hardwood trees located on the hillside around the perimeter of the existing fill. To mitigate for this loss of upland and bottomland hardwood trees and shrubs present at the disposal site and for the 1.5 acres of bottomland hardwoods not replaced along Island Creek, the 6.5 acres of new fill would be seeded with native grass, annual and perennial mix and planted with upland deciduous trees and shrubs. The planting would be maintained as a successional plant community requiring no maintenance such as mowing or herbicide use. The spoil disposal site would be acquired in fee to insure control and management of mitigation

To mitigate for the disturbance of the aquatic and benthic life, riffle/pool complexes would be constructed intermittently along the 0.7 miles of Island Creek to be widened. The riffle structures, consisting of stone similar in size to the stone slope protection, would be approximately 25 feet wide and extend across the width of the channel. The riffle structures would be anchored approximately 1 foot into the streambed and rise approximately 1.5 feet above the streambed.

2.6 Permits and Other Environmental Compliance

2.6.1 Section 404/401. The Corps of Engineers will coordinate with the State of West Virginia to obtain a Section 401 Water Quality Certification for the authorized project at Logan. Also, a 404 (b) (1) Analysis will be obtained due to the fill activities occurring with at the School House Hollow disposal site.

2.6.2 **Solid Waste Disposal.** The contaminated soils discussed below in paragraph 2.6.6 Hazardous, Toxic and Radiological Wastes, would be taken to an appropriate landfill for disposal. All other excavated spoil materials would be disposed of at the School House Hollow spoil disposal site.

2.6.3 **Fish and Wildlife Coordination Act.** Compliance with the Fish and Wildlife Coordination Act has been conducted concurrent with NEPA compliance. Coordination with Federal and state natural resource agencies would commence through project implementation.

2.6.4 **Endangered Species Act.** In accordance with the Endangered Species Act of 1973 and the Endangered Species Act Amendments of 1978, the Huntington District requested the views of the U.S. Fish and Wildlife Service concerning the potential presence of special listed or proposed for listing as endangered. USFWS indicated a federally listed species that could occur within the proposed project area is the endangered Indiana bat, Myotis sodalis. This species may use the project area for foraging and roosting between April 1 and November 14.

The Service has determined the number of acres of suitable foraging and roosting habitat on the West Virginia landscape available to each Indiana bat known to occur there. On that basis, it has been determined that small projects, generally affecting 17 acres or less of suitable foraging and roosting habitat, would have an infinitesimally small chance (at the 98% confidence level) of resulting in direct or indirect take. If less than 17 acres of suitable habitat would be disturbed, the Service considers that action discountable and unlikely to adversely affect the endangered Indiana bat at any season of the year.

2.6.5 **Cultural Resources Requirements.** Section 106 of the National Historic Preservation Act of 1966 requires the Corps to identify historic properties affected by the proposed action and to evaluate the eligibility of those properties for the National Register of Historic Places. An archeological literature survey of the Island Creek Basin was conducted in 1983 and no archeological material was discovered.

As part of the EA, a request was submitted to the West Virginia SHPO for comments regarding any adverse impacts that the proposed project may have on cultural resources. Information received from the West Virginia SHPO indicates that the project site has the potential to contain archeological sites. In accordance with this information, a Corps of Engineers' archeologist has performed a site reconnaissance. A report is currently being prepared to report the findings to the West Virginia SHPO. If significant archeological or historical resources are encountered during construction, appropriate mitigative measures will be incorporated, and the Corps will fully comply with the consultation requirements of Section 106.

2.6.6 Hazardous, Toxic, and Radiological Wastes.

Channel Widening Activities

GRW Engineers Inc. of Lexington, KY conducted a Phase I Hazardous, Toxic, and Radiological Waste investigation on the site, (HTRW report dated May, 1991). From this investigation, four Areas of Concern (AOC) were identified as AOC-1 Appalachian Power, AOC-4 Fill Material Area, AOC-5 Baisden Brothers Hardware, and AOC-6 Gaylock Wrecker Service. A Phase II investigation was conducted by personnel from the Huntington and Nashville District Corps of Engineers. Results of the Phase II investigation indicated the following: Polychlorinated biphenyl's (PCBs) contamination was detected at AOC-1, petroleum products and metals contamination was detected in AOC-4, potential leaking of a kerosene underground storage tank (UST) is suspected in AOC-5 and petroleum contamination was detected in AOC-6.

In May 1993, International Consultants Incorporated (ICI) conducted a further Phase II HTRW Investigation for AOC 4. Fill material encountered during this investigation was consistent with mining operations. The recommendation of this study was for disposal of the soils at AOC 4 as special waste.

In September 2000, WasteTron, Inc. completed another Phase II HTRW Investigation of Areas of Concern 1 and 4. Based on review of the analytical data and the comparison levels to the WV Voluntary Remediation Program De Minimus Levels and USEPA Toxicity Risk Based Concentrations Table for residential soil, there is no contaminated soil at AOC-1 which would require treatment, however, there is some contamination within AOC-4. The contamination identified in AOC-4 consists of TPH-DRO and lead.

The recommended method of treatment is that the approximately 11,000 cy of contaminated soil be taken from AOC-4, AOC-5 and AOC-6 to an appropriate landfill for disposal. The TPH (AOC-4), kerosene (AOC-5), and petroleum (AOC-6) can be disposed in a solid waste facility that accepts petroleum-impacted soil. The lead-impacted soil would require disposal at a properly permitted facility as a special (non-hazardous, contaminated) waste.

Spoil Disposal Location

In accordance with established Corps of Engineers (COE) Hazardous, Toxic, and Radioactive Waste (HTRW) policies, a Limited Phase I HTRW Investigation has been conducted at the request of the Huntington District's Planning Branch for the Island Creek Basin Local Protection Project's proposed spoil site. The spoil site would be used for the disposal of excess soil and rock excavated from the Island Creek channel during construction of the Local Protection Project and would also be used by the local sponsor for future disposal of channel sediment.

A site inspection was performed on the tract within the project's CWL. The site is on the north side of State Route 73, approximately 0.35 miles from its intersection with Old

U.S. Route 119 and State Route 44. During the site inspection, it was observed that approximately 12 acres of the valley portion of the site had previously been used as a spoil disposal site during the construction of U.S. Route 119 and State Route 73 in the mid-1990's. During the site inspection, no HTRW concerns were found, including staining or stressed vegetation on the former spoil area or in the surrounding area.

A search of available environmental records for the proposed spoil site was conducted using Environmental Data Resources, Inc. (EDR). This search met the government records search requirements of ASTM Standards Practice for Environmental Site Assessments, E1527-00. Search distances were also as per ASTM standards.

Based on the findings from the above activities, the proposed spoil site was determined to be free of HTRW concerns, nor were any identified in adjacent properties that would have the potential to impact this tract. Therefore, no further HTRW investigations are warranted at this time.

3.O AFFECTED ENVIRONMENT AND CONSEQUENCES OF ALTERNATIVES

3.1 General. Island Creek, a tributary of the middle reach of the Guyandotte River, drains approximately 105 square miles of rugged mountainous terrain. Island Creek basin is part of the extensively dissected Appalachian Plateau physiographic province and is comprised largely of steep-sided mountains and narrow stream valleys. Ninety percent of all slopes in Logan County, in which the basin lies, are in excess of 25 percent. Industrial, transportation, and residential land uses and community facilities occupy much of the rather limited level or gently sloping land.

3.2 Sensitive Resources

3.2.1 Geology and Soils. Most bedrock in the Island Creek watershed is from the Kanawha Formation, which is part of the Pottsville Group. High ridges are capped by bedrock from the Allegheny Formation. These rocks are of sedimentary origin. The Pennsylvanian age geology consists of dominantly massive sandstone interbedded with numerous coal seams, impure fire clays, sandy and argillaceous shales, and a few thin impure lenticular limestones. Coal is the most important economic constitute and is environmentally attractive because of its low sulfur content. The largest reserves have been mined from the No. 5 Block, Coalburg, Peerless, No. 2 Gas, (locally know as Upper and Lower Cedar Grove), and Powellton seams (locally known as Alma seams).

Soils that weather from this sandy geology include the Matewan, Highsplint, and Guyandotte soils on the steep mountain ridges, sideslopes, and cove areas; and the Yeager, Craigsville, and Chavies soils in the narrow floodplains. Most floodplain soils are impacted by residential, industrial and other commercial development, as is the case along this project reach. Natural soils have been disturbed by adding of spoil material and earth moving activities. These disturbed and mostly filled areas consist of land covered by houses, buildings, streets, parking lots, railroad tracks, and other urban components. Natural soil is almost non-existent along this project reach. There is no Prime Farmland, Statewide Important Farmland, Locally Important Farmland, or Hydric soils along this project reach.

3.2.1.1 **No Federal Action**. The no Federal action alternative would result in no impact on geology and soils.

3.2.1.2 **Preferred Plan.** The preferred plan when implemented would have no significant impact upon the soils or geology of the area.

3.2.2 **Fish and Wildlife**. Wildlife habitat is good in most areas of the basin except where impacted by mining operations, residential areas, and roads. Forest game habitat predominates and offers the most potential for wildlife. Farm game habitat is scarce, but good songbird and cottontail rabbit habitat exists in valleys having adequate streambank cover and brushy areas. Good riparian habitat exists in areas where not disturbed or destroyed by urbanization and channelization. In spite of the generally adequate habitat in the basin, wildlife populations are well below the carrying capacity of the land. Game species inhabiting the basin include whitetail deer, turkey, gray squirrel, cottontail rabbit, raccoon, ruffed grouse, Bobwhite, and gray fox. Mink, muskrats, mallards, and wood ducks breed along the streams.

The fishery resources of the Guyandotte River in the vicinity of Logan, West Virginia were surveyed in August 1982 by the West Virginia Department of Natural Resources under contract to the Huntington District Corps of Engineers. Three stations totaling 4.1 surface acres were surveyed using rotenone. Standing crop estimates ranged from 30.4 lbs./acre to 110.3 lbs./acre, and difference were attributed to dissimilar habitats and sampling efficiencies. Channel and flathead catfish are the dominant species in the Guyandotte River at Logan. Gizzard shad are the dominant nongame species. Forty-three species and two hybrids were collected during the survey. The Guyandotte River is presently affected by both domestic and industrial pollution. Silt and sediments and associated high turbidities are presently limiting factors of gamefish species reproduction. In spite of this, game fish populations in the Guyandotte are good and overall standing crop is comparable to other West Virginia streams. Island Creek does not sustain a sport fishery in the project area.

3.2.2.1 **No Federal Action**. The no Federal action plan would have no impact on fish and wildlife. Current human encroachment on the fish and wildlife resources of the area would continue uninfluenced by a Federal flood damage reduction plan.

3.2.2.2.Preferred Plan. Implementation of the preferred alternative would not have a significant effect upon the fish and wildlife resources of the area. The limited urban wildlife resources found in the project area could be temporarily disrupted or dislocated during the interval of construction; however, no permanent losses are predicted to occur. Riparian losses are to be mitigated on-site with the revegetation of deep rooting grasses and non-woody annuals and perennials beneficial to wildlife. Short-term and temporary siltation effects are expected during construction. The fishery of lower Island Creek is of poor quality, so anticipated impacts to that resource are minimal. A temporary increase in turbidity of the Guyandotte River could affect sport fishing on the Guyandotte below the mouth of Island Creek. Erosion control practices would be fully implemented throughout construction of the new channel to minimize sedimentation of surface waters. In-stream mitigation would include the construction of riffle/pool complexes along the 0.7 miles channel widening.

3.2.3 Water Quality. The aquatic environment of the study area may be characterized as severely degraded through natural resource exploitation and man's encroachment and pollution. Coal mining pollution is undoubtedly the major cause of the poor water quality in the study area. Abandoned deep mines are a major source of acid mine drainage. Siltation can be attributed to both the surface mine industry and the lumber companies. Untreated domestic sewage is a serious problem over most of the watershed and is extremely critical during low flow periods.

Island Creek proper receives acid mine drainage, siltation from surface mine and logging activities, and domestic sewage. Tributary streams of Island Creek suffer similar abuses plus physical degradation from channelization by landholding companies and residents. Such practices periodically destroy certain segments of aquatic habitats.

The Huntington District's Water Quality Section established water monitoring stations throughout the basin in 1978-79. Findings of the two-year study revealed that the water quality of the major streams in the Island Creek Basin was fair to poor. Most stations having poor water quality had low pH values, measurable dissolved iron or both, and had low numbers of benthic organisms. Most of Copperas Mine Fork, Mud Fork, and main Island Creek below Miller Branch had poor water quality. Upstream from Miller Branch, Island Creek is considered fair-to-good water quality.

3.2.3.1 No Federal Action. Without the implementation of a Federal project in Logan, the status of surface water quality in the project area would be expected to either remain the same or deteriorate.

3.2.3.2 Preferred Plan. Implementation of the preferred alternative for the lower 0.7 miles of Island Creek would result in the temporary degradation of lower Island Creek and the Guyandotte River near the mouth of Island Creek due to siltation and turbidity. An erosion control plan would be prepared for the project specifications and fully implemented throughout construction. Close adherence to such a plan would minimize the off-site impacts resulting from erosion and channel bank excavation. Siltation effects are expected to be minor and short-term. The removal of automobile bodies and other solid waste materials along the stream channel would contribute to the overall improvement of the stream environment. Such cleanup would eliminate potential sources of contamination to surface waters in the project area.

3.2.4 Wetlands. One jurisdictional wetland was identified in the early 1980s during field studies and literature search. It consisted of a quarter acre Palustrine Emergent and Scrub-Shrub variety interpreted within an old field and bottomland hardwood area not far from the mouth of Island Creek. Intense human disturbance along the Island Creek corridor within the project area has led to the disappearance all of the former wetlands except a few isolated cattails.

3.2.4.1 **No Federal Action**. No wetlands would be affected.

3.2.4.2 **Preferred Plan**. No wetlands would be affected by implementation of the preferred channel plan at Logan.

3.2.5 **Endangered Species**. A federally listed species that could occur within the proposed project area is the endangered Indiana bat, Myotis sodalis. This species may use the project area for foraging and roosting between April 1 and November 14. Indiana bat summer foraging habitats are generally defined as riparian, bottomland, or upland forest, and old fields or pastures with scattered trees. Roosting/maternity habitat consists primarily of live or dead hardwood tree species, which have exfoliating bark that provides space for bats to roost between the bark and the bole of the tree. Tree cavities, crevices, splits, or hollow portions of tree boles and limbs also provide roost sites.

There are 29 known hibernacula for the Indiana bat in the limestone region of eastern West Virginia in Preston, Tucker, Randolph, Pendleton, Pocahontas, Greenbrier, Monroe, and Mercer Counties. The population of the hibernacula in West Virginia range in size from one to 9,000 Indiana bats. Recent data indicate that the area within an approximate 5.0 mile radius of a hibernaculum is important foraging and roosting habitat for the Indiana bat in the fall swarming period, August 15 through November 14.

3.2.5.1 **No Federal Action**. The No Federal Action alternative would have no impact on the Indiana bat's foraging and roosting habitat.

3.2.5.2 **Preferred Plan**. The USFW Service has determined the number of acres of suitable foraging and roosting habitat on the West Virginia landscape available to each Indiana bat known to occur there. On that basis, it has been determined that small projects, generally affecting 17 acres or less of suitable foraging and roosting habitat, would have an infinitesimally small chance (at the 98% confidence level) of resulting in direct or indirect take. If less than 17 acres of suitable habitat would be disturbed, the Service considers that action discountable and unlikely to adversely affect the endangered Indiana bat at any season of the year. The preferred plan has no impact on the Indiana bat habitat since the entire project would disturb less than 17 acres.

3.3 Sensitive Cultural Resources

3.3.1 **Socio-economic Factors**. Economic conditions throughout the project area have, for many years, been far below average for the United States. In general, the economy of the basin is dependent upon the coal industry, either directly or indirectly. Industrial and housing development are restricted by the rugged topography of the region and the flooding potential. Income, living conditions, employment, and necessary facilities have been behind national averages, although they have grown closer to these averages during the past 10-15 years.

3.3.1.1 **No Federal Action**. No Federal action in the project area would result in a continuation of certain commercial and residential structures being subjected to periodic flood damage, with the resulting increase of adverse social and economic impacts.

3.3.1.2 **Preferred Plan**. Implementation of the preferred alternative for property damage reduction and saving lives along lower Island Creek would make a positive contribution to economic health and social well being. Although one commercial structure, the Super 8 Motel, would be removed during construction, the reduced threat of flooding would have a beneficial effect upon the socio-economic factors bearing upon the local project area.

3.3.2 **Education**. In 1970, a median number of school years completed for Logan County residents 25 years of age and older was 8.9. This compared unfavorably with both West Virginia and the nation, which reported median levels of education of 10.6 years and 12.1 years, respectively. Between 1970 and 1980, school enrollment in the county decreased about 3.0 percent, from 12,847 students to 12,471 students. Between 1980 and 1990, school enrollment in the county decreased 10.6 percent from 12,471 students to 11,142 students. Bureau of Census data in 1990 indicated that 53.4 percent of the county residents have completed high school compared with 66 percent for the state.

3.3.2.1 **No Federal Action**. No Federal action in the project area would result in no effect upon education.

3.3.2.2 **Preferred Plan**. Project implementation would have no anticipated effects upon education.

3.3.3 **Recreation**. The study area has no major recreational facilities within its boundaries. However, there are a number of facilities within a one hour drive. Chief Logan State Park is located five miles north of Logan on U.S. Route 10. Laurel Creek Public Hunting Area is located 15 miles west of Logan in Mingo County. About 30 miles further north, the Cabwaylingo State Forest is located in Wayne, Cabell, Lincoln and Mingo Counties. The City of Logan has a park located on Hatfield Island in the Guyandotte River. Much land owned by coal and timber companies is available as hunting lands throughout the county. Fishing resources are poor throughout the county because of degraded streams and the lack of reservoirs. R.D. Bailey Lake, on the Guyandotte River in adjoining Wyoming County, is approximately 35 miles south of Logan. East Lynn Lake, 50 miles north from Logan, also is in operation and available to the study area inhabitants.

3.3.3.1 **No Federal Action**. Because no recreation development occurs in the project area, no impacts would result.

3.3.3.2 **Preferred Plan**. Because no recreation development occurs in the project area, no impacts would result.

3.3.4 **Aesthetics**. Aesthetics in the project area range from fair to poor. Indiscriminate dumping of refuse along the road network and streambank in the study area is a common practice, making aesthetics generally less than appealing. Stream banks in the study area are frequently observed to be littered with refuse as well as automobile bodies. A portion of Island Creek above the confluence with the Guyandotte River contains many such discarded automobile bodies.

3.3.4.1 **No Federal Action**. The no action plan would contribute to the decline of the aesthetic environment in the project area.

3.3.4.2 **Preferred Plan**. Implementation of the preferred plan would consist of both positive and negative attributes. Improvements to the overall scenic appearance would result from removal of existing litter and refuse. The replacement of portions of the riparian vegetation with rock riprap is considered by some to be unnatural and unpleasing to the eye. Where feasible, all disturbed banks are to be reseeded and replanted with plant species favored by wildlife resources.

3.3.5 **Cultural Resources**. An archeological reconnaissance was made of the proposed site, and no archeological materials were found. The cultural resources literature investigation indicated that construction of flood protection projects is not expected to impact cultural resources in the basin.

3.3.5.1 **No Federal Action**. No impacts are anticipated under the no action plan

3.3.5.2 **Preferred Plan**. Implementation of the preferred alternative would not have an effect on cultural resources of the area. Initial archeological investigations did not reveal the presence of any cultural resources in the area. If significant archeological or historical resources are encountered during construction, appropriate mitigative measures will be incorporated as required.

3.3.6 **Air Quality** Logan County is currently in attainment for all criteria pollutants according to the USEPA.

3.3.6.1 **No Federal Action** No impacts are anticipated under the no action plan.

3.3.6.2 **Preferred Plan** Channel widening would have minor impacts on air quality. Vehicular emissions from construction equipment would be limited and temporary. Heavy truck traffic associated with the hauling of material to the disposal site would not be expected to cause major impacts on air quality.

3.3.7 **Noise** Commercial and residential traffic, CSX traffic and local business noise are the current sources of noise in the project vicinity.

3.3.7.1 **No Federal Action** No impacts are anticipated under the no action plan.

3.3.7.2 **Preferred Plan** Construction of the channel widening in Island Creek would generate additional construction noise in the region. Heavy construction equipment, material handling, and truck traffic would temporarily generate noise in the construction area. Upon completion of the channel widening, the construction noise would cease.

4.0 PUBLIC AND AGENCY COORDINATION

4.1 Required Coordination. The Huntington District has coordinated the Local Protection Project and Environmental Assessment for the Island Creek Basin with the U.S. Fish and Wildlife Services and the West Virginia Department of Natural Resources. The following agencies would receive project plans and NEPA documents for review and comment:

U.S. Fish and Wildlife Service
U.S. Environmental Protection Agency
West Virginia Department of Natural Resources
West Virginia Department of Transportation
West Virginia State Historic Preservation Office

4.2 Public Involvement. Public meetings, workshops, public announcements, literature and close cooperation with local citizens have been and would continue to be important to the implementation of a recommended alternative. The following summarizes public involvement since the reevaluation study update began in October 1999:

A Public Meeting held at Logan, WV on February 9, 2000 to collect information for assessing impacts to the community of Logan for the intended project to reduce flooding along the lower 0.7 miles of Island Creek. Logan County Commission and local residents attended the meeting. Comments included support for a flood warning system, a suggestion to use the channel around Hatfield Island as spoil disposal, and a suggestion to extend channel widening further upstream.

5.0 BIBLIOGRAPHY

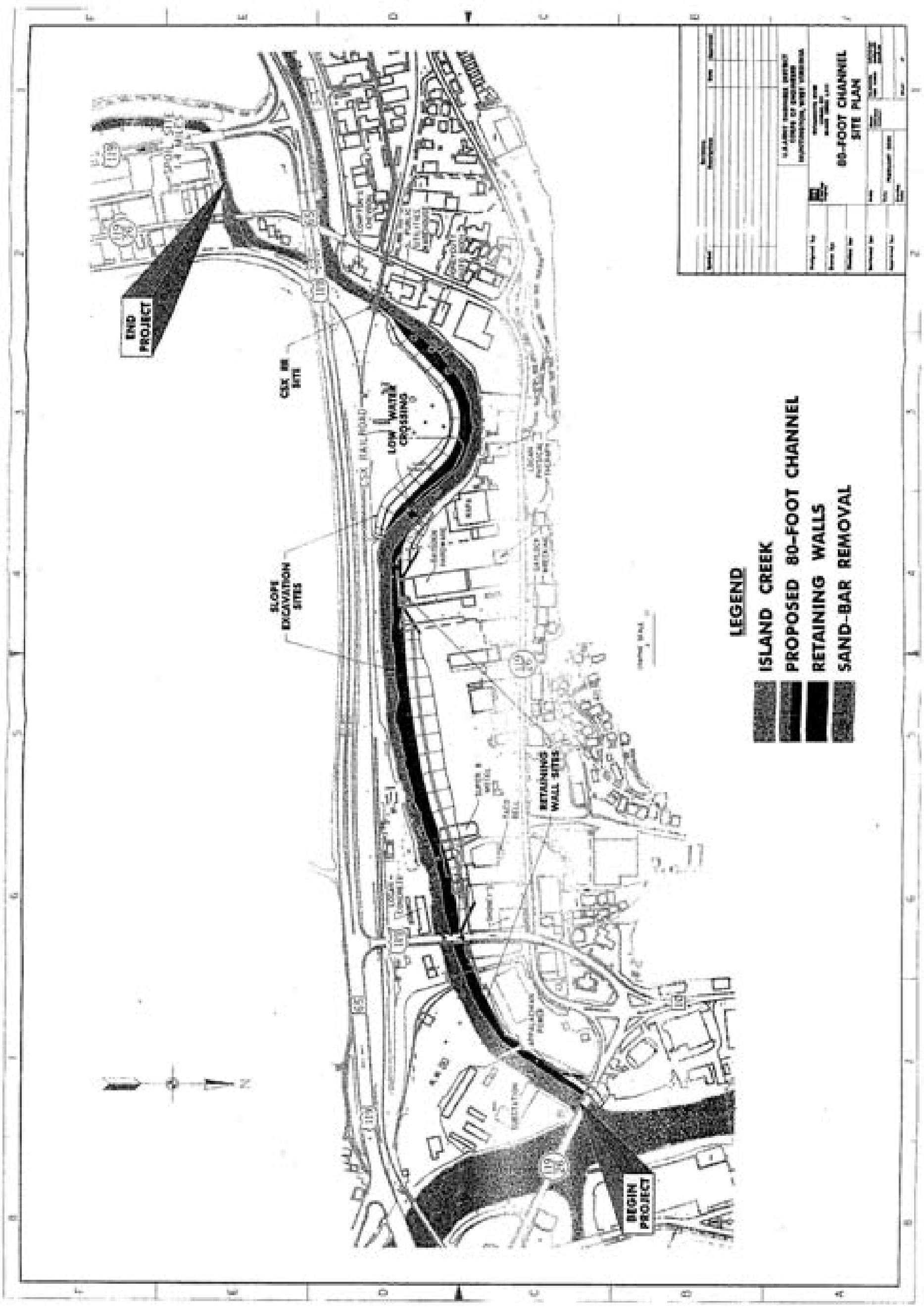
U.S. Army Corps of Engineers. 1993. Main Report and Environmental Assessment for Island Creek At Logan, West Virginia, Local Flood Protection Project. Huntington District. Huntington, West Virginia.

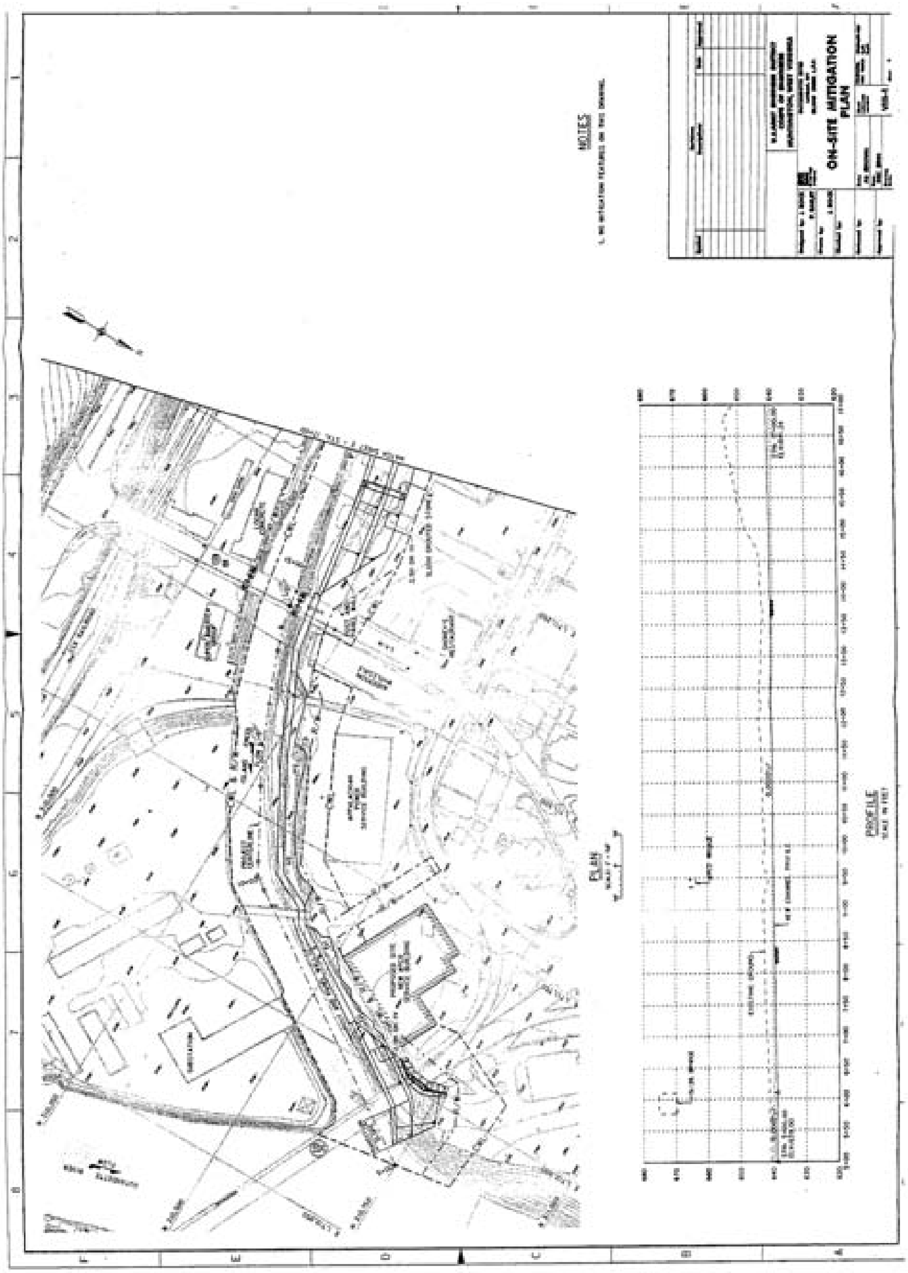
U.S. Army Corps of Engineers. 1985. Final Feasibility Report on Island Creek Basin, Guyandotte River Basin Study, West Virginia. Huntington District. Huntington,West Virginia.

Table 1 – Relationship of Preferred Alternative to Environmental Requirements and Protection Statutes

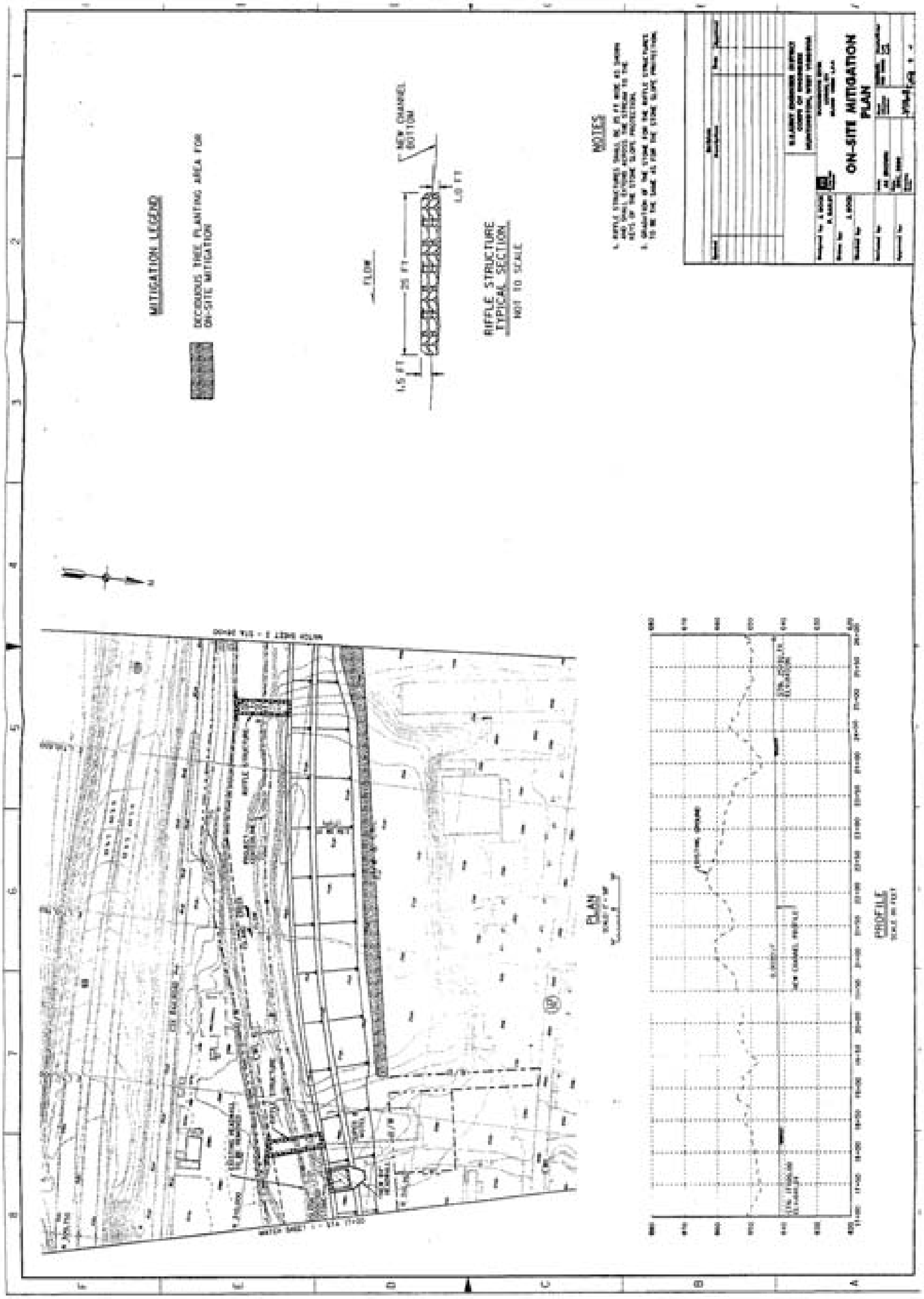
FEDERAL STATUTES	Preferred Plan*
Archeological and Historic Preservation Act As amended, 16 U.S.C. 469, et seq.	FC
Clean Air Act As amended, 42 U.S.C. 7401, et seq.	FC
Clean Water (federal Water Pollution Control Act) As amended, 16 U.S.C. 1251, et seq.	FC
Endangered Species Act As amended, 16 U.S.C. 1531, et seq.	FC
Federal Water Project Recreation Act As amended, 16 U.S.C. 460-1 (12), et seq.	NA
Fish and Wildlife Coordination Act As amended, 16 U.S.C. 4601-4601-11, et seq.	FC
National Environmental Policy Act As amended, 42 U.S.C. 4321, et seq.	FC
National Hisotric Preservation Act As amended, 16 U.S.C. 470a, et seq.	FC
Rivers and Harbors Act, 33 U.S.C. 401, et seq.	FC
Rivers and Harbors Act, 91 U.S.C. 122, et seq.	FC
Watershed Protection and Flood Prevention Act 16 U.S.C. 1001, et seq.	FC
Wild and Scenic Rivers Act As amended, 16 U.S.C. 1271, et seq.	FC
EXECUTIVE ORDERS, MEMORANDA, etc.	
Floodplain Management (E.O. 11988)	FC
Protection of Wetlands (E.O. 11990)	NA
Environmental Justice (E.O. 12898)	FC
Farmland Protection Policy Act, PL 97-98, 7CFR 658	NA
STATE AND LOCAL POLICIES	
Hazardous, Toxic, and Radioactive Waste (HTRW) Guidance, ER 1165-2-132	FC

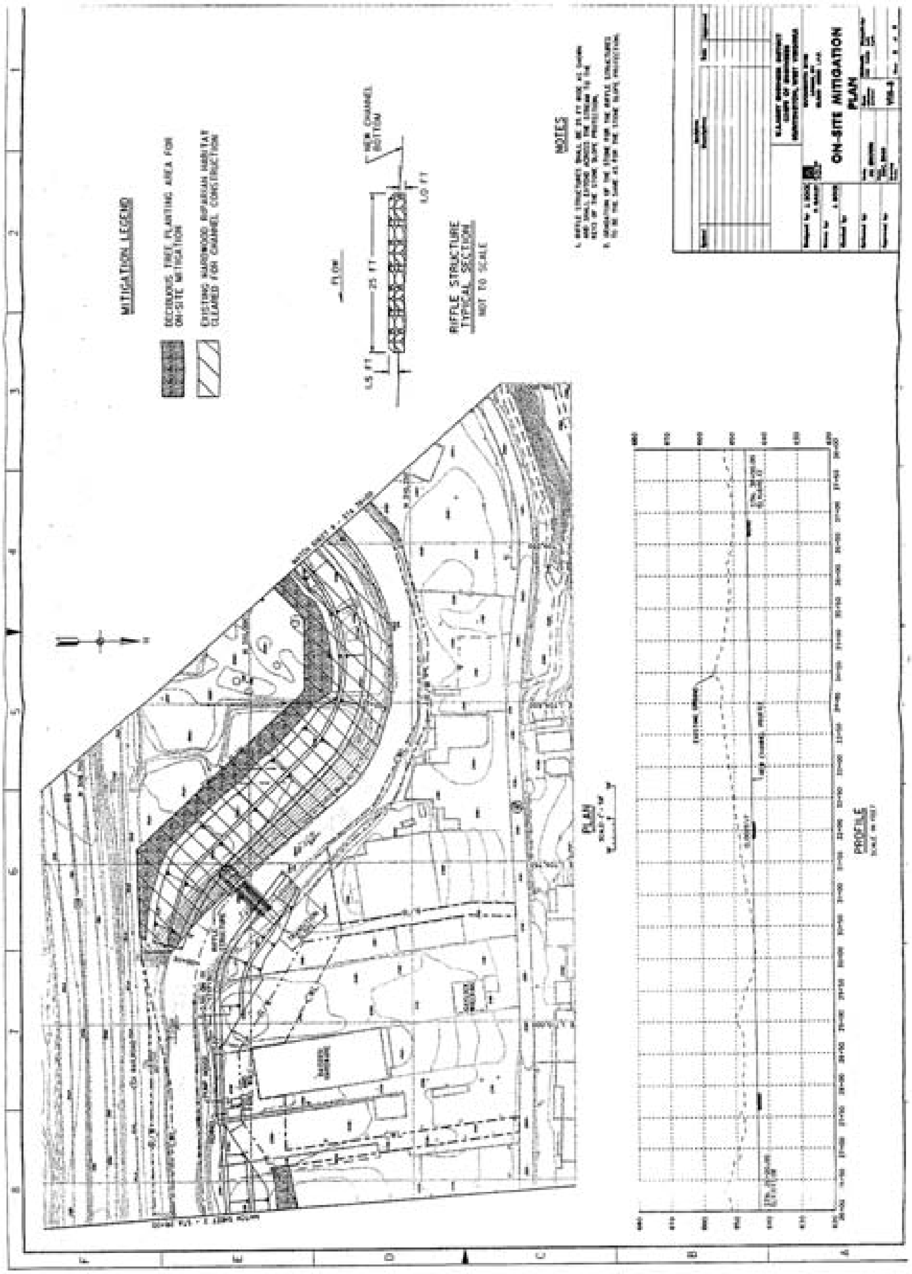
*NOTE: FC = Full Compliance
PC = Partial Compliance
NA = Not Applicable


LEGEND
ISLAND CREEK
PROPOSED 80-FOOT CHANNEL
RETAINING WALLS
SAND-BAR REMOVAL
END PROJECT
BEGIN PROJECT
SLOPE EXCAVATION SITES
RETAINING WALL SITES
LOW WATER CROSSING
CSX RAILROAD
80-FOOT CHANNEL
SITE PLAN



ON-SITE MITIGATION PLAN
NOTES
PLAN
PROFILE


MITIGATION LEGEND
DECIDUOUS TREE PLANTING AREA FOR ON-SITE MITIGATION
FLOW
25 FT
1.5 FT
1.0 FT
NEW CHANNEL BOTTOM
RIFFLE STRUCTURE TYPICAL SECTION
NOT TO SCALE
NOTES
ON-SITE MITIGATION PLAN
PLAN
PROFILE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DECIDUOUS TREE PLANTING AREA FOR ON-SITE MITIGATION
EXISTING HARDWOOD RIPARIAN HABITAT CLEARED FOR CHANNEL CONSTRUCTION
FLOW
25 FT
1.5 FT
1.0 FT
NEW CHANNEL BOTTOM
RIFFLE STRUCTURE TYPICAL SECTION
NOT TO SCALE
NOTES
ON-SITE MITIGATION PLAN
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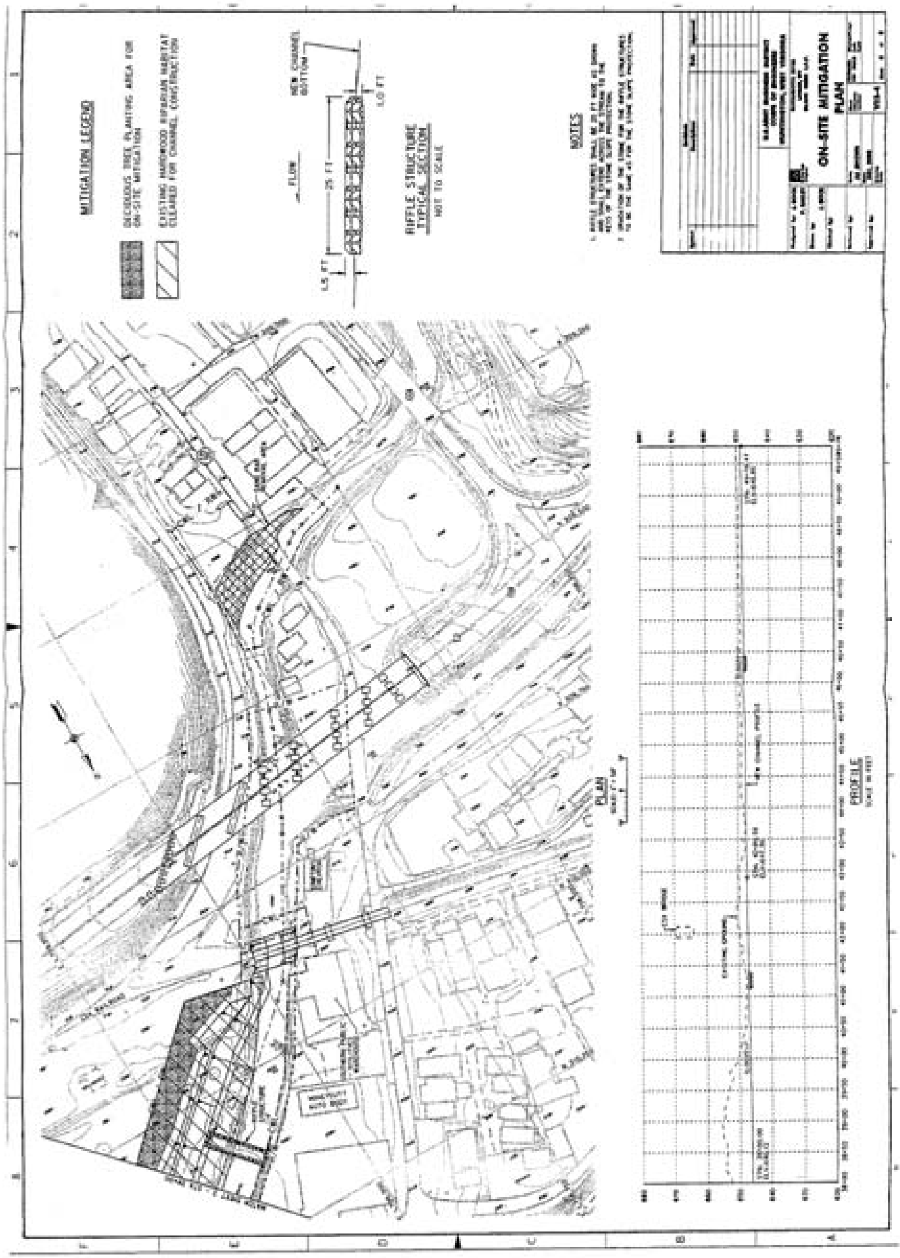
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EXISTING HARDWOOD RIPARIAN HABITAT CLEARED FOR CHANNEL CONSTRUCTION
NEW CHANNEL BOTTOM
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RIFFLE STRUCTURE TYPICAL SECTION
NOT TO SCALE
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ON-SITE MITIGATION PLAN
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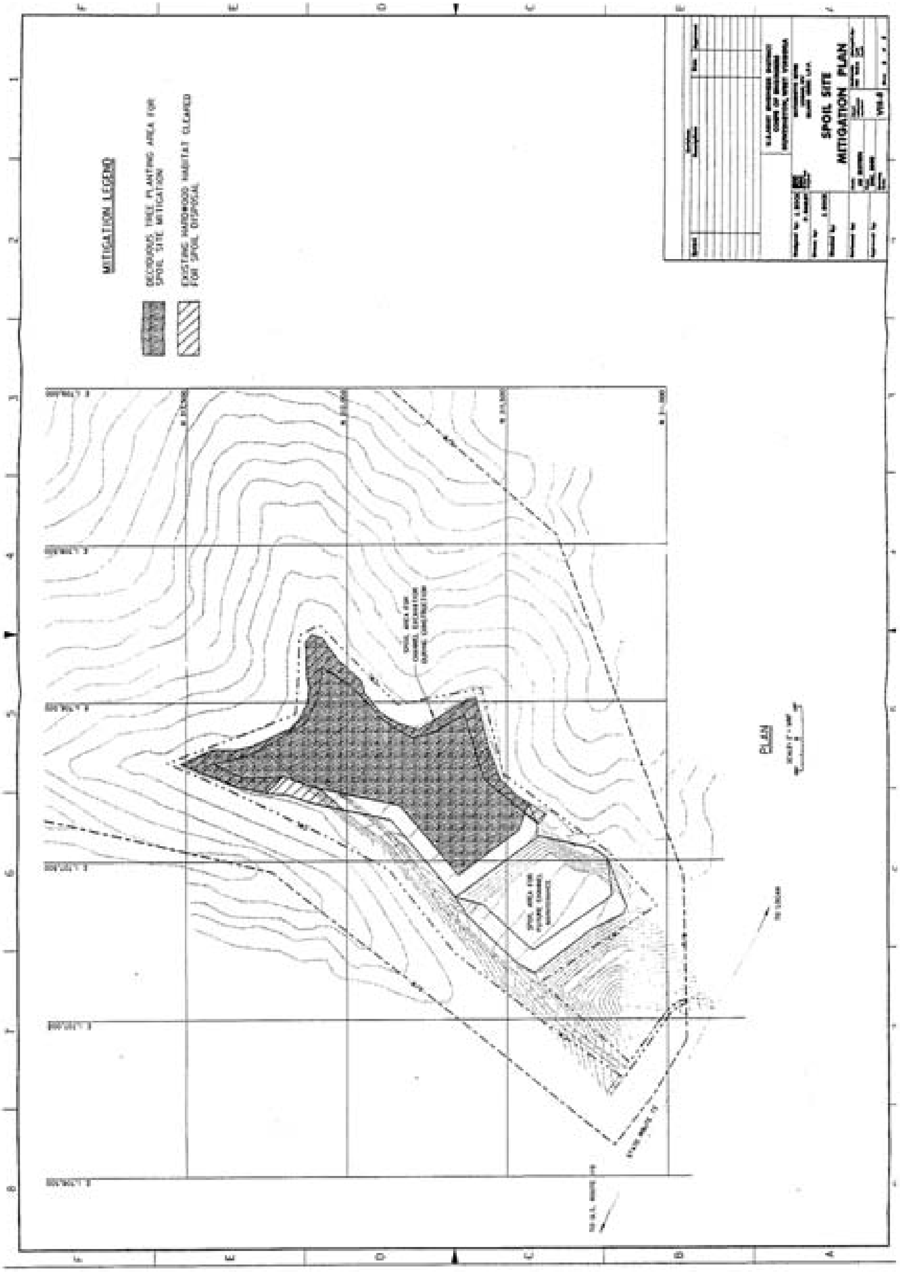

MITIGATION LEGEND
DECIDUOUS TREE PLANTING AREA FOR SPOIL SITE MITIGATION
EXISTING HARDWOOD HABITAT CLEARED FOR SPOIL DISPOSAL
SPOIL SITE
MITIGATION PLAN
PLAN

Finding of No Significant Impact
Island Creek Basin
Local Protection Project
Logan, West Virginia

1. I have conducted an environmental assessment in the overall public interest concerning implementation of the Island Creek Basin Local Protection Plan. The purpose of this project is to reduce flooding damages with the Island Creek Basin and to improve response time of the community in the event of a flood situation as authorized in Section 202 of PL 96-367.

2. The possible consequences of the project have been studied for environmental, cultural and social impacts. Another factor bearing on my assessment was the capability of the project to meet the public needs for which it was proposed. The following references the assessment:

a. Environmental Considerations. The Huntington District has taken reasonable measures to assemble and present the known or foreseeable environmental impacts of the project in the environmental assessment. These impacts involve biological and human resources. All adverse effects of project implementation are considered insignificant or will be avoided through best management techniques.

b. Social Well-Being Considerations. The proposed project will provide reduced flooding damages with the Island Creek Basin and improve response time of the community in the event of a flood situation. No significant economic or social well-being impacts are forseen as a result of the proposed project. No archeological resources are recorded in the project area. There would be temporary visual and noise impacts associated with construction, however these are considered minor and will cease once project is constructed.

c. Coordination with Resource Agencies. Pursuant to the Fish and Wildlife Coordination Act (FWCA) of 1958, coordination with the U.S. Fish and Wildlife Service and the West Virginia Department of Natural Resources has been maintained throughout the study. Appropriate measures and best management practices have been identified and incorporated into the plan. Also, in accordance with the Endangered Species Act, as amended, the recommended plan would not impact listed species.

d. Other Pertinent Compliance. No prime or unique farmland under the Farmland Protection Policy Act will be involved. The proposed action is also in compliance with the National Historic Preservation Act, (Section 106 32 CFR 300), Executive (EO) 11988 (Floodplain Management) and EO 11990 (Protection of Wetlands).

Finding of No Significant Impact
Island Creek Basin
Local Protection Project
Logan, West Virginia

e. Other Public Interest Considerations. There has been no significant opposition to the proposed action by State or local Governments, or organized environmental groups. Comments received during the public review period have been included in the Final Environmental Assessment. There are no unresolved issues regarding the implementation of the project.

f. Section 176(c) Clean Air Act. The proposed action has been analyzed for conformity applicability pursuant to regulations implementing Section 176 (c) of the Clean Air Act. It has been determined that the proposed action will not exceed deminimis levels or direct emissions of criteria pollutant or its precursors and is exempted by 40 CFR Part 93.153. Any later direct emissions are generally not within the Districts' continuing program responsibility and generally cannot be practicably controlled by the District. For these reasons a conformity determination is not required for this action.

3. I find the Island Creek Basin Local Protection Plan has been planned in accordance with the current authorization as described in the Environmental Assessment. The project is consistent with National policy, statutes, and administrative directives. This determination is based on a thorough analysis and evaluation of the project and alternative courses of action. In conclusion, I find the proposed Island Creek Basin Local Protection Plan will have no significant adverse effect on the quality of the human and/or natural environment.

5/30/01
DATE

for JOHN RIVENBURGH
Colonel, Corps of Engineers
District Engineer

APPENDIX A

APPENDIX A
Notice of Availability

The US Army Corps of Engineers, Huntington District, by the Notice of Availability (NOA), advises the public that the Draft Environmental Assessment (DEA) for the Local Protection Plan for the Island Creek Basin, is complete and available for review. The project is located in Logan, West Virginia. A Finding of No Significant Impact (FONSI) is anticipated for the proposed project. A Draft FONSI is included with the DEA for public review.

In compliance with the National Environmental Policy Act (NEPA) and 40 CFR 1501.4, the DEA and Draft FONSI must be available to the public in the affected area for thirty (30) DAYS FOR REVIEW AND COMMENT. Final determination regarding the need for additional NEPA documentation will be made after public review period, which begins on or about January 5, 2001 and ends on or about February 5, 2001. Copies of the documents may be viewed at the following locations:

Logan County Courthouse
300 Stratton Street
Logan, West Virginia 25601

Logan Area Public Library
16 Wildcat Way
Logan, West Virginia 25601

Corps of Engineers, Huntington District
502 Eighth Street
Huntington, West Virginia 25701

Copies of the DEA and Draft FONSI may be obtained by contacting the Huntington District office of the Corps of Engineers at 304-529-5712. Comments pertaining to the documents should be directed by letter to the following address, by February 5 2001.

Ms. Ginger Mullins
Chief, Environmental Analysis Section
Planning Branch
Huntington District of Corps of Engineers
502 Eighth Street
Huntington, West Virginia 25701-2070

APPENDIX A
Notice of Availability

The Notice was provided to the following newspapers for public information:

The Logan Banner
435 Stratton Street
Logan, West Virginia 25601

Charleston Gazette
1001 Virginia Street, East
Charleston, West Virginia 25301

APPENDIX B

SECTION 404 (b) (1) EVALUATION
ISLAND CREEK BASIN
LOGAN COUNTY, WEST VIRGINIA
LOCAL PROTECTION PLAN

This report concerning disposal of excavation materials at School House Hollow, Logan County, West Virginia is submitted in accordance with Section 404 of the Clean Water Act of 1977 (Public Law 95-217).

I. PROJECT DESCRIPTION

A. Location.

The project is located along the north and south banks of Island Creek in Logan County West Virginia. The proposed disposal site is located in Logan, West Virginia at School House Hollow, an area adjacent to and to the east of Milkhouse Hollow. The disposal site is on the north side of State Route 73, approximately 0.35 miles from its intersection with Old U.S. Route 119 and State Route 44. A 12-foot wide paved road provides access to the site from State Route 73.

B. Description of Proposed Work.

The project consists of widening the lower portion of Island Creek to increase the channel width to 80 ft. Channel widening will begin at the confluence of Island Creek and the Guyandotte River and continue upstream for approximately 0.7 miles. Generally widening is accomplished on only one side of the channel in any area. Clearing and grubbing will be accomplished only in those areas where walls are constructed or where earthwork cuts will be made. All other areas will remain undisturbed as much as possible. Post and panel walls will be constructed in certain locations to avoid impacts associated with the acquisition of certain structures along the channel. Stone slope protection will be placed along the base of the wall and at the toe of the newly excavated slope to reduce the effects of erosion in the lower level flood frequencies. The remaining area between the stone slope protection and the CWL will be seeded. The material removed during the channel widening will be spoiled at a nearby site at School House Hollow.

Approximately 203,000 cy of soil and rock excavated from the Island Creek channel will be spoiled at a depth of 19 feet over the 6.5 acres of the 12 acres of existing fill. The site contains sufficient acreage to allow benching and flattening of slopes to ensure slope stability. Drilling and testing of the previous fill and insitu soils will be completed prior to placement of the fill. Ditches will be placed around the outside of the new fill to collect and carry storm water surface runoff from the fill and the valley hillsides to the toe of the fill slope, where it will flow through existing drainage culverts beneath the access road and State Route 73.

C. Authority and Purpose.

The Corps is undertaking structural measures to alleviate the flooding problems experienced in the Island Creek Basin as authorized by the Water Resources Development Act of 1986 (PL 99-62).

D. Description of Material.

1. General Characteristics of Proposed Fill Material.
Approximately two hundred and three thousand cubic yards of soil and rock will be spoiled in the disposal area.

2. Source of Material.
The soils and rock will be excavated from the lower 0.7-mile of Island Creek and its banks during construction. Currently, the commercial neighborhood of Black Bottom and unoccupied lots occupy most of the proposed construction area.

E. Description of Proposed Discharge.

1. Location.
Please refer to Section I.A.

2. Size.
The disposal fill is approximately 203,000 cy of soil and rock excavated from the Island Creek channel and will be spoiled at a depth of 19 ft over the 6.5 acres of the 12 acres of existing fill. The site contains sufficient acreage to allow benching and flattening of slopes to ensure slope stability. Drilling and testing of previous fills and insitu soils will be completed so the proposed fill slopes can be designed. Ditches will be placed around the outside of the new fill to collect and carry storm water surface runoff from the fill and the valley hillsides to the toe of the fill slope, where it will flow through existing drainage culverts beneath the access road and State Route 73.

3. Type of Disposal Site and Habitat.
The spoil site is a valley containing 105 acres of moderate to steep hillside with upland hardwood vegetation. Approximately 12 acres of the valley portion of the site has been utilized in the past as an excess spoil location during the construction of U.S. Route 119 and State Route 73. The previous fill material consists of rock and soil and is configured in two benches with fill slopes of approximately 2.5 to 1. These 12 acres are vegetated with tall grasses and low growing brush. Within the valley, a dirt haul road provides access along the west side of the fill. A shallow ditch around the perimeter of the existing fill collects storm water surface runoff from the hillsides and carries it to the base of the fill where it flows under the access road and State Route 73 via concrete culverts.

4. Timing and Duration of Discharge.
The proposed construction work is expected to last approximately 15 to 18 months (2004 initiate, 2006 completion). Construction will be performed during high, normal and low flow periods. Excavation of disposal material will be greatest during the first phase of construction.

F. Description of Disposal Method.
The earth and rock fill will be placed with standard land-based construction machinery.

II. FACTUAL DETERMINATIONS.

A. Physical Substrate Determination.

1. Substrate Elevation and Slope.
Fill material application is designed to cover existing fill material along with surrounding land area.

2. Sediment Type.
Covering of existing substrates and surrounding area with earth fill and rock are proposed.

3. Dredged/Fill Material Movement.
Project intent is to transport excess fill material excavated through construction of channel widening to School House Hollow for disposal. The disposal fill will be seeded and landscaped in an environmentally beneficial manner once construction is complete. Standard sediment control measures will be observed throughout the process.

4. Physical Effects on Benthos.
Any existing benthic populations occupying Island Creek will be disturbed during widening of the channel. However, benthos will colonize the channel rather quickly from undisturbed upstream and downstream sources. Placement of the fill material will not disturb any benthic populations since the previous activity at the site had disturbed any benthic populations present.

5. Other Effects.
Cultural /historical resources are not present within the project area.

6. Actions Taken to Minimize Impacts.
Impacts listed are expected to be permanent; however, on-site mitigation will not only minimize impacts, but over time will improve areas designated for wildlife habitat.

B. Water Circulation, Fluctuation, and Salinity Determinations.

1. Water.
a. Salinity. Not Applicable
b. Water Chemistry. During construction, run-off will introduce some suspended solids into the Guyandotte River and temporarily increase sedimentation down river to an extent.

2. Clarity. Only short term increases in turbidity are expected. Standard best management practices and seeding are planned to prevent run-off erosion.

C. Color. No effect.

D. Odor. No effect.

E. Taste. No effect.

F. Dissolved Gas Levels. No effect.

G. Nutrients.

No significant nutrient effects aside from possible dissolution of carbonates should limestone be used as the graded stone source. If this is the case, impacts would be beneficial.

H. Eutrophication. No effect.

I. Other as Appropriate.

Temporary increases in turbidity would not have significant impacts on municipal water systems. Run-off erosion during construction will have only minor effects on water supplies due to the small source, approximately 0.7 mile of creek bank, in comparison to other sources of sediments in this watershed which experiences high levels of erosion.

1. Current Patterns and Circulation.

a. Current Patterns and Flow. The Island Creek channel will be expanded in width, however, the flow gradient will not be effected by this project.
b. Velocity. Water velocity will not be effected by the proposed project.
c. Stratification. Not applicable.
d. Hydrologic Regime. No significant changes.

2. Normal Water Level Fluctuations.

Normal water level fluctuations will not be affected by this action. Riffle/pool complexes will be constructed within the stream to mimic the natural stream bed.

3. Salinity Gradients. Not applicable.

4. Actions that will be taken to minimize impacts.

Appropriate measures have been identified and incorporated in the proposed plan to minimize adverse effects of the project on the aquatic environment. These measures include stone slope protection of erosion prone areas, proper design and construction, use of environmentally acceptable fill material, and revegetation of exposed soils not protected by stone. Riffle/pool complexes will also be constructed to return a more natural contour to the stream bed while also improving dissolved oxygen levels.

J. Suspended Particulate/Turbidity Determinations.

1. Expected changes in suspended particulates and turbidity levels in vicinity of disposal site. Fill materials consist of natural granular materials and rock and are not expected to create significant turbidity or sedimentation.

2. Effects on chemical and physical properties of the water column.

a. Light Penetration. See Section II.B.(2). Minor reduction will occur during construction period due to turbidity. Best management practices will be employed during construction to minimize turbidity levels.

b. Dissolved Oxygen. Riffle/pool complexes will be constructed within the channel of lower Island Creek. The riffle/pool complex will be constructed approximately 1.5 feet above the streambed. During low flow and normal average flow, the riffle/pool complex will improve the dissolved oxygen concentrations.

c. Toxic Metals and Organics. Phase I and II HTRW studies indicated the granular materials and natural stone fill are not likely to contain harmful contaminants. Discussions of the results of all testing and clean-up plans are included in the Engineering Appendix.

d. Pathogens. See Section II.J.2.(c) , immediately above.

e. Aesthetics. Although the fill area may have an artificial appearance, debris and refuse removal should result in an overall improvement in aesthetic values. The landscaping plan greatly increases edge effects and compliments the disposal fill.

3. Effects on Biota.

a. Primary Production, Photosynthesis. No significant effects.
b. Suspension/Filter Feeders. No significant effects.
c. Sight Feeders. No significant effects.

4. Action to Minimize Impacts. Fill areas will be protected as soon as possible to prevent erosion. Placed rock would minimize bank erosion and related turbidity levels.

K. Contaminant Determination. See Section II.J.2.(c) .

L. Aquatic Ecosystem an Organism Determinations.

1. Effects on Plankton. Turbidity levels may temporarily affect plankton populations through abrasions by suspended material and light transmission reduction. However, neither phyto- nor zooplankton are present in appreciable quantities.

2. Effects on Benthos. See Section II.A.4 and Section II.J.3.b.

3. Effects on Nekton. Ordinarily, adverse effects on fisheries would be possible from temporary turbidity and sedimentation during the construction period, especially during spawning periods. It is unlikely that turbidity will exceed normal levels.

4. Effects on Aquatic Food Web. Loss of riparian vegetation associated with the project is not considered significant enough to affect stream allochthonous energetics or temperature regimes given recent clearing activities.

5. Effects on Special Aquatic Sites.

a. Wetlands. There are no wetlands in the proposed project area.

b. Threatened and Endangered Species. According to the Federal List of Endangered Species, the USFWS and Huntington District's field investigations, there are no federally listed endangered species in the project area.

6. Other wildlife. Impacts of the channel widening would be of temporary nature during construction activity. Over the life of the project, wildlife habitat will be enhanced by the proposed disposal and mitigation measures.

7. Actions to Minimize Impacts. The proposed material placement activities would be accomplished under conditions that would minimize, to the extent practicable, adverse effects on aquatic ecosystem. Best management practices will be employed to avoid sedimentation.

M. <u>Proposed Disposal Site Determinations.</u>

1. Mixing Zone Determination. No discharge of liquid material would be involved with project construction.

2. Determination of Compliance with Applicable Water Quality Standards. Fill activities would be in conformance with the State of West Virginia standards.

3. Potential Effects on Human Use Characteristics.

a. Municipal and Private Water Supply. See II.I.

b. Recreational and Commercial Fisheries. See II.J.3.b., II.J.3.c., and II.L.3.

c. Water Related Recreation. No impact.

d. Aesthetics. See II.J.2.e.

e. Parks, National and Historical Monuments, National Seashores Wilderness Areas Research Sites, and similar Preserves. None.

N. <u>Determination of Cumulative Effects of the Aquatic Ecosystem.</u>

Protection of the riverbank will reduce stress associated chronic turbidity, failed soil and related sediment yields. Placement of fill will expand habitat diversity and hence population diversity within the ecosystem.

O. Determination of Secondary Effects on Aquatic Ecosystems. See II.N.

III. FINDINGS OF COMPLIANCE OR NONCOMPLIANCE WITH THE RESTRICTIONS ON DISCHARGE.

A. No significant adaptations of the guidelines were made relative to this evaluation.

B. Alternatives. Two disposal alternatives for excavation materials were considered for the project.

1. Alternative A utilized School House Hollow, which is a site previously used by the Department of Highways for an excess spoil disposal site.

2. The No Action Alternative would result in continued property damage for both residents and commercial property in the vicinity.

C. Description of Proposed Work. Work to be performed consists of Alternative A, listed above.

D. The proposed placement of fill material will not result in significant adverse effects on human health and welfare, including drinking water supplies, recreation and commercial fishing, plankton, fish, shellfish, wildlife, or special aquatic sites. Aquatic life and other wildlife will not be adversely affected. No significant adverse effects on aquatic ecosystem diversity, productivity and stability, or recreational, aesthetic and economic values will occur.

E. Appropriate steps to minimize potential adverse impacts from any discharges on aquatic systems have been incorporated.

APPENDIX C

**Resolutions to Comments
Received for
Island Creek Local Protection Plan**

1. Comment from Mr. David R. Stillwell, council member of the Town of West Logan, pertaining to the City of Logan's existing sanitary sewer along the left descending bank of Island Creek.

Response: Although not specifically mentioned in the Environmental Assessment, the existing 15-in gravity sanitary sewer on the left descending bank of Island Creek, between the existing manhole located in the parking lot beside Super 8 Motel and the manhole just north of the new Water Street Bridge (at the confluence of Island Creek and the Guyandotte River, will be relocated along the south edge of State Route 119/26. The drawing showing this relocation is included in the Engineering Technical Appendix as Drawing 102/01.

2. Comment from United States Department of Agriculture, Natural Resources Conservation Service, on Section 3.2.1 Geology and Soils.

Response: Concur. The text has been changed to reflect the comments of the NRCS on page 9 of the Environmental Assessment.

3. Comment from U.S. Fish and Wildlife Service on Section 3.2.5 Endangered Species.

Response: Concur. The project will disturb less than 17 acres of potential Indiana Bat summer foraging and roosting habitat.

4. Comment from WV Division of Natural Resources on Section 2.4 and 2.5 Plan Considered in Detail and Environmental Design Measures.

Response: Please refer to response letter located in this appendix.

5. Comment from WV Division of Cultural and History dated 31 January 2001 over concerns on Section 3.3.5 of addressing Architectural and Archaeological Resources.

Response: Concur. An abbreviated technical report was prepared by the Army Corps of Engineers addressing these concerns.

02/08/2001 THU 10:05 FAX 002

324 First Avenue
West Logan, WV 25601-3206

2/8/01

Chief, Environmental Analysis Section
U. S. Corps of Engineers
502 Eighth Street
Huntington, WV 25701

Sir:

I only today received the opportunity to briefly review the Draft Environmental Assessment (DEA) for Island Creek Local Protection Plan, Logan County, WV. after receiving a copy sent to my employer, American Electric Power Company.

My only comment is to point out an ongoing problem I'm aware of which certainly becomes, in my opinion, an even greater problem during flooding conditions and which should be addressed in your study. The City of Logan Sanitary Board apparently maintains a wastewater or sewage collection system extending along lower Island Creek from what I understand might be Super 8 Motel and Shoney's Restaurant, past American Electric Power's Service Building, and on to their treatment plant north of Logan. Many times over the past year or longer a manhole just a few feet above normal pool of Island Creek at the base of the power company's retaining wall has overflowed with wastewater, creating severe odor conditions. This wastewater flows directly into Island Creek and the Guyandotte River a short distance away. It is my clear understanding that the City of Logan and the EPA have been contacted by interested parties on several occasions. Apparent blockages were cleared and the overflows ceased temporarily. Then the discharges reoccurred.

The City of Logan's manhole is undoubtedly within the flood plain and uphill of the main Island Creek channel. I believe your study and improvement plans should address this condition.

I am not herein representing American Electric Power, just a concerned citizen of Logan County. I am presently a council member of the Town of West Logan and an electrical engineer with the Power Company.

I trust my fax of this letter will arrive in time to be within your 30 day public review period. Thank you for your time.

Sincerely,

David R. Stillwell

David R. Stillwell

USDA

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

75 High Street,
Room 301,
Morgantown, WV
26505

Phone:
(304) 284-7540

Fax:
(304) 284-4839

February 1, 2001

Larry E. Workman
Acting Chief, Planning Branch
Environmental Analysis Section
Department of the Army
Huntington District, Corps of Engineers
502 Eighth Street
Huntington, WV 25701-2070

RE: DEA for Island Creek Local Protection Plan, Logan County, WV

Dear Mr. Workman:

This is in response to your letter of January 8, 2001, requesting our comments on the above referenced project. Accordingly, my staff has reviewed the DEA, and our comments are as follows:

-(page 9)**3.2.1 Geology and Soils.** Most bedrock in the Island Creek watershed is from the Kanawha Formation, which is part of the Pottsville Group. High ridges are capped by bedrock from the Allegheny Formation. These rocks are of sedimentary origin. This Pennsylvanian age geology consists of dominantly massive sandstone interbedded with numerous coal seams, impure fire clays, sandy and argillaceous shales, and a few thin, impure lenticular limestones. Coal is the most important economic constituent and is environmentally attractive because of its low sulfur content. The largest reserves have been mined from the No. 5 Block, Coalburg, Peerless, No. 2 Gas, (locally known as Upper and Lower Cedar Grove), and Powellton (locally known as Alma seams).

Soils that weather from this sandy geology include the Matewan, Highsplint, and Guyandotte soils on the steep mountain ridges, sideslopes, and cove areas; and the Yeager, Craigsville, and Chavies soils in the narrow floodplains. Most floodplain soils are impacted by residential, industrial, and other commercial development. This is the case along this project reach. Natural soils have been disturbed by added spoil material and earth moving activities. These disturbed and mostly filled areas consist of land covered by houses, buildings, streets, parking lots, railroad tracks, and other urban components. Natural soil is almost non-existent along this project reach. There is no Prime Farmland, Statewide Important Farmland, Locally Important Farmland, or Hydric soils along this project reach.

Page 2

Thank you for the opportunity to respond. Should you need further clarification of our comments, please contact Mr. Rob Pate, Resource Soil Scientist, at the following address:

USDA-Natural Resources Conservation Service
465 Ragland Road
Beckley, WV 25801

Telephone: 304-253-9597

Sincerely,

Paul S. Dunn, Acting STC
WILLIAM J. HARTMAN
State Conservationist

cc:
Paul Dunn, ASTC-Technology, NRCS, Morgantown, WV
Kelley Sponaugle, ASTC-FO, NRCS, Beckley, WV
Alan Boone, DC, NRCS, Hamlin, WV
Rob Pate, Resource Soil Scientist, NRCS, Beckley, WV
Lynn Shutts, Environmental Biologist, NRCS, Morgantown, WV

file:SHUTTS/moody/l:winword/shutts/workman, larry.doc

United States Department of the Interior

FISH AND WILDLIFE SERVICE

West Virginia Field Office
694 Beverly Pike
Elkins, West Virginia 26241

FEB 06 2001

Ms. Ginger Mullins, Chief
Environmental Analysis Section
Huntington District Corps of Engineers
502 Eighth Street
Huntington, West Virginia 25701-2070

Dear Ms. Mullins:

This is in response to your January 16, 2001 letter of transmittal of the Draft Environmental Assessment (EA) Island Creek Local Protection Project, Logan County, West Virginia. The project purpose is reduction of flooding damages within the Island Creek Basin. The structural project component includes channel widening of 0.7 mile of lower Island Creek in the town of Logan. With the exception of the addition of a Flood Warning System, the proposed project has not changed since the original EA was circulated in 1993.

The Service provided a Planning Aid Letter to the Corps in December, 1993. In April, 2000 a preliminary Draft EA was transmitted to our office with a request for any undated information relating to potential environmental impacts from the proposed project. In June, 2000, the Service provided a letter that stated that the endangered Indiana bat, Myotis sodalis could occur within the proposed project area. We indicated that projects disturbing less than 17 acres of potential Indiana bat summer foraging and roosting habitat were considered by the Service to have a very small chance (at the 98% confidence level) of resulting in direct or indirect take.

The Draft EA indicated that the proposed project will disturb less than 17 acres of potential Indiana bat summer habitat. Therefore, the Service considers the proposed action discountable and unlikely to adversely affect the Indiana bat. Therefore, no further Section 7 consultation under the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) is required with the Service on the proposed Island Creek Local Protection Project. Should project plans change, or if additional information on listed and proposed species or species of concern becomes available, this determination may be reconsidered.

If you have any questions concerning these comments, please contact Linda Smith of my staff at (304)636-6586, extension 17 or at the letterhead address.

Sincerely,

Jeffrey K. Towner

Jeffrey K. Towner
Field Supervisor

DIVISION OF NATURAL RESOURCES
Wildlife Resources Section
Capitol Complex, Building 3, Room 812
1900 Kanawha Boulevard, East
Charleston WV 25305-0664
Telephone (304) 558-2771
Fax (304) 558-3147
TDD 1-800-354-6087

Bob Wise
Governor

Ed Hamrick
Director

February 21, 2001

Mr. Larry M. Workman
Acting Chief, Environmental Analysis Section
U.S. Corps of Engineers
502 Eighth Street
Huntington, WV 25701

Dear Mr. Workman:

Thank you for the opportunity to comment on the Draft Environmental Assessment (DEA) for Island Creek Local Protection Plan, Logan County, West Virginia dated January 2000. This plan is a reduced version of both the original local protection plan that was completed in 1986 and the 1993 General Re-evaluation Study. It calls for the installation of a state-of-the-art flood warning system and for the channelization of approximately 0.7 miles of Island Creek beginning at its mouth to the Guyandotte River and proceeding upstream.

The Division of Natural Resources concurs that a need exists for flood prevention measures in this drainage. However, the continued construction and filling activities in the Island Creek flood plain, as mentioned in the DEA, causes us great concern. Severe action, such as stream channelization, should be an action of last resort. The filling activity since the initial study should be investigated and action should be taken to restore the original flood plain before any protection plan, other than a warning system, is considered.

If, after flood plain restoration, a need still exists for further action, methods other than stream channelization and widening should be considered. It is known that stream widening has a severe impact on the aquatic ecosystem. By widening the flow, you will decrease water depth and velocity. Shallow depths result in increased water temperatures and decreased oxygen levels which are harmful to aquatic life. Decreased water velocities lower the stream's ability to transport sediment loads. This will result in sediment deposition which will cover and destroy aquatic habitats, decrease the area's ability to store flood waters and cause a continuous aesthetic and maintenance problem from collected debris.

Mr. Larry M. Workman
Page 2
February 21, 2001

Although this stream has been degraded by previous activities, it has the potential to be a valuable aquatic resource to the region. Stronger mining and industrial regulation have led to dramatic improvements in water quality in the area in the last decade. This, coupled with improved wastewater treatment facilities and abandoned mine land reclamation projects, continue to improve the water quality of Island Creek.

If this plan moves forward with channelization as the preferred alternative, then efforts should be made to construct this channel using the best possible methods. These should include the use of Natural Stream Restoration Techniques for in-stream work. My staff stands ready to assist in any way possible.

Sincerely,

Bernard F. Dowler

Bernard F. Dowler, Deputy Director
Division of Natural Resources

BFD/akk

DEPARTMENT OF THE ARMY
HUNTINGTON DISTRICT, CORPS OF ENGINEERS
502 EIGHTH STREET
HUNTINGTON, WEST VIRGINIA 25701-2070

REPLY TO
ATTENTION OF:

March 7, 2001

Planning, Programs and Project Management Division
Planning Branch, Environmental Analysis Section

Mr. Bernard F. Dowler, Deputy Director
Division of Natural Resources
Wildlife Resources Section
Capitol Complex, Building 3, Room 812
1900 Kanawha Boulevard, East
Charleston, West Virginia 25305-2771

Dear Mr. Dowler,

Thank you for your comments regarding the Draft Environmental Assessment (DEA) for Island Creek Local Protection Plan, Logan County, West Virginia.

We understand your concern of the potential impacts of channelization and widening of Island Creek. However, due to the population density along Island Creek, Copperas Mine Fork and their tributaries, we feel the possible restoration of the original flood plain is unattainable. Responses from interviews with the residents and businesses in the community of Logan indicated they will welcome both the Flood Warning System (FWS) and channel expansion of Island Creek to reduce economic losses and potential loss of life incurred by recurrent flooding of this lower portion of Island Creek.

Our coordination with the U.S. Fish and Wildlife Service has continued since the 1993 report submittal. The only concern the Service had with our project included potential Indiana bat summer habitat. However, the acreage being disturbed within the project area is less than what would adversely affect the Indiana bat.

Our current mitigation, as described in the DEA, includes reseeding with deep rooting native grasses and non-woody annuals and perennials. Also, approximately 1.0 acre of native bottomland hardwood tree and shrub species would be planted along the stream. The other 1.5 acres will be mitigated on the face of the new spoil fill. The Plan, itself, has not changed since 1993 except for the spoil site location. The new spoil location site will be placed on existing fill from the construction of State Route 73 in Logan. Approximately, 1.5 acres of upland and bottomland hardwoods would be disturbed at the new spoil site compared to 7.2 acres described at the previous spoil site.

The in-stream mitigative measures include riffle pool complexes placed intermittently along the 0.7 mile of channel widening. These complexes will ensure pools for smaller aquatic life forms during lower flows and aeration of the water during normal to higher flows. We look forward to working with you throughout the design phase of this project and will consider any recommendations you may have to incorporate "Natural Stream Restoration Techniques."

If you have any further comments or questions concerning this project, please feel free to contact Ms. Ginger Mullins, of my staff, at the commercial telephone number 304-529-5712.

Sincerely,

/S/

Larry E. Workman
Acting Chief, Planning Branch

WEST VIRGINIA DIVISION OF
CULTURE AND HISTORY

January 31, 2001

Mr. Larry Workman
Chief, Environ Anlys Sect
U.S. COE
502 Eighth Street
Huntington, WV 25701

RE: Draft Environmental Assessment
Island Creek Local Protection Plan
FR#: 01-443-LG

Dear Mr. Workman:

We have reviewed the above mentioned project to determine its effects to cultural resources. As required by Section 106 of the National Historic Preservation Act, as amended, and its implementing regulations, 36 CFR 800: "Protection of Historic Properties," we submit our comments.

Architectural Resources:
Although the Draft Environmental Assessment for the Island Creek Local Protection Project, Logan County, West Virginia, addresses archaeology it does not comment on the project's potential impact to architectural resources listed in or eligible for the National Register of Historic Places. Please provide information regarding architectural resources within the project area and the undertaking's expected effect, if any, to them.

Archaeological Resources:
Thank you for providing us with a copy of the Draft Environmental Assessment for the Island Creek Local Protection Project, Logan County, West Virginia. However, we require additional information in order to complete our review. In the aforementioned EA, it is stated that an archaeological reconnaissance was made of the proposed area in 1980 indicating that there would be no significant impact from the project to archaeological resources. Please submit a copy of this report. We will complete our review immediately upon its receipt.

We appreciate the opportunity to be of service. *If you have questions regarding our comments or the Section 106 process, please call me or Rachel Black, Staff Archaeologist at (304) 558-0220.*

Sincerely,

Joanna Wilson

Joanna Wilson
Senior Archaeologist

mh/reb

WEST VIRGINIA DIVISION OF
CULTURE AND HISTORY

April 27, 2001

Mr. Larry Workman
Chief, Environ Anlys Sect
U.S. COE
502 Eighth Street
Huntington, West Virginia 25701

RE: Draft Environmental Assessment
Island Creek Local Protection Plan
FR#: 01-443-LG-1

Dear Mr. Workman:

We have reviewed the above mentioned project to determine its effects to cultural resources. As required by Section 106 of the National Historic Preservation Act, as amended, and its implementing regulations, 36 CFR 800: "Protection of Historic Properties," we submit our comments.

Architectural Resources:
During a records search at our office and a windshield survey of the project area two architectural resources were identified. These are the Appalachian Power Company building and the CSX railroad bridge. Both of these resources are eligible for listing in the National Register of Historic Places. However, the proposed activities will have *No Adverse Effect* on these two structures.

Archaeological Resources:
The report satisfactorily addresses our concerns regarding the presence of cultural resources within the project area. Systematic testing of the project area located no previously unrecorded archaeological sites, therefore, no further archaeological investigation is recommended. We have also determined that no known archaeological sites listed on or eligible for inclusion in the National Register will be affected by this project. No further consultation is necessary.

We appreciate the opportunity to be of service. *If you have questions regarding our comments or the Section 106 process, please call Marc Holma, Senior Structural Historian for Review and Compliance or Rachel Black, Staff Archaeologist at (304) 558-0220.*

Sincerely,

Joanna Wilson

Joanna Wilson
Senior Archaeologist

mh/reb

FR# 01-443-LG

Island Creek Local Protection Plan
Logan County, West Virginia
Cultural Resources Reconnaissance Report

Prepared by

Dr. Robert Maslowski and Amy Frantz, P.G.
U.S. Army Corps of Engineers
Huntington District
502 Eighth Street
Huntington, West Virginia 25701-2070
304-528-5712

April 2001

FR# 01-443-LG

TABLE OF CONTENTS

Introduction

A literature and records search was conducted for the Island Creek project on 2/15/01. The state site files showed that there were no archeological sites located in the immediate project area. Two structures with historic structure numbers were located in the immediate project area. These structures located on Maps 1 and 2, include LG169 (Appalachian Power Company Building) and LG 86 (CSX railroad bridge).

A literature search indicated that a basin wide reconnaissance had been completed in 1980 by the Corps of engineers and further studies were recommended when specific project alternatives were selected for future study.

A cultural resources reconnaissance of the Island Creek Local Protection Project was performed in Logan, West Virginia on 20 February 2001 by the staff archeologist and ecologist of the Corps of Engineers, Huntington District. The purpose of the proposed project is to reduce flooding impacts along the lower 0.7 miles of Island Creek. Channel widening would begin at the confluence of Island Creek and the Guyandotte River and continue for approximately 0.7 miles. Post and panel walls would be constructed in certain locations to avoid impacts associated with the acquisition of certain structures along the channel. The cultural resources reconnaissance of the project entailed a site walkover at the site of approximately 17 acres along the channel widening along Island Creek and approximately 6.5 acres of the fill site.

Project Description and Authority

Preauthorization studies of the water and related land resources problems and needs of the Island Creek area of Logan County, West Virginia, were undertaken as a result of the Senate Public Works Committee Resolution dated 2 June 1976. The resolution is as follows:

> *"Resolved by the Committee on Public Works and Transportation of the United States House of Representatives, that the Board of Engineers for Rivers and Harbors is hereby requested to review the report of the Chief of Engineers on the Ohio River, published as House Document numbered 306, Seventy-fourth Congress, and other pertinent reports, with a view to determining whether they should be modified to provide additional means of flood damage prevention and to meet other water and related land resource development needs for communities in the southern coal mining regions of West Virginia, with particular reference to flood protection for the Island Creek area of Logan County and the City of Mullens in Wyoming County."*

The Water Resources Development Act of 1986 (PL 99-662) authorized the Island Creek Local Protection Project for flood control.

A concept plan of the proposed structural and nonstructural measures to alleviate the flooding problems in the Island Creek basin began in 1985 with "Interim Report, Island Creek Basin, Guyandotte River Basin Study, West Virginia," U.S. Army Corps of Engineers, Huntington District. However, a general reevaluation of the economic feasibility of the Island Creek Local Protection Project continued until 1991, when results of that study concluded that the nonstructural alternative was too costly to be considered a measure of protection.

In the 1993 "Island Creek at Logan, West Virginia Local Protection Project, General Reevaluation Report" U.S. Army Corps of Engineers, Huntington District, several structural alternatives were addressed including variations of the authorized channel. After detailed analyses were performed, it was determined that the 80-foot wide channel is the most economically feasible.

FR# 01-443-LG

The Island Creek Local Protection Plan project area is located in the sub-basin of Island Creek and drains about 105 square miles of rugged, mountainous terrain and is composed of three major streams – Island Creek, Copperas Mine Fork and Mud Fork. The project site is located in the city of Logan, West Virginia and begins at the confluence of the Guyandotte River and Island Creek. (Figure 1). The project then continues approximately 0.7 miles upstream of the confluence and terminates at the CSX railroad bridge above the confluence of Copperas Mine Fork and Island Creek. The project area is bounded to the south by CSX railroad tracks and U.S. Route 119, to the west, Mount Gay, West Virginia and State Route 119/26 to the north. U.S. Route 119 and State Routes 10 and 44 serve the area and access to the site is provided from city streets.

The plan considered in detail entails widening Island Creek to create a trapezoidal channel using 2.5 horizontal to 1.0 vertical side slopes. Channel widening would begin at the confluence of Island Creek and the Guyandotte River and continue for approximately 0.7 miles. Post and panel walls would be constructed in certain locations to avoid impacts associated with the acquisition of certain structures along the channel. Widening would only be accomplished on one side of the channel in any area. Clearing and grubbing would be accomplished only in those areas where walls are constructed or where earthwork cuts would be made. All other areas would remain undisturbed as much as possible. Stone slope protection would be placed along the base of the wall and at the toe of the newly excavated slope to reduce the effects of erosion in the lower level flood frequencies. The remaining area between stone slope protection and the contractors working limits would be seeded.

The material removed during channel widening would be spoiled at a nearby site, School House Hollow. Excess material was spoiled at the site during the construction of U.S. Route 119 and State Route 73 in the mid-1990s. The material from the channel widening would be placed at an approximately depth of 19 feet. The final graded slopes would be properly drained and seeded and blended into the surrounding terrain. An additional 2.5 acres of the 12 acre site would be utilized by the local sponsor for future disposal of channel sediment.

A sandbar located above the railroad bridge and south of U.S. Route 119 will also be removed. The removal of the sandbar will keep higher flows from backing up behind the bridge causing flooding in the Cherry Tree area.

Environmental Setting

The terrain is of rugged mountainous terrain and is comprised largely of steep-sided mountains and narrow stream valleys. Ninety percent of all slopes in Logan County, are in excess of 25 percent. Industrial, transportation, and residential land uses and community facilities occupy much of the rather limited level or gently sloping land. Existing environment along the 0.7 mile reach of Island Creek is limited to a narrow band of bottomland along the stream. Disturbed areas have grown up in old fields adjacent to the nearly continuous string of commercial and industrial development.

The spoil disposal site at School House Hollow was utilized for construction of U.S. Route 19 and State Route 73. The site is currently accessed via a dirt road and the disposal area is vegetated with grasses and brush.

The Island Creek basin has experienced numerous damaging floods. The maximum flood of record in the basin occurred in March 1963. During March 1963 flooding event, the area's residences, and commercial and industrial establishments were flooded to a depth of up to 15 feet. Other major floods have occurred in January 1957, January 1974, April 1977, and May 1996. The flood plains along the major streams are occupied almost entirely by residential and commercial structures, highways, and railroads. As a result, almost all development within the basin is susceptible to damage by even moderate flood events.

Field Techniques

The project area was visually inspected for archeological materials beginning on the downstream left descending bank near Motel 8 (Photo 1). The area along the left descending bank which will be widened had been previously disturbed and was covered with modern debris (Photos 2 to 5).

The area most likely to have archeological sites was the field immediately downstream from the railroad bridge (Map 1) on the right descending bank. This area had several house sites which have been removed. The field is totally disturbed from the removal of the houses and the dirt has been mounded up to form a series of jumps and a trail for bikes and ATVs (Photo 6). In one area there was a deep cut down the stream bank (Photo 7). This area and all of the trails were walked and visually inspected and no prehistoric or significant historic artifacts were observed. The only artifacts observed were modern debris consisting of glass, plastic, coal, cinders and brick fragments.

The disposal area located outside of town was visually inspected from the road (Figure 8) and was fund to be a narrow valley that had been previously filled with material from the construction of U.S. Route 119 and State Route 73.

Results

The cultural resources reconnaissance of the project area and disposal area produced no evidence of archeological sites largely because the project area was totally disturbed by modern construction and the disposal area has been previously used as a disposal site for road construction. Two structures with state inventory numbers were located adjacent to the project (the Appalachian Power Company building and the CSX railroad bridge) but neither structure will be adversely affected by construction of the local protection project. The Appalachian Power Company building will actually be protected by the project. There will be visual impacts to these structures during construction but these will be temporary.

Recommendations

No further cultural resources work is recommended for the project.

Conclusions

There are no recorded archeological sites within the project area because most of the area has been extensively disturbed. The Appalachian Power Company building and the CSX railroad bridge will not be adversely affected by the project.

FR# 01-443-LG

References Cited

U. S. Army Corps of Engineers
1980 A Cultural Resources Reconnaissance of the Island Creek Basin, Logan County, West Virginia. Huntington District.

1985 Interim Report, Island Creek Basin, Guyandotte River Basin Study, West Virginia, Huntington District.

1993 Island Creek at Logan, West Virginia Local Protection Project, General Reevaluation Report. Huntington District.

2001 Draft Environmental Assessment, Island Creek Local Protection Project, Logan County, West Virginia. Huntington District.

FR# 01-443-LG

APPENDIX 1

FR# 01-443-LG

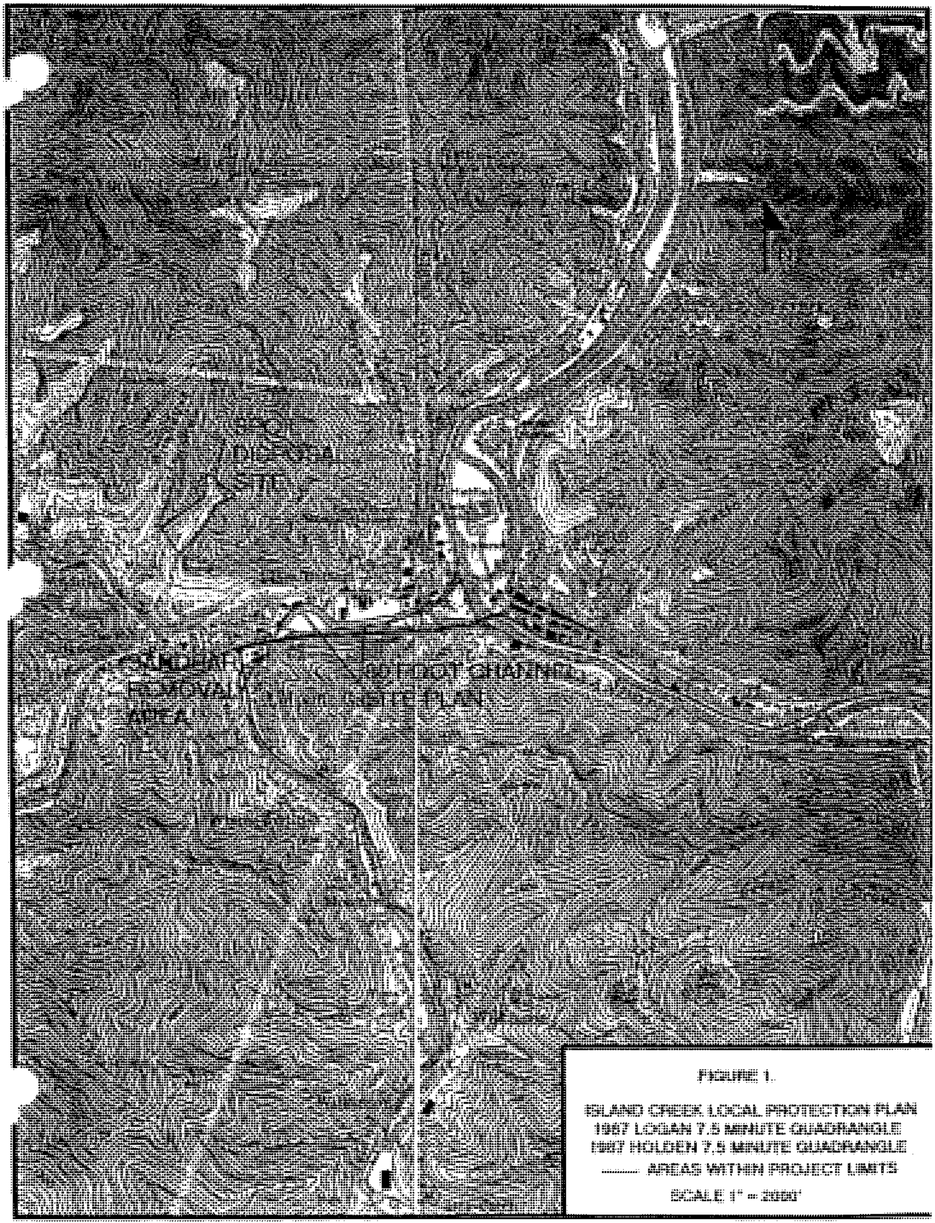


FIGURE 1.

ISLAND CREEK LOCAL PROTECTION PLAN
1987 LOGAN 7.5 MINUTE QUADRANGLE
1987 HOLDEN 7.5 MINUTE QUADRANGLE
—— AREAS WITHIN PROJECT LIMITS

SCALE 1" = 2000'

West Virginia
State Historic Preservation Office

Cultural Resources Files and Library
User Registration and Research Record Form

INSTRUCTIONS: Part I must be completed before you will be permitted access to the SHPO Cultural Resource Files and Library. Part II is a record of the site files, cultural resource reports, USGS topographic maps and other materials you utilize during your visit. Part III will be completed and signed by a SHPO staff member only when you have completed your research and have returned the materials to which you have been given access.

I. IDENTIFICATION

DATE: 2/15/01

Name (s) Dr Robert Maslowski
Leslie Birdwell

Organization or Company: US Army Corps of Engineers

Address: 502 8th St
Huntington WV 25701 Phone 304 / 529-5712

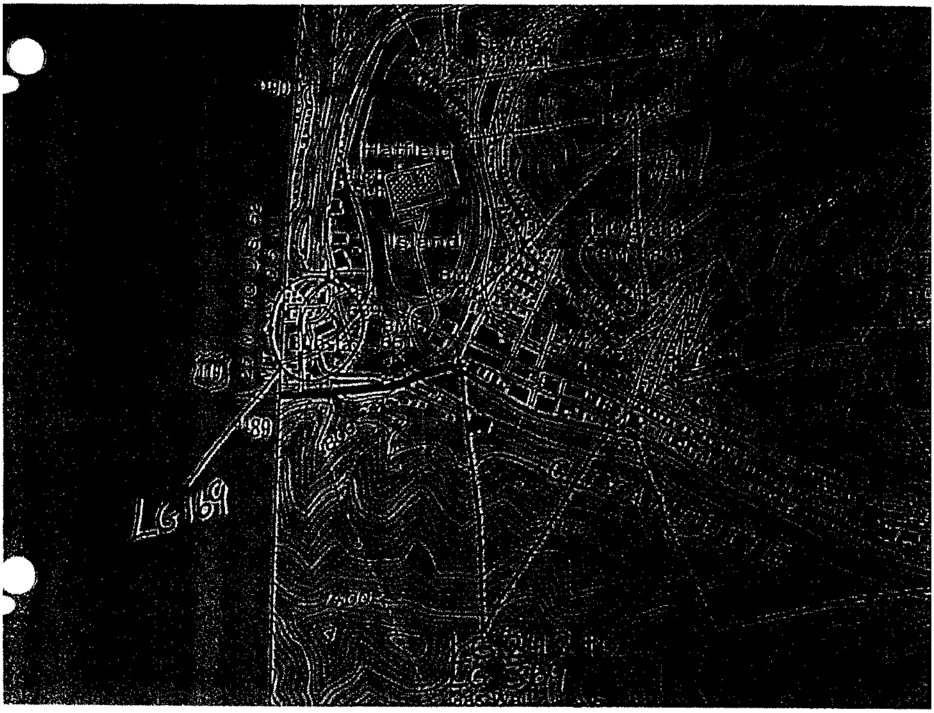
FR Number (if known) __________

II. MATERIALS UTILIZED

USGS Quad Maps: Welch
Logan
Holden

Archaeological Site Forms:

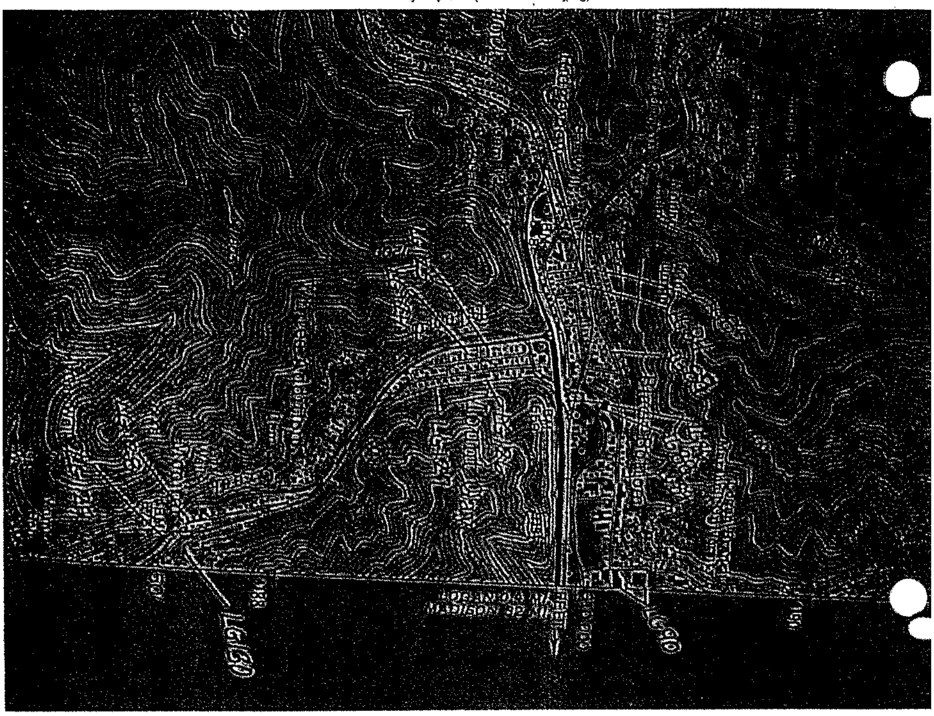
M1 Hatfield Island Map JPG (1024x768x16M jpeg)



Map 1. Appalachian Power Company LG169

MAP 1

M4 Mount Gay Map.JPG (1024x768x16M jpeg)



Map 2. CSX Railroad Bridge LG68

MAP 2

Photo 1. North bank of Island Creek and Motel 8.

Island Creek 10.bmp (1203x758x16M bmp)

Photo 2. North bank of Island Creek behind Gaylocks.

near gaylocks.bmp (1202x768x16M bmp)

Photo 3. North bank near Logan Physical Therapy.

black bot debris.bmp (1207x762x16M bmp)

Photo 4. Looking downstream near former Honeycutt Auto.

looking downstream from rrbridge.bmp (1191x752x16M bmp)

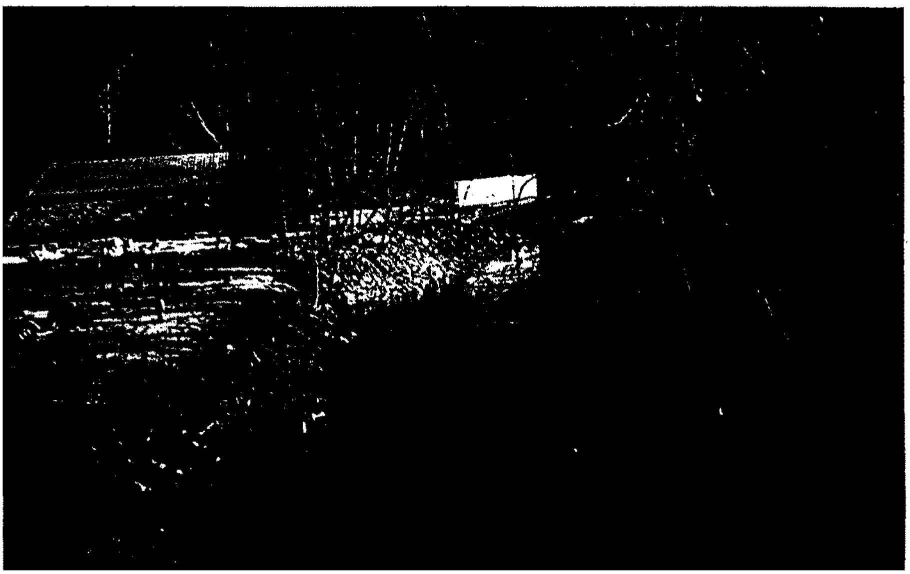


Photo 5. Looking upstream at CSX bridge.

rr bridge.bmp (1207x762x16M bmp)

Photo 6. ATV Trail.

4wheel road near wetland.bmp (1207x752x16M bmp)

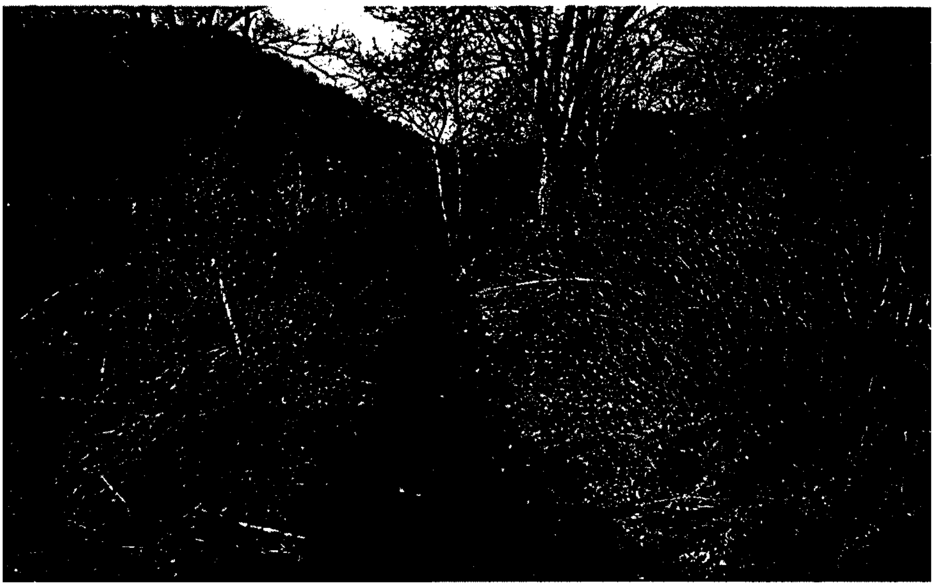
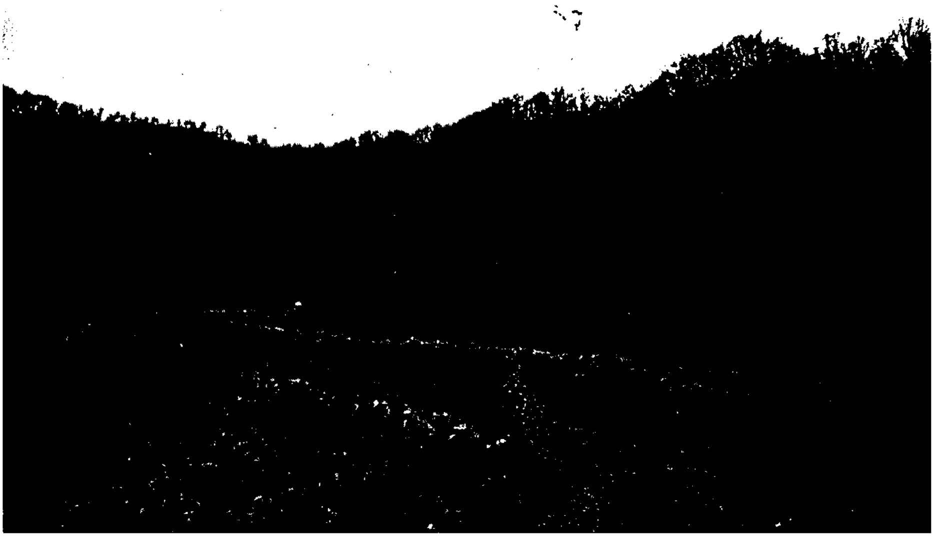


Photo 7. ATV Trail crossing Island Creek.

old bridge site.bmp (1206x758x16M bmp)

Photo 8. View of spoil disposal area.

spoil disposal site (top).bmp (1202x762x16M bmp)



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ISLAND CREEK

LOCAL PROTECTION PROJECT

APPENDIX A

ENGINEERING TECHNICAL APPENDIX

TO THE

GENERAL REEVALUATION REPORT

Department of the Army
Huntington District, Corps of Engineers
Huntington, West Virginia

Island Creek Local Protection Project
Logan, West Virginia

APPENDIX A – ENGINEERING TECHNICAL APPENDIX TO THE GENERAL REEVALUATION REPORT

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00/02	General Legend
00/03	Not Used
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06/01	CWL Monument Plan
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06/05	R/W Monument Plan
06/06	R/W Monument Plan
06/07	R/W Monument Plan
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11/03	Survey Centerline of Protection
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16/03	General Protection Plan & Profile 26+00 to 38+00
16/04	General Protection Plan & Profile 38+00 to 49+78
16/05	General Protection Typical Sections
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16/22	Cross Sections Bridges

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20.1/02	Tied-Back Retaining Walls Plan & Profile Wall #1
20.1/03	Tied-Back Retaining Walls Wall #1
20.1/04	Tied-Back Retaining Walls Wall #1
20.1/05	Tied-Back Retaining Walls Wall #1
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20.1/08	Tied-Back Retaining Walls Wall #2
20.1/09	Tied-Back Retaining Walls Wall #2
20.1/10	Tied-Back Retaining Walls Typical Section
20.1/11	Tied-Back Retaining Walls Typical Section
20.1/12	Tied_Back Retaining Walls Concrete Panels
20.2/01	84" Headwall Site Plan
20.2/02	84" Headwall Details
102/01	Utilities Relocated 15" Sewer
103/01	Standard Details Guardrail Elements
103/02	Standard Details Guardrail Posts

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80/03	Photographs 5 thru 7
80/04	Photographs 8 thru 11
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80/06	Alternative 1
80/07	Alternative 2
80/08	Alternative 3
80/09	Alternative 4
80/10	Alternative 5
80/11	Plan and Profile (60ft channel) 5+00 to 16+00
80/12	Plan and Profile (60ft channel) 16+00 to 25+50
80/13	Plan and Profile (60ft channel) 25+50 to 38+00
80/14	Plan and Profile (60ft channel) 38+00 to 48+77
80/15	Plan and Profile (80ft channel) 5+00 to 16+00
80/16	Plan and Profile (80ft channel) 16+00 to 25+50
80/17	Plan and Profile (80ft channel) 25+50 to 38+00
80/18	Plan and Profile (80ft channel) 38+00 to 48+50
80/19	Plan and Profile (100ft channel) 5+00 to 16+00

Information Drawings Continued

80/20	Plan and Profile (100ft channel)	16+00 to 27+00
80/21	Plan and Profile (100ft channel)	27+00 to 38+00
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Logan, West Virginia

APPENDIX A – ENGINEERING TECHNICAL APPENDIX TO THE GENERAL REEVALUATION REPORT

1. AUTHORIZATION

The Island Creek Local Protection Project was authorized by the Water Resources Development Act of 1986 (Public Law 99-662, dated 17 November 1986).

2. PURPOSE AND SCOPE

The purpose of this Engineering Technical Appendix (ETA) is to present and obtain approval for the engineering plans and design for the Island Creek Local Protection Project (LPP). This project would reduce flooding in Logan, West Virginia, and provide reliable warnings of local flooding situations to the residents and businesses situated along Island Creek. The ETA, which concerns only the lower portion of Island Creek, is presented as a separable element of the previously authorized project and has been prepared in accordance with the general requirements established by ER 1110-2-1150, dated 31 August 1999. The design included in this ETA was performed at the Feasibility level of detail. Final design of the project features will be developed during the preparation of the Design Documentation Report (DDR). Once a completed design of the project features has been developed and documented in the DDR, Plans and Specifications will be initiated. The DDR will be updated as the Plans and Specifications are developed and during the construction phase of the project.

3. PERTINENT DATA

Purpose: Local Flood Protection Project

State: West Virginia

County: Logan

City: Logan

River: Island Creek (tributary of the Guyandotte River)

Estimated Cost: $21,522,000 (1 October 2001 Price Level)

Construction Period: The approximate construction duration is 18 months.

4. REFERENCES

a. Final Feasibility Report, Island Creek Basin, Guyandotte River Basin Study, WV, March 1985.

b. ER 1110-2-1150, Engineering and Design for Civil Works Projects, 31 August 1999.

c. ER 1110-8-1 (FR), Civil Works Cost Engineering, 1 October 1992.

d. ER 1110-2-1302, Engineering and Design Civil Works Cost Engineering, 31 March 1994.

e. EM 1110-2-1411, Standard Project Flood Determination, March 1952.

f. EM 1110-2-1601, Hydraulic Design of Flood Control Channels, July 1991.

g. Bulletin 17B, Guidelines for Determining Flood flow Frequency, United States Water Resources Council, March 1976.

h. West Virginia Interpretive Rules Board of Health: Sewage Treatment and Collection System Design Standards, Chapter 16-1, Series VII, 1983.

i. Standard Details Book, West Virginia Department of Highways, Volume 1, revised 1/1/2000.

j. Concrete Pipe Design Manual, American Concrete Pipe Association, 1990, p. 440, fig, 227.

k. Statistical Methods in Hydrology, Leo R. Beard, January 1962.

l. SAM Hydraulic Design Package for Channels, CEWES, April 1993.

m. For references used in the structural design, see paragraph 6.c. below.

5. DEVELOPMENT OF PROPOSED PROJECT

a. **Plan Screening.** The previously authorized plan consists of structurally modifying the first 0.7 miles of Island Creek by widening the stream channel to 100 feet. The remaining 19 miles of Island Creek, Copperas Mine Fork, and Mud Fork would be treated with various nonstructural measures. It was determined during the reevaluation of the non-structural flood proofing features that such non-structural measures would be too costly to be considered for cost-shared flood protection in the Island Creek Basin. Initial reevaluation of the structural portion of the authorized plan compared the authorized 0.7-

mile channel (Plan A) with five other channel plans (Plans B – F), each 0.7 miles in length. Plans C and D, as well as two variations of Plan C, were selected to be carried forward for further evaluation.

i. Intermediate Screening Plans. The four initial screening plans carried forward for intermediate screening were renamed Alternatives 1 through 4. Another plan, Alternative 5, was developed from features contained in Alternatives 2 and 3. The five alternatives, each 80-ft wide and 0.7 miles in length, are described below. It should be noted that the Super 8 Motel was not constructed until after Alternatives 1 through 4 were developed. Therefore, the Super 8 Motel is not reflected in Alternatives 1 through 4, but is incorporated into Alternative 5. Implementation of Alternatives 1 and 2 would now require the removal of the Super 8 Motel.

(1). Alternative 1. Alternative 1, shown in Drawing 80/06, consists of widening the channel to 80 feet along the entire project length. A tied-back retaining wall would be built along the left descending bank from the confluence of Island Creek and the Guyandotte River to the U.S. 119/S.R. 10 bridge. The remainder of the project would consist of a trapezoidal channel, with 2.5 horizontal to 1 vertical side slopes. Generally, widening is accomplished only on one side of the channel in any area. This alternative would require the removal of four structures: Anderson Wholesale, Baisden Hardware, Southern Public Utilities Warehouse, and Compton's Chevron.

(2). Alternative 2. Alternative 2 is also an 80-foot channel with 2.5H to 1V side slopes. It differs from Alternative 1 in that the 80-foot width would only be maintained from the U.S. 119/S.R. 10 bridge upstream to the end of the project. The remainder of the project, from the confluence of Island Creek and the Guyandotte River to the U.S. 119/S.R. 10 bridge, would be improved by snagging and clearing without altering the existing channel width. Alternative 2 requires the removal of the same four structures referred to in Alternative 1: Anderson Wholesale, Baisden Hardware, Southern Public Utilities Warehouse, and Compton's Chevron. See Drawing 80/07 for Alternative 2.

(3) Alternative 3. Alternative 3 includes the placement of four tied-back retaining walls in various places along the left descending bank to minimize the removal of structures. The 80-foot channel width is reduced slightly in some areas where the walls are installed. A portion of one building must be removed in order to provide access behind one of the walls. Alternative 3 is shown in Drawing 80/08.

(4) Alternative 4. Alternative 4 (see Drawing 80/09) consists of three tied-back retaining walls along the left descending bank. The first wall, over 2300 feet long, begins at the confluence of Island Creek and the Guyandotte River and ends just after Baisden Brothers Hardware. The other two walls protect two other structures located farther upstream. A portion of one building must be removed in order to provide access room behind the wall.

(5) **Alternative 5.** Alternative 5 consists of snagging and clearing from the confluence of the Guyandotte River to the U.S. 119/S.R. 10 bridge (see Drawing 80/10). A tied-back retaining wall starts along the right descending bank at the U.S. 119/S.R. 10 bridge and continues past the Logan Concrete Complex. This wall would not only protect Logan Concrete, but would also preclude the taking of the Super 8 Motel on the opposite bank. Work on the trapezoidal channel, with 2.5 horizontal to 1 vertical side slopes, would then begin. The channel excavation would begin on the left descending bank, transition to the right, then back to the left descending bank. Walls would then be erected along the left descending bank to prevent the removal of Baisden Hardware and Compton's Chevron. Sediment deposition that constricts the flow of Island Creek would also be removed in an area upstream of the U.S. 119/S.R. 26 (South) bridge. This alternative would require the removal of only one structure – southern Public Utilities Warehouse.

ii. **Channel Optimization.** Alternatives 1 through 5 were presented at a Technical Review Conference in October 1992. During the conference, CELRD personnel felt that the reasons for changing from the authorized 100-foot wide channel to an 80-foot wide channel were not adequately addressed. A decision was made to conduct a channel optimization study to determine the most feasible channel width for continued design.

Three channel widths were chosen for study – 60-foot, 80-foot, and 100-foot. All channel plans begin at the confluence of the Guyandotte River and end at the sandbar removal, located under the U.S. 119/S.R. 26 (South) bridge. Generally, channel widening would occur only on one side of the channel in any area for all plans studied. Each channel width was first examined using a base design, which consists of full channel excavation with no retaining walls. The base design includes channel widening, from the beginning of the project to the CSX Railroad bridge, and the sandbar removal. An upstream extension was later added to the study. This upstream extension consists of the channel area from the CSX Railroad bridge to the confluence of Copperas Mine Fork and Island Creek.

Tied-back retaining walls were studied within each channel plan where they could be constructed to prevent the removal of structures. These retaining walls were planned only so as to maintain the true channel width under study.

Each channel plan begins with a tied-back retaining wall in the downstream reach. Full excavation was not considered an option in this area because it would have required the removal of either (1) American Electric Power Company (AEP) Substation, the Marathon Oil's Facilities, and a portion of Logan Concrete on the right descending bank, or (2) AEP's main facility and Anderson Wholesale on the left descending bank. The AEP bridge was threatened regardless of which bank was selected for the full excavation. The extremely large cost associated with full excavation of either bank in this area removed that as a consideration for any channel option.

(1) 60-Foot Channel. The 60-foot channel studied produced 20 different alternatives when the various combinations of retaining walls and the upstream extension were considered. The following tables outline the components contained in the different alternatives. The 60-foot plan, including the various components, is described below.

Features	60 Foot Channel Alts. A-J									
	A	B	C	D	E	F	G	H	I	J
Base Design	x	x	x	x	x	x	x	x	x	x
Super 8 Motel Wall		x		x					x	x
Super 8 Motel Bldg Removed	x		x		x	x	x	x		
Baisden Hardware Wall			x	x						
Baisden Building Removed	x	x			x	x	x	x	x	x
Kennel/Pump House Removed	x	x	x	x	x	x	x	x	x	x
Upstream Extension					x	x	x	x	x	x
Honeycutt Auto Body Shop Wall						x		x		x
Honeycutt Building Removed					x		x		x	
S. Public Utilities Bldg Removed					x	x	x	x	x	x
Compton's Chevron Wall							x	x		
Compton's Building Removed					x	x			x	x

Features	60 Foot Channel Alts. K-T									
	K	L	M	N	O	P	Q	R	S	T
Base Design	x	x	x	x	x	x	x	x	x	x
Super 8 Motel Wall	x	x					x	x	x	x
Super 8 Motel Bldg Removed			x	x	x	x				
Baisden Hardware Wall			x	x	x	x	x	x	x	x
Baisden Building Removed	x	x								
Kennel/Pump House Removed	x	x	x	x	x	x	x	x	x	x
Upstream Extension	x	x	x	x	x	x	x	x	x	x
Honeycutt Auto Body Shop Wall		x		x		x		x		x
Honeycutt Building Removed	x		x		x		x		x	
S. Public Utilities Bldg Removed	x	x	x	x	x	x	x	x	x	x
Compton's Chevron Wall	x	x			x	x			x	x
Compton's Building Removed			x	x			x	x		

(a) Base Design. The 60-foot channel plan, presented in drawings 80/11-14, begins with approximately 1000 feet of tied-back retaining wall along the left descending bank of Island Creek. This wall extends upstream to the U.S. 119/S.R. 10 bridge. Channel excavation continues along the same bank, but the sides are laid back on a 2.5H to 1V slope. Just upstream of Baisden Hardware the cut transitions to the right descending bank. The excavation continues along this bank and ends just short of the CSX Railroad bridge. The base design requires the removal of the following structures: Super 8 Motel, Baisden Hardware, and a combined kennel and pump house behind Baisden Hardware. Tied-back retaining walls can be constructed as additions to the base design to prevent the removal of Super 8 Motel and Baisden Hardware. The combined kennel and pump house must be removed to allow installation of the tied-back retaining wall.

(b) Upstream Extension. The upstream extension continues the channel excavation along the left descending bank to the confluence of Copperas Mine Fork and Island Creek. The upstream extension requires the removal of three additional structures: Honeycutt Auto Body Shop, Southern Public Utilities Warehouse, and Compton's Chevron. Two of these structures, Honeycutt Auto Body Shop and Compton's Chevron, could have tied-back retaining walls constructed around them to prevent their removal. Southern Public Utilities Warehouse must be removed to maintain a 60-foot channel width.

(2) 80-Foot Channel. The 80-foot channel provides only six alternatives because it is not possible to construct tied-back retaining walls to protect as many structures as in the 60-foot plan. The following table shows the features of the 80-foot alternatives. See drawings 80/15-18 for the 80-foot alternatives.

Features	80 Foot Channel Alts.					
	A	B	C	D	E	F
Base Design	x	x	x	x	x	x
Super 8 Motel Wall						
Super 8 Motel Bldg Removed	x	x	x	x	x	x
Baisden Hardware Wall		x			x	x
Baisden Building Removed	x		x	x		
Kennel/Pump House Removed	x	x	x	x	x	x
Upstream Extension			x	x	x	x
Honeycutt Auto Body Shop Wall				x		x
Honeycutt Building Removed			x		x	
S. Public Utilities Bldg Removed			x	x	x	x
Compton's Chevron Wall						
Compton's Building Removed			x	x	x	x

(a) Base Design. The 80-foot channel base design is similar to the 60-foot base design (except for the channel width). A tied-back retaining wall is only an option to save Baisden Hardware. The Super 8 Motel and the combined kennel and pump house behind Baisden Hardware must be removed.

(b) Upstream Extension. The 80-foot upstream extension is also similar to the 60-foot upstream extension requiring the acquisition of the same three structures. A tied-back retaining wall can be constructed to prevent the removal of Honeycutt Auto Body Shop, but not the Southern Public Utilities Warehouse or Compton's Chevron.

(3) 100-Foot Channel. The following table shows the components of the two alternative 100-foot channel alternatives. Tied-back retaining walls cannot be constructed to prevent the removal of any of the threatened structures. See drawings 80/19-22 for the 100-foot plan.

	100 Foot Channel Alts.	
Features	A	B
Base Design	x	x
Super 8 Motel Wall		
Super 8 Motel Bldg Removed	x	x
Baisden Hardware Wall		
Baisden Building Removed	x	x
Kennel/Pump House Removed	x	x
Upstream Extension		x
Honeycutt Auto Body Shop Wall		
Honeycutt Building Removed		x
S. Public Utilities Bldg Removed		x
Compton's Chevron Wall		
Compton's Building Removed		x

(a) Base Design. The 100-foot base design requires the acquisition of the Super 8 Motel, Baisden Hardware, and the kennel and pump house behind Baisden Hardware. Tied-back retaining walls cannot be used to prevent the removal of any of these buildings.

(b) Upstream Extension. The 100-foot upstream extension requires the removal of the Honeycutt Auto Body Shop, Southern Public Utilities Warehouse and Compton's Chevron. Tied-back retaining walls will not preclude the acquisition of any of these structures.

b. Plan Selection. A benefit/cost analysis was performed on the three channel widths, including the various wall and upstream options. The selected plan, 80-foot channel with a tied-back retaining wall at Baisden Hardware (Alternative B), was presented at a Review Conference held on 22 June 1993. The upstream extension, including variations with the Honeycutt Auto Body Wall, did not produce enough additional benefits to justify its additional cost. The cost of the Super 8 Motel Wall was prohibitive compared to the cost of acquiring and removing the structure. All options other than the selected plan were dropped from further consideration.

c. Reevaluation of Selected Plan. Preliminary design of the selected plan was suspended in December 1993 due to funding limitations of the local sponsor. The project became active again in November 1999 when the West Virginia Soil Conservation Agency agreed to provide funding to assist the local sponsor. The previously selected 80-foot channel plan (80B) was reevaluated with the 60-foot (60E) and 100-foot (100A) channel plans with the highest net benefits as presented at the 22 June 1993 Review Conference. The cost estimates for these three alternatives were updated to account for changes in HTRW quantities and disposal regulations, new aquatic and terrestrial mitigation features, a new spoil disposal site, and the inclusion of a Flood Warning System (FWS), which was requested by the local sponsor and the residents of Island Creek at a public meeting held on 9 February 2000. Based upon highest net benefits, alternative 80B was again chosen as the selected plan.

d. Description of Selected Plan

i. Project Components. Alternative 80B consists of widening the existing stream bed to a trapezoidal channel with an 80-foot bottom width and 2.5H:1V side slopes, where feasible. Special features of the project include two tied-back retaining walls, structure removal, removal of a sand bar, permanent channel access for maintenance purposes, mitigation plantings and riffle structures, and a flood warning system. The project begins at the confluence of the Guyadotte River and Island Creek and terminates with the sandbar removal located approximately 400 feet upstream of the confluence of Island Creek and Copperas Mine Fork. The project's total length is approximately 4500 feet. Drawings 16/01 – 16/04 depict plan and profile views of the selected plan. Cross sections are shown in drawings 16/06 – 16/22 and typical sections in Drawing 16/05.

(1) Trapezoidal Channel. The trapezoidal channel proposed for the project was modified in several ways to address existing site conditions. For example, channel work will be done on only one side of the channel to reduce the concerns about the acquisition of real estate. Also, the side slopes were steepened to 2H:1V in a short transition section at the beginning of the project. The final configuration of the channel was derived from a channel optimization study that balanced the hydraulic requirements for flood reduction against the economic justification for the project.

(2) Tied-back Retaining Walls. In several areas, widening the channel and laying the bank back on a 2.5H:1V slope would force the removal of certain buildings. In these areas, the cost of acquiring and removing the buildings was compared with widening the channel and stabilizing the bank with a tied-back retaining wall. A tied-back retaining wall would be constructed by placing H-piles along the edge of the bank at intervals between four and six feet, then sliding concrete panels into the slots formed by the flanges of the piles. The piles would be secured with tie-back anchors drilled into rock behind the wall. If the cost of the wall was greater than the appraised value of the building, the building was scheduled for acquisition. Otherwise, the wall was incorporated into the design.

The first tied-back retaining wall begins at the upstream side of the U.S. 119/S.R. 26 (North) bridge abutment and terminates approximately 120 feet upstream of the U.S. 119/S.R. 10 bridge (Station 6+49 to Station 15+70). Backfill will be placed behind this first wall to maintain a 15-foot-wide access road for project maintenance. There is an existing bridge, owned by the American Electric Power Company (formerly Appalachian Power Company), in this reach of the project. The wall will tie into the abutment for this bridge in such a manner that no modifications to the bridge will be needed. The second tied-back retaining wall lies around the Baisden Hardware store, running from Station 26+35 to Station 29+92. See Drawings 20.1/01 – 20.1/12 for details of the tied-back retaining walls.

(3) Sandbar Removal. The design also incorporated the removal of a sand bar in order to improve flow through the channel. The area of deposition is from Station 47+15 to Station 49+18, which is located at the extreme upstream end of the project adjacent to the U.S. 119/S.R. 26 (South) bridge.

(4) Stone Slope Protection. The velocities of the flow found in the channel during flood events are great enough to require stone slope protection along unprotected areas of the stream bank. A stone key will be placed along the base of the post-and-panel wall to prevent erosion of the base material and either 1.5 feet or 2.5 feet of stone will be placed on the stream banks, as hydraulic considerations require. The stone slope protection will be placed to a height of 12 feet above the channel bottom.

A hydraulic analysis revealed a special area of concern under the railroad bridge at approximate Station 42+00. The calculated velocities under the bridge were extremely high and it was felt that increased erosion under the bridge would be probable. A 54-inch thick layer of stone will be placed 25 feet upstream and 25 feet downstream of the bridge to rectify this problem. The stone is basically trenched into the stream banks with little attempt to modify the existing slopes, which varied from 1.5H:1V to 2H:1V. It is undesirable to modify these slopes due to the negative impact on the existing bridge abutments.

(5) Structure Removal. Several structures will require removal in order to attain the necessary channel width. A combination kennel and pump house and an underground storage tank will be removed in order to construct the tied-back retaining wall behind Baisden Hardware. The Super Eight Motel will be demolished in order to excavate for the channel side slopes between the two tied-back retaining walls. This excavation will also force the removal of 77 linear feet of 84-inch corrugated metal pipe and a corresponding headwall. The headwall will be replaced and slush grouting will be poured between the new headwall and the edge of water to prevent erosion. See Drawings 20.2/01 and 20.2/02 for the redesigned headwall.

A sanitary sewer line located along the left descending bank of Island Creek will require relocation. The replacement-in-kind design for this sanitary sewer is shown in Drawing 102/01. See paragraph 8, Relocations, for further details on the relocations required to construct the project.

(6) Stream Crossing. A temporary channel crossing will be built just downstream of the Baisden Hardware store for purposes of project construction. This crossing will be removed upon completion of the project and replaced with a in-stream mitigation riffle structure, that will be used to access the right descending bank during channel maintenance.

(7) Mitigation Features. In-stream riffle structures and mitigation plantings along the channel and at the spoil disposal site have been incorporated into the project to compensate for aquatic and terrestrial losses due to widening of the channel. A detailed description of the mitigation features is given in Section 11. ENVIRONMENTAL DESIGN MEASURES.

(8) Flood Warning System (FWS). A maximum of 9 new FWS stations will be located within the Island Creek basin. The locations of the stations were determined during field investigations and took into account recommendations of the Logan County Office of Emergency Services. An existing river gauge on the Guyandotte River in Logan will also be automated and incorporated into the system. A plan and details of the FWS are located in ETA TAB II, Hydrology and Hydraulics, SECTION B. The FWS will be constructed as part of the local protection project under a contract separate from the channel modification.

ii. Construction Procedure.

(1) General. Construction of the project features will require clearing and excavation of each area shown on the contract drawings. Prior to excavating the channel side slopes, selected structures will require removal. Excavation in areas along retaining walls will require coordination with the wall installation to insure the stability of the bank is not threatened. The most critical items are materials approval/acquisition and the installation of the retaining walls.

Excavated materials will be removed and spoiled in the nearby School House Hollow spoil disposal area. This spoil site is adequate to support disposal during construction and maintenance dredging disposal throughout the estimated 50 year project life. The spoil area is shown on Drawing 00/04 .

(2) Tied-back Wall Construction Sequence. In general, the construction sequence of the tied-back retaining walls should be as follows, except step 2 for sections of the wall under U.S. 119/S.R. 10 bridge:

1. Drill 30 in. diameter holes in overburden and 10 ft. into rock.
2. Insert W14 steel piles in the 30 in. diameter hole.
3. Install pre-cast concrete panels from top to bottom. The concrete panels will be held in place and welded to the W14 steel piles.
4. Excavate soil as required to install the next row of concrete panels.
5. Install pedestals, wales, stiffener plates and lacing plates as shown in the contract drawings.
6. Install and pre-stress tie-back anchors according to the specifications at the locations shown in the contract drawings.
7. Continue soil excavation and installation of the concrete panels until an elevation two feet below the bottom of the channel is reached or the installation of another row of anchors is required. If another row of anchors is required, repeat steps 5 and 6.

Installation of piles under the U.S. 119/S.R. 10 bridge: The vertical clearance under this bridge at the wall location is about 25 feet. The steel piles to be installed at that location are 41 feet long. Consequently, the piles will be installed in two sections that are welded together.

6. STRUCTURAL DESIGN

a. Scope of Design. This section presents the basic criteria, assumptions, analysis method and computations for the structural design of the project. See ETA TAB I for structural design calculations and quantities.

The preliminary design of the tied-back wall was based on assumed geotechnical parameters. The final design will be completed once the field data becomes available. The following assumptions also apply:

i. It was assumed that the American Electric Power (formerly APCO) bridge abutments and piers were structurally sound and founded on rock. It was also assumed that the bridge piers will remain stable after the channel excavation takes place.

ii. it was assumed that the Highway Department will authorize the construction of the post and panel wall under the U.S. 119/S.R. 10 bridge and contiguous to the U.S. 119/S.R. 26 (North) bridge (See ETA TAB I).

b. Loading Conditions. The three loading conditions considered in the preliminary design of the anchored post and panel wall were as follows:

i. Load Case 1 (Critical Moment). This case considered the water table at the top of the retained ground surface and two feet above the channel bottom on the stream side. Due to the addition of a driveway behind the post and panel wall, the design considered two concentrated loads of sixteen kips (AASHTO-HS-20 loading) applied at 3 feet and 9 feet from the face of the wall.

ii. Load Case 2 (Construction). Load Case 2 considered the water table at the top of the retained ground and two feet above the channel bottom on the other side of the wall. The purpose of this load case was to determine the maximum allowable cantilever height for a given section before the anchors are installed. The allowable stress in bending was increased to 73 percent of the Yield Strength for this load case.

iii. Load Case 3 (Normal Operating Condition, No Surcharge). Considered the water table at 2 feet above the channel bottom on both sides of the wall. Sections with two, one and no anchors were analyzed for this load case.

The effect of the HS20 truck load on the post and panel wall was analyzed using Spangler equations as shown in EM 1110-2-2502, Retaining and Flood Walls, Page 3-48.

c. References. The design criterion was based on applicable sections of the Corps of Engineers manuals and other references as follows:

i. EM 1110-1-2101, Working Stresses for Structural Design

ii EM 1110-2-2105, Design of Hydraulic Steel Structures

iii. EM 1110-2-2502, Retaining and Flood Walls

iv. EM 1110-2-256, Sliding Stability for Concrete Structures

v. AISC, Manual of Steel Construction – 1989

vi. ACI Building Code Requirements for Reinforced Concrete (ACI-318-83)

vii. GEOTECHNIQUE Volume IV, 1954, Evaluation of Coefficients of Subgrade Reaction by Karl Terzaghi

viii. Computer programs used to analyze and design subject project:

(1) X0030, CFRAME (CASE project frame analysis) is a general purpose 2-D frame analysis program with a wide range of load types and support conditions.

(2) X0031, CWALSHT, Design and analysis of sheet-pile walls by classical methods including Rowe's moment reduction.

(3) X0070, CWALSSI, Finite Element program to analyze cantilever or anchored sheet pile walls by a soil-structure interaction technique.

(4) X0075, CSLIDE, stability analysis in accordance with ETL 1110-2-256.

The program CWALSSI was chosen over the CWALSHT to analyze the post and panel wall for the following reasons:

1. CWALSSI allows more than one anchor to be place on the wall. CWALSHT allows only one anchor to be placed on the wall section (Handles statically determined structures only).

2. Due to the proximity of the rock to the invert elevation of the channel, the soldier piles for this wall had to be embedded in rock. CWALSSI features allowed to model the field conditions because the anchors can be fixed or flexible. The point of fixity of the piles was modeled with fixed anchors. The actual flexibility of the tie-backs could be accounted for by using flexible anchors.

d. Foundation Data. The preliminary design of the two post and panel walls was based on the information provided by the Geotechnical Engineer. The first section of post and panel wall (Behind the American Electric Power Building, Sta. 0+00 to 9+24) was based on boring C-90-2. The second section of post & panel wall (Sta. 0+00 to 3+66.4) was based on geotechnical information from the field log HTRW 4-9 (See ETA TAB I).

The Soil Stiffness Coefficient for the submerged soil used in the CWALSSI program was assumed as 60 percent of the Dry Stiffness Coefficient. This assumption was based on Reference vii.

For additional geotechnical information see paragraph 10, Geotechnical.

e. American Electric Power (AEP) Bridge. At the present time the structural information of the American Electric Power bridge is incomplete. The structural information about the bridge piers and abutments is not available, therefore several assumptions were made. The assumptions made are explained in the following paragraphs.

Based on the proximity of the rock to the invert elevations and the bridge inspections, it was assumed that the AEP bridge abutments and piers were structurally sound and founded on rock. If the bridge abutments are founded on piles, soil and/or above elevation 640, it will be recommended to change the proposed alignment and make the tied-back wall continuous under the bridge. It will be required to design a special tied-back wall under the bridge. The special section will span at least 10 feet since the limited clearance does not allow drilling any holes under the bridge.

If any of the bridge piers becomes unstable during or after the excavation, it will be recommended to wrap a sheet pile cell around the particular pier and fill it with concrete.

The replacement of the AEP bridge should be considered if the required modifications exceed the cost of replacement.

Modifications to the preliminary design, if needed, will be done during the plans and specifications as soon as field data becomes available.

f. Basic Design Data. The assumed values for weights of materials are as follows:

Water = 62.5 pcf
Concrete = 150 pcf
Steel = 490 pcf
Earth Backfill (Moist and Saturated) = 125 pcf

g. Allowable Design Stresses.

i. Concrete. The allowable unit stresses for reinforced concrete design are as follows :

(1) Specific Compressive Strength: $f'c = 3000$ psi

(2) Specific Yield Strength of Reinforcement: $fy = 60{,}000$ psi

Other requirements are made in accordance with applicable criteria contained in the previously listed references.

ii. Structural Steel. The allowable unit stresses for structural steel are as follows:

(1) Hydraulic Structures: $fs = 0.50\ Fy$

(2) Others: $fs = 0.60\ Fy$

7. HYDROLOGY AND HYDRAULICS

a. General. Hydrologic data, including climatology, stream flow, historic flows, and flood probability, have been developed for the project area. The hydraulic design studies included the development of water-surface profiles for existing and modified conditions, determination of erosion protection, estimation of annual maintenance requirements, and development of inundation limits. The following paragraphs summarize the hydrologic and hydraulic studies and ETA TAB II, Hydrology and Hydraulics, Section A, contains the detail data.

b. Hydrology

i. Drainage Basin Description. The Island Creek Drainage Basin is a tributary to the Guyandotte river, rises near the Logan-Mingo County line and flows in a northerly direction to its confluence with the Guyandotte River at Logan, West Virginia.

ii. Climatology and Precipitation. The climate of the Island Creek Drainage Basin is temperate and subject to unusual seasonal variations. Normal temperature distribution ranges from 0 degrees F to the low 90's degree F. The average annual precipitation over the Island Creek Drainage Basin is about 46 inches. Climatological and precipitation data for five stations near the Island Creek Drainage Basin are included in ETA TAB II, Section A.

iii. Streamflow. Although no stream gaging stations are located on Island Creek, streamflow data is available for one of its tributaries, Whitman Creek, for a period from April 1969 through September 1977. In addition, streamflow records for the

Guyandotte River in the vicinity of Island Creek have been available since 1915 when a staff gage was installed at Logan. Data for the gaging stations on the Guyandotte River and the Whitman Creek at Whitman gage are included in ETA TAB II, Section A.

iv. Major Floods. Island Creek is subject to both headwater flooding and backwater flooding from the Guyandotte River near the mouth. Brief descriptions of storms and floods July 1875, January 1918, January 1957, March 1963, January 1974, April 1977, and May of 1984 are included in ETA TAB II, Section A.

v. Unit Hydrographs. Unit hydrograph data were available for John's Creek near Meta, KY, and transferred into Island Creek using Snyder's coefficients.

vi. Standard Project Flood. The Standard Project Flood (SPF) was computed in accordance with Civil Engineering Bulletin 52-8 and EM 1110-2-1411, Standard Project Flood Determination, dated March 1952.

vii. Flood Probability. Natural discharge-frequency relationships used in this study were developed on a regionalized basis in accordance with the methods outlined in "Statistical Methods in Hydrology," by Leo R. Beard, dated January 1962, and Bulletin 17B, Guidelines for Determining Flood Flow Frequency, published by the United States Water Resource Council, dated March 1976.

c. Hydraulics

i. Water-Surface Profiles. Water-surface profiles were computed for the 1-, 2-, 5-, 10-, 20-, 50-, 100-, and 500-year frequency floods for both existing and modified channel conditions. The profiles were developed on Island Creek for approximately 10.4 miles and on Copperas Mine Fork for approximately 5.5 miles. On the lower 1.6 miles of Island Creek, the water-surface profile development was based on topographic mapping and field surveys completed in the period 1991 through 1992. The water-surface profiles for the remainder of the Island Creek study reach and all of the Copperas Mine area were based on topographic mapping and field surveys completed in the period 1978 through 1979.

Water-surface profiles were developed for each of the alternatives as described in Section 5. These plans involved channel widths of 60, 80, and 100 feet with various combinations of walls and channel extensions. All channel widening was accomplished in the lower 0.7 miles of Island Creek. The water-surface profiles for the most cost-effective 60-, 80-, and 100-foot channels are provided in ETA TAB II, Section A. As discussed in paragraph 5b, a channel optimization study was completed an the 80-foot channel with tied-back retaining walls from Station 6+49 to Station 15+70 and from Station 26+35 to Station 29+92 was selected as the recommended plan. With this plan, areas of excavation will have side slopes of 1V on 2.5H except at the short transition section at the beginning of the project which is at 1V on 2.0H. A detailed description of the recommended plan is contained in paragraph 5d. The recommended channel-modification plan results in a maximum reduction of the water surface in the project reach of approximately 9 feet for the 1- and 10-year frequency floods and approximately 7 feet for the 100-year frequency flood.

ii. Risk and Uncertainty Analysis. The transmittal memorandum for the draft EC entitled Risk Analysis Framework for Evaluation of Hydrology/Hydraulics and Economics in Flood Damage Reduction Studies states that for projects further along in feasibility, risk and uncertainty (R&U) principles should be addressed, but the explicit computational procedures will not be required. Because this report is a reevaluation of the completed Island Creek Local Protection Project Feasibility Report, the R&U procedures contained in the draft EC were not used. Instead of the R&U computational procedures, sensitivity analyses were completed on the existing and the modified condition water surface profiles. These sensitivity analyses concentrated on areas of uncertainty that affect stage including starting water surface elevations, conveyance roughness, debris accumulation, and sediment transport. None of the sensitivity studies showed any significant impact on the water surface profiles.

iii. Erosion Protection. All cut slopes will be protected with stone slope protection (SSP). The SSP requirements were determined using the criteria and procedures outlined in EM 1110-2-1601 dated July 1991. Using this criteria, the required layer thickness for the SSP is shown in the table below. Standard toe and end key details will be provided for all SSP.

Required Stone Slope Protection Layer Thickness	
Layer Thickness (inches)	Station Limits (feet)
54	41+75 – 42+25
30	5+00 – 6+50 15+60 – 26+35
18	29+92 – 41+75

iv. Maintenance Dredging Requirements. In order to determine the maintenance dredging requirements, a sediment impact assessment was accomplished using the "SAM" computer package. The "SAM" computer package is a system of computer programs developed by the Waterways Experiment Station to assess the stability of channels in alluvial material. The results of this assessment showed no significant change in the sediment transport capacity between the existing and modified channel conditions. Therefore, it was assumed that the maintenance dredging requirements for the modified channel would be approximately the same as the deposition currently occurring in the existing channel. Based upon the bars observed in the existing channel, the current annual deposition was approximated as being 1,500 cubic yards. It is assumed that the average annual dredging requirement of the modified channel will be this same quantity of material.

v. Inundation and Residual Flooding. The residual flooding is documented in the main report. The overbank velocities for the 100-year flood with project conditions average approximately 2.5 feet per second (FPS) for the left overbank and 1.0 fps for the right overbank. Inundation maps are provided in ETA TAB II, Section A, showing the inundation for the 100-year frequency flood with and without the modified channel. It should be noted that the 1- and 10-year frequency floods are essentially contained in the modified channel through the 0.7 mile project reach.

8. RELOCATIONS

a. General. Plans and estimates for the relocation of utilities were based on field investigations of the project area and utility maps previously provided by the utility companies. Designs of relocated water, sewer, and gas pipelines were based on standard designs for underground pipelines. Designs of relocated power and telephone facilities were based on REA Power and Telephone standards. Cost estimates were prepared using MCACES for Windows v1.2 cost estimating software. Company overheads for the power, telephone, and gas companies were based on previous proposals submitted by the companies for relocation contracts. Engineering by the power, telephone, and gas companies is estimated at 6% of the direct cost. Indirect costs for the relocation of water and sewer lines were based on indirect costs for a construction contractor. E&D and S&A for the relocation of water and sewer lines is based on those items being performed by the Government. A contingency of 25% was used based on Appendix C of EM 1110-2-1301 (estimate based on layout recommended in a Phase I GDM and direct cost less than $10,000,000). Contingencies of 50% were used for sewer and power line relocations because of uncertainties with their respective plans of relocation. The locations of affected utilities are shown on the drawings included in ETA TAB III.

b. Coordination. The relocation of utilities was coordinated with the owners of affected facilities. The owners provided information on sizes and capacities of existing utilities. Representatives of the owners have given tentative approval of the preliminary plans of relocation. Letters of approval from West Virginia Department of Transportation (WVDOT) Division of Highways and CSX Transportation were not available for this report.

c. Responsibility for Relocations. The relocation of utilities will be the responsibility of the project local sponsor as part of LERRDs. Attorneys Reports will be prepared to verify ownership of the utilities and determine compensable interest in the lands occupied by the utilities. Where utility companies are vested with a compensable interest, the sponsor will receive a LERRDs credit for the cost of relocating the utilities. Where no compensable interest exists and the sponsor can compel the utilities to relocate at their own cost, no LERRDs credit will be allowed. The cost of any betterments requested by the owners will be borne by the owners. The sponsor will not receive any LERRDs credit for betterments. Should the sponsor enter into a Memorandum of Agreement for the Government to assist with relocations, it is anticipated that relocations contracts will be required with Pure Water Company, the City of Logan, Allegheny Power Systems, American Electric Power, Verizon, the WVDOT, and CSX Transportation.

d. Water Lines. Water lines serving the project area are owned by the Pure Water Company of Logan, West Virginia. The only water line affected by the project is a 4-inch Cast Iron Pipe, which crosses Island Creek near project station 34+00. A new 4-inch Ductile Iron Pipe water line will be installed and buried three feet below the proposed channel bottom. It is anticipated that all water line remedial work will be performed by the construction contractor.

e. Sewer Lines. Sewer lines serving the project area are owned by the City of Logan, West Virginia. The only sewer line affected by the project is a 15-inch sanitary sewer located along the left descending bank of Island Creek, between Shoney's Restaurant and the mouth of Island Creek. About 1,220 feet of the sewer will require relocation. It is proposed to construct about 1,030 feet of new 15-inch sanitary sewer along the south side of U.S. 119/S.R. 26 between existing manhole #6 and a new manhole to be constructed in front of the Taco Bell Restaurant. A total of eight new manholes will be installed as part of the relocation. At this time, it is assumed that the city of Logan will perform all sewer remedial work. The city's consulting engineer has advised that the city is considering extending the existing sewer upstream along Island Creek to provide service to an area of expected commercial development. The city may include a betterment to the plan of relocation of this sewer. If it is later decided to perform the sewer relocation as a part of the construction contract, additional Contractor Work Limits (CWL) will be required. An existing, privately owned, 84-inch storm sewer culvert, which empties into Island Creek between the Shoney's Restaurant and Motel 8, is not a relocation item.

f. Gas Lines. Gas lines serving the project area are owned by Allegheny Power Systems. Gas lines affected by the project include an 8-inch medium pressure gas line crossing Island Creek near project station 12+00 and a suspended 3-inch gas line crossing Island Creek near project station 34+00. Project construction will require adjustment of these gas lines. It is proposed to replace the gas lines by installing new gas lines three feet below the new channel bottom. It is anticipated that all gas line remedial work will be performed by Allegheny Power Systems.

g. Power Lines. Power lines serving the project area are owned by American Electric Power Company. The first 1,500 feet of the project alignment passes through American Electric Power's (AEP) Logan substation and division office property. Project construction will require temporary relocation of six three-phase primary power lines which cross Island Creek between project stations 5+00 and 12+00. These crossings comprise the Aracoma, Island Creek, and Mud Fork primary distribution circuits. One of the crossings is a primary service line to the Super America Group. A series of temporary relocations is proposed to allow drilling of the piles for the tied-back retaining wall along Island Creek. AEP also owns a three-phase primary power line which crosses Island Creek near project station 17+00 to serve Logan Concrete and a single-phase primary power line which crosses Island Creek near project station 34+50 to serve a residence. These power lines will be relocated/adjusted to get the poles outside the construction limits and provide adequate vertical clearance. It is anticipated that all power line remedial work will be performed by AEP.

h. Telephone Lines. Telephone lines serving the project area are owned by Verizon. Verizon owns a 900 pair aerial telephone cable, which crosses Island Creek near project station 12+00. Project construction will require a temporary relocation of the cable, which will be restored to its original alignment after construction of this reach of the project. Verizon also owns two 25 pair aerial telephone cables, which cross Island Creek near project stations 16+00 and 34+00. These cables will be relocated by installing new poles outside the construction limits. It is anticipated that all telephone facility remedial work will be performed by Verizon.

i. Bridges. Several bridges in the project area will have work performed around and under them. A tied-back retaining wall will begin at the abutment of the U.S. 119/S.R.26 (north) highway bridge (project station 6+00), tie-in to each side of the AEP service bridge abutment (project station 9+50), and pass under the U.S. 119/S.R. 10 bridge between its abutment and pier (project station 14+50). The retaining wall will not require structural modification to these bridges, but will necessitate an easement from the WVDOT and AEP since it encroaches on those properties. A 54-inch thick layer of stone slope protection will replace the existing channel material below the CSX railroad bridge (project station 42+00). The stone will not require structural modification to this bridge, but will necessitate an easement from CSX since it extends onto their property.

9. SURVEYING AND MAPPING REQUIREMENTS

The mapping for the project was developed from aerial photography flown on 2 April 1991 at a scale of 1:8000 with a contour interval of 2 feet. The horizontal control was based on the North American Datum of 1927 and the vertical control was based on the National Geodetic Datum of 1929. The grid projection shown is based on the West Virginia Coordinate System, South Zone.

Complete as-built information was not available for all bridges in the project area. Specifically, the AEP bridge, the CSX Railroad bridge, and the upstream U.S. 119/S.R. 26 bridge (South) all lacked complete as-built drawings. Information on these bridges was obtained from project mapping, field surveys, contract drawings (for repairs to the bridges), and state bridge inspection reports.

Additional surveys performed concerned utility locations, locations and first-floor elevations of the buildings in the vicinity of the tied-back retaining walls, and miscellaneous cross sections of the creek.

10. GEOTECHNICAL

Geotechnical work performed for this study includes the review of subsurface information by other agencies, drilling, sampling, testing, and selection of design parameters for project features. Recommendations regarding construction methods and procedures, stone slope protection sources, and spoil sites are given in ETA TAB IV.

A total of 13 borings were obtained to obtain general information regarding soil and bedrock stratigraphies and engineering properties. Overburden was found to consist primarily of loose to very dense sands and gravels with some soft to stiff fine-grained soils. Bedrock at the project site is Pennsylvanian age sedimentary rock of the Kanawha Formation and consists of upper shale, sandstone, and lower shale members. Preliminary rock design parameters were selected from visual examination of NX-sized rock core that was recovered as part of the subsurface exploration program.

11. HAZARDOUS, TOXIC AND RADIOLOGICAL WASTES (HTRW)

a. Phase I. A Phase I HTRW (Hazardous, Toxic, and Radioactive Waste) Investigation of the study area was completed in May 1991. The investigation consisted of a physical inspection of the study area, a research of the historical land use and ownership, and a regulatory records review. From this investigation, four Areas of Concern (AOC) were identified within the project limits.

AOC#1 This is the present site of the American Electric Power (AEP) Logan Substation located at the confluence of Island Creek and the Guyandotte River. There is a transformer storage area on the upper left descending bank adjacent to Island Creek. Potential contaminants identified in this area include PCBs.

AOC#4 This is a large vacant area with large amounts of fill material visible including metal debris, concrete rubble, auto parts, and miscellaneous construction debris. Potential contaminants identified in this area include metals and petroleum from scrap autos.

AOC#5 Baisden Brothers Hardware is located on this site. A kerosene underground storage tank (UST) is present near the rear of the hardware store adjacent to a small privately owned dog kennel. Potential contaminants identified in this area include petroleum products from the potentially leaking UST.

AOC#6 Gaylock Wrecker Service occupies this property and currently operates a salvage yard on the site. Several scrap cars and buses are present. Potential contaminants identified in this area include petroleum.

b. Phase IIA. Based on the findings presented in the 1991 Phase I report, in April 1992, the Nashville District (LRN), Great Lakes Ohio River Division's HTRW Design District, performed sampling and testing in these four areas in order to confirm or deny the presence of any hazardous or toxic substances within the construction work limits (CWL). LRN's report recommended further testing in some of the areas of concern based on lab analyses. However, the report did recommend eliminating one area of concern (AOC#1) based on the data collected and the excavation limits proposed for that reach of Island Creek. The report also identified a kerosene UST and a salvage yard in AOC#5 and AOC#6 respectively. The removal of the UST and scrap auto and bus bodies will be performed prior to construction and will be included as a project cost as per Division policy for petroleum contaminated media. The LRN report recommendation for the remaining area of concern (AOC#4) was to excavate and test soils for metals and petroleum contamination during the construction phase and dispose of the material accordingly.

c. **Phase II.** Based on the large volume of excavation required within AOC#4, in January 1993 an A-E for the Huntington District performed a Phase II investigation to determine extents of potential contamination within the CWL. A phased approach was implemented with 5 borings drilled to depths of 25-40 feet at upper bank locations along AOC#4. The borings revealed 10-15 feet of relatively clean fill over most of the area of concern. Coal, mine waste, wood fragments, and metal debris were encountered at depth. Contaminant levels for metals, semi-volatiles and volatiles, and petroleum constituents indicated that the soils in this reach could be treated as non-hazardous.

d. **Supplemental Phase II.** Due to funding issues, the Island Creek project had been placed on hold. Recently, funds became available to restart the project. Because of the amount of time lapsed between the 1993 HTRW investigation and the present, the project site was revisited in November 1999 by personnel from the Huntington District (LRH). The purpose of the site visit was to walk the CWL of the project to visually observe any changes in site conditions since 1993. No changes in site conditions were noted at AOCs 5 and 6. However, based upon the site visit, further investigations on AOCs 1 and 4 were warranted. In July 2000 an A-E for the Huntington District performed a Phase II HTRW investigation to determine extents of potential contamination in the two areas. A phased approach was implemented with 4 soil borings in AOC#1 and 6 additional borings drilled to depths of 40 feet at upper bank locations along AOC#4, supplementing the previous borings. The results of the Phase II investigation eliminated AOC#1 as an area needing treatment. The results of the Phase II investigation of AOC#4 revealed contaminant levels for metals, semi-volatiles and volatiles, and petroleum constituents indicating that the soils in this reach could be treated as non-hazardous, but as special waste. The A-E, utilizing data from the previous Phase II, was able to define the depth and extent of soil needing removed, and reduce the amount of special waste for disposal in a state permitted landfill.

e. **Spoil Site.** The spoil site for the LPP was changed to an alternative location along State Route 73. A Phase I HTRW investigation was conducted in accordance with established ACOE HTRW policies. Based on the findings from the investigation, the spoil site was determined to contain no potential HTRW concerns, nor were any adjacent properties observed to contain any HTRW concerns that would impact the tract. Therefore, no further HTRW investigations on the spoil site are warranted at this time.

f. HTRW Summary. In summary, no remediation of AOC#1 is necessary, and no significant amount of soil excavated during construction should require special treatment; however, car and bus bodies and scrap metal in AOC#6 may be disposed of at another local salvage yard or state permitted landfill. Some isolated pockets of surficial petroleum contamination may be present in soils in and around the area of Gaylock's Wrecker Service (AOC#6), and there may be a small amount of petroleum contaminated soil associated with the removal of the kerosene UST in AOC#5. These concerns will be addressed during the development of Plans and Specifications for this project, as will the excavation plan for AOC#4. Should the CWL deviate drastically from the current plan, further investigations may be warranted.

12. ENVIRONMENTAL DESIGN MEASURES

The quality of the environment has been affected in the densely populated study area. The quality of fish and wildlife habitats in the impact area range from fair to very poor. Most of this results from the fact that almost all development occurs in the bottomland along the stream due to the steep topography. Most of the bottomlands along Island Creek are limited to a narrow band of riparian vegetation and small stands of hardwoods. Disturbed areas have grown up in old fields adjacent to the nearly continuous string of commercial and industrial development in the project area. Major wildlife species found in the bottomlands of the study area are resident and migrant songbirds, small mammals, amphibians, and reptiles.

The aquatic resources of the impact area are greatly stressed by dense population. Resource related problems in the area include but are not limited to acid mine drainage, siltation from logging and mining, untreated domestic sewage, trash, dredging and filling, and general stream bank disturbances such as riprap, cribwalls, gas and sewer pipes, and bridges. Most of the stream reach has some snag cover and instream structure. Solid substrate is in short supply however, since much of the bottom is unconsolidated sediment. Overhanging riparian vegetation from the steep banks shade much of the stream, but the canopy rarely completely closes over the stream.

Except for the upper reaches of Island Creek, some small relatively undisturbed tributaries, and the Guyandotte River mainstem, the project area has poor water quality that is generally incapable of supporting aquatic life, or at best it is a depressed resemblance of what would normally occur.

The bottomland and upland habitats are interspersed with small businesses, road, railroads, and some industry throughout the project area. Quality of this habitat type ranges from good to poor. Availability of food items is fair except for the absence of some major food producers, i.e., oaks and dogwoods. Sycamore and river birch are dominant. The stands are of uneven age with most being young. There is a general lack of mast-producing plant species and den sites. Downed logs and detritus, rock and lush vegetation offer adequate small mammal, amphibian, and reptile habitat. High human disturbance (negative interspersion) makes the area undesirable for most game species.

Food, cover, and reproduction value to wildlife generally declines downstream due to the increased human population downstream.

During construction, vegetation would be snagged and cleared adjacent to the stream bank of Island Creek within the CWL. Approximately 2.5 acres of this cleared vegetation is considered to be bottomland hardwood riparian habitat, which is located along the right descending bank of Island Creek. To mitigate for the loss of riparian habitat, the upper slopes of the stream bank would be reseeded with deep rooting native grasses and non-woody annuals and perennials. Approximately 1.0 acre of native bottomland hardwood tree and shrub species would be planted along the stream leaving a 12 foot wide access road for maintenance vehicles (See ETA TAB VIII, On-Site Mitigation Plan Drawings VIII-1 through VIII-4). The native bottomland plant community would be maintained as a successional plant community requiring no maintenance such as mowing or herbicide use.

The proposed School House Hollow disposal area consists of a valley containing approximately 105 acres of moderate to steep hillside. The site is vegetated with upland hardwood vegetation. Approximately 12 acres of the valley portion of the site has previously been used as a spoil disposal site during the construction of U.S. Route 119 and State Route 73 in the mid-1990s. The previous fill material consists of rock and soil and is configured in two benches with fill slopes of approximately 2.5 to 1. The existing fill is vegetated with tall grasses and low growing brush. Within the valley, a dirt haul road provides access along the west side of the fill. A shallow ditch around the perimeter of the existing fill collects storm water surface runoff from the hillsides and carries it to the base of the fill where it flows under the access road and State Route 73 via concrete culverts. The placement of channel excavated material over 6.5 acres of the spoil site would require the removal of approximately 1.5 acres of upland and bottomland hardwood trees located on the hillside around the perimeter of the existing fill. To mitigate for this loss of upland and bottomland hardwood trees and shrubs present at the disposal site and for the 1.5 acres of bottomland hardwoods not replaced along Island Creek, the 6.5 acres of new fill would be seeded with native grass, annual and perennial mix and planted with upland deciduous trees and shrubs (See ETA TAB VIII, Spoil Site Mitigation Plan Drawing VIII-5). The planting would be maintained as a successional plant community requiring no maintenance such as mowing or herbicide use. The spoil disposal site would be acquired in fee to insure control and management of mitigation.

To mitigate for the disturbance of the aquatic and benthic life, riffle/pool complexes would be constructed intermittently along the 0.7-mile of Island Creek to be widened. The riffle structures, consisting of stone similar in size to the stone slope protection, would be approximately 25 feet wide and extend across the width of the channel. The riffle structures would be anchored approximately 1 foot into the stream bed and rise approximately 1.5 foot above the stream bed (See ETA TAB VIII, On-Site Mitigation Plan Drawings VIII-1 through VIII-4).

13. REAL ESTATE

Acquisition of lands, easements, rights-of-ways, relocations and disposal lands (LERRD) is the responsibility of the non-Federal sponsor. For this project, the proposed sponsor is the Logan County Commission. A determination of the Sponsor's land acquisition experience and ability has been made. It is assumed that the sponsor will request the Corps to accomplish acquisitions of all necessary interests in lands on their behalf due to their limitations. Following execution of the Project Cooperation Agreement, a Memorandum of Agreement will be entered into between the Corps and the Commission that will specify the details of this acquisition service. Generally, all project lands will be acquired in the name of the Commission. See ETA TAB V Real Estate Plan, to this report for a complete discussion or real estate requirements.

There is no known Government or sponsor-owned land within the project area.

The proposed acquisition limits conform to currently identified construction and operation and maintenance requirements. The required area is comprised of 93 tracts, containing approximately 125 acres. It is proposed to acquire the standard fee and easement estates, as set forth in Chapter 5 of ER 405-1-12. It is proposed to acquire a perpetual channel improvement easement for most of project area. Several temporary work area easements, a perpetual pipeline easement required for sewer line relocation, together with perpetual access road easements that will also be required for the construction and operation of the project. Additionally, it is proposed to acquire fee to the surface of the proposed spoil site. This spoil site is required for both construction and the continued operation and maintenance of the project. It is proposed to acquire mineral easements within the channel CWL to protect the integrity of the project however; it is proposed to leave mineral interests outstanding in the spoil area. No residences are to be relocated. There is one commercial relocation - Motel 8. The total estimated cost for relocation benefits is $50,000 including contingencies. The tabulation below shows the breakout by estate, tracts involved, and acres.

ESTATE	TRACTS	ACRES
Fee	1	105
Perp. Channel Improv. Ease.	66	17
Perp. Access Road Ease.	9	5
Perp. Pipeline Ease.	1	1
Temp. Work Area Ease.	16	2
TOTAL	**93**	**125**

Construction of the proposed channel improvement will affect facilities owned by Pure Water Company of Logan, Allegheny Power Systems, City of Logan, American Electric Power, and Verizon. The Logan County Commission, as the proposed sponsor, will be responsible for all relocations and adjustments to the facilities as part of LERRDs. Preliminary Attorney's reports have been prepared to verify ownership of the utilities and determine compensable interest in the lands occupied by the utilities. Should the sponsor request the assistance of the Government in accomplishing relocations, it will be necessary for the Government to enter into a Memorandum of Agreement for such work. For the purposes of this report it has been assumed that all owners have a compensable interest.

HTRW investigations have been accomplished and four areas of concern (AOCs) were noted. In summary, no remediation of AOC#1 is necessary, and no significant amount of soil excavated during construction should require special treatment, however, car and bus bodies and scrap metal in AOC#6 may be disposed of at another local salvage yard or state permitted landfill. Some isolated pockets of surficial petroleum contamination may be present in soils in and around AOC#6, and there may be a small amount of petroleum-contaminated soil associated with the removal of the kerosene UST in AOC#5. These concerns will be addressed during the development of Plans and Specifications for this project, as will the excavation plan for AOC#4. Should the CWL deviate drastically from the current plan, further investigations may be warranted. See the HTRW section of this report for a more complete discussion.

The estimated cost to acquire the real estate required for this project is approximately $5,932,000. Acquisition or real estate will be accomplished over a period of 42 months. Real estate acquisitions would be initiated after execution of the PCA and entering into an MOA for acquisition services.

14. OPERATION AND MAINTENANCE

Operation, repair, and maintenance of the Island Creek LPP is the local sponsor's responsibility. The Operation and Maintenance, Repair, Rehabilitation, and Replacement Plan (OMRR&R) is described in ETA TAB VI. The absence of mechanically operated features reduces the complexity, scope, and cost of project operation and maintenance. The estimated annual maintenance cost of the project is $19,100. The project's most costly component is the requirement to remove approximately 1,500 cubic yards of sediment annually.

15. COST ESTIMATE

The baseline cost estimate (BCE) covers the cost to accomplish the work required to expand the channel width of Island Creek, WV. The estimate was prepared in accordance with ER 1110-2-1302, Civil Works Cost Engineering. Feature account cost codes assigned are in accordance with the Civil Works Breakdown Structure.

The selected 80-foot channel plan was developed by using different schemes for each of the 60-foot, 80-foot and 100-foot channel widths. Spread sheets showing a cost comparison for all schemes in each of the channel widths in included in ETA Tab VII, Section F, "Summary Sheets – Screening of Alternatives."

The total project cost includes the following feature accounts: 01 Lands & Damages, 02 Relocations, 09 Channels & Canals, 22 Feasibility Studies, 30 Engineering & Design, and 31 Supervision & Administration. The construction cost estimate was prepared using MCACES for Windows v1.2 by developing labor, equipment and material costs for the major cost items as outlined by the ETA for the selected scheme. Construction of this project is expected to require 18 months to complete and is scheduled to begin about July 2005. The BCE is Tab VII of the ETA. The price level base is 1 October 2001.

16. SCHEDULE FOR DESIGN AND CONSTRUCTION

An overall project schedule for the design and construction of the Island Creek LPP is provided at the end of the ETA write-up (just before the drawings). It is currently projected that the Flood Warning System (FWS) and the "channel widening" will be designed and constructed in two separate phases. Installation of the FWS is projected to begin in FY03 and expected to last 9 months. A 42-month real estate acquisition duration results in a FY05 projected construction start date for the "channel widening" phase. The construction duration for the channel widening phase is projected to be 18 months.

17. PERMITS

Anticipated permits and certifications required prior to the award of the channel widening construction contract include the following:

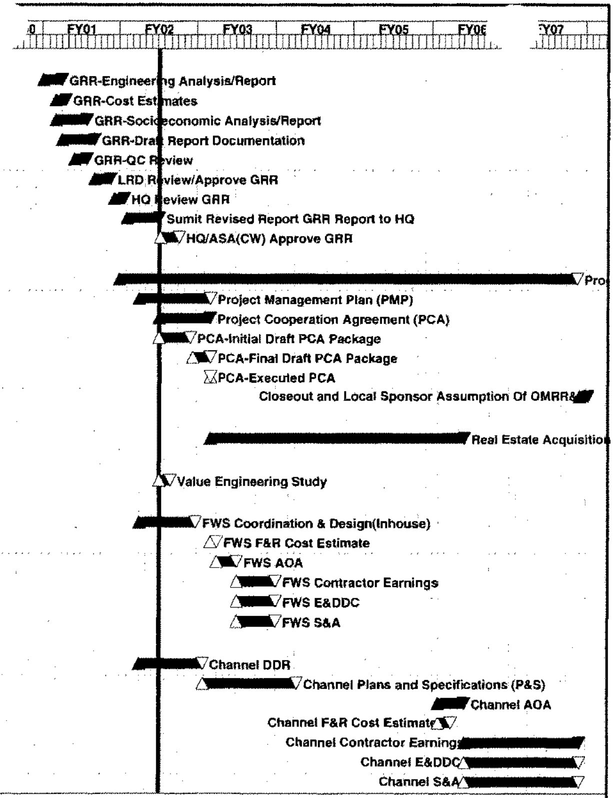
Clean Water Act Section 401 Water Quality Certification (WV DEP*)
UST Removal Permit (WV DEP)
Stream Activity Permit (WV Public Land Corporation)

*WV Department of Environmental Protection

18. RECOMMENDATION

This appendix has been prepared to obtain approval of the engineering and design for the Island Creek Local Protection Project. It is recommended that the layout and design of the project, as shown in this document, be approved for development of the construction plans and specifications.

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish
General Reevaluation Report						
57	GRR-Engineering Analysis/Report	260	0	100	02OCT00A	29DEC00A
5	GRR-Cost Estimates	24	0	100	01DEC00A	15JAN01A
7	GRR-Socioeconomic Analysis/Report	133	0	100	01DEC00A	30APR01A
8	GRR-Draft Report Documentation	110	0	100	01JAN01A	31MAY01A
10	GRR-QC Review	44	0	100	01MAR01A	30APR01A
30	LRD Review/Approve GRR	56	0	100	01JUN01A	20AUG01A
31	HQ Review GRR	36	0	100	03SEP01A	23OCT01A
00005C	Sumit Revised Report GRR Report to HQ	112	0	100	01NOV01A	05APR02A
39	HQ/ASA(CW) Approve GRR	65	65	0	08APR02*	05JUL02
Project Management Activities						
29	Programs and Project Management Documents	1,535	1,402	0	01OCT01A	20AUG07
28	Project Management Plan (PMP)	63	171	0	02JAN02A	29NOV02
27	Project Cooperation Agreement (PCA)	171	171	0	05APR02*	29NOV02
000002	PCA-Initial Draft PCA Package	105	105	0	05APR02*	29AUG02
000008	PCA-Final Draft PCA Package	56	56	0	13SEP02	29NOV02
00000V	PCA-Executed PCA	0	0	0	02DEC02	29NOV02
00009F	Closeout and Local Sponsor Assumption Of	30	30	0	31AUG07	11OCT07
Real Estate Activities						
12	Real Estate Acquisition	848	848	0	02DEC02*	01MAR06
Value Engineering Studies						
24	Value Engineering Study	37	37	0	05APR02*	27MAY02
Flood Warning System Design & Installation						
26	FWS Coordination & Design(Inhouse)	499	121	0	02JAN02A	20SEP02
17	FWS F&R Cost Estimate	21	21	0	02DEC02*	30DEC02
15	FWS AOA	67	67	0	31DEC02	02APR03
19	FWS Contractor Earnings	129	129	0	03APR03	30SEP03
21	FWS E&DDC	129	129	0	03APR03	30SEP03
23	FWS S&A	129	129	0	03APR03	30SEP03
Channel Design & Construction						
25	Channel DDR	213	146	0	02JAN02A	25OCT02
11	Channel Plans and Specifications (P&S)	314	314	0	28OCT02*	08JAN04
14	Channel AOA	88	88	0	31OCT05	01MAR06
16	Channel F&R Cost Estimate	44	44	0	31OCT05*	29DEC05
18	Channel Contractor Earnings	391	391	0	02MAR06	30AUG07
20	Channel E&DDC	391	391	0	02MAR06	30AUG07
22	Channel S&A	391	391	0	02MAR06	30AUG07



Early Bar
Progress Bar
Critical Activity

ISLAND CREEK LPP
LOGAN, WV
PROJECT SCHEDULE

INDEX

DRAWING NO.	TITLE
	GENERAL
00/01	INDEX
00/02	LEGEND
00/03	GENERAL NOTES (NOT IN THIS REPORT)
00/04	SITE PLAN
	CONTRACTOR WORK LIMITS
06/01	MONUMENT PLAN
06/02	MONUMENT PLAN
06/03	MONUMENT PLAN
06/04	MONUMENT TABLE
	RIGHT OF WAY
06/05	MONUMENT PLAN
06/06	MONUMENT PLAN
06/07	MONUMENT PLAN
06/08	MONUMENT TABLE
	SURVEY
11/01	REFERENCE (NOT IN THIS REPORT)
11/02	REFERENCE (NOT IN THIS REPORT)
11/03	CENTERLINE OF PROTECTION
11/04	CENTERLINE OF PROTECTION
11/05	CENTERLINE OF PROTECTION
	GENERAL PROTECTION
16/01	PLAN AND PROFILE 5+00 TO 17+00
16/02	PLAN AND PROFILE 17+00 TO 26+00
16/03	PLAN AND PROFILE 26+00 TO 38+00
16/04	PLAN AND PROFILE 38+00 TO 49+78
16/05	TYPICAL SECTIONS
16/06	CROSS SECTIONS 5+00 TO 7+50
16/07	CROSS SECTIONS 8+00 TO 10+50
16/08	CROSS SECTIONS 11+00 TO 13+50
16/09	CROSS SECTIONS 14+00 TO 16+50
16/10	CROSS SECTIONS 17+00 TO 19+50
16/11	CROSS SECTIONS 20+00 TO 22+50
16/12	CROSS SECTIONS 23+00 TO 25+50
16/13	CROSS SECTIONS 26+00 TO 28+50
16/14	CROSS SECTIONS 29+00 TO 31+78
16/15	CROSS SECTIONS 31+50 TO 34+00
16/16	CROSS SECTIONS 34+50 TO 37+00
16/17	CROSS SECTIONS 37+50 TO 40+00
16/18	CROSS SECTIONS 40+50 TO 43+00
16/19	CROSS SECTIONS 43+50 TO 46+00
16/20	CROSS SECTIONS 46+50 TO 49+00
16/21	CROSS SECTIONS 49+50 TO 49+78
16/22	CROSS SECTIONS AT BRIDGES

DRAWING NO.	TITLE
	TIED-BACK RETAINING WALLS
20.1/01	PLAN AND PROFILE WALL #1
20.1/02	PLAN AND PROFILE WALL #1
20.1/03	WALL #1
20.1/04	WALL #1
20.1/05	WALL #1
20.1/06	WALL #1
20.1/07	PLAN AND PROFILE WALL #2
20.1/08	WALL #2
20.1/09	WALL #2
20.1/10	TYPICAL SECTION
20.1/11	TYPICAL SECTION
20.1/12	CONCRETE PANELS
	60" HEADWALL
20.2/01	SITE PLAN
20.2/02	DETAILS
	UTILITIES
101/01	RELOCATED 15" SEWER
	STANDARD DETAILS
103/01	GUARDRAIL ELEMENTS
103/02	GUARDRAIL POSTS
	INFORMATION
80/01	PHOTOGRAPH INDEX PLAN
80/02	PHOTOGRAPHS 1 THRU 4
80/03	PHOTOGRAPHS 5 THRU 7
80/04	PHOTOGRAPHS 8 THRU 11
80/05	PHOTOGRAPHS 12 THRU 14
80/06	ALTERNATIVE NO. 1
80/07	ALTERNATIVE NO. 2
80/08	ALTERNATIVE NO. 3
80/09	ALTERNATIVE NO. 4
80/10	ALTERNATIVE NO. 5
80/11	60' CHANNEL - PLAN AND PROFILE 5+00 TO 16+00
80/12	60' CHANNEL - PLAN AND PROFILE 16+00 TO 25+50
80/13	60' CHANNEL - PLAN AND PROFILE 25+50 TO 36+00
80/14	60' CHANNEL - PLAN AND PROFILE 36+00 TO 49+77
80/15	80' CHANNEL - PLAN AND PROFILE 5+00 TO 16+00
80/16	80' CHANNEL - PLAN AND PROFILE 16+00 TO 25+50
80/17	80' CHANNEL - PLAN AND PROFILE 25+50 TO 36+00
80/18	80' CHANNEL - PLAN AND PROFILE 36+00 TO 49+50
80/19	100' CHANNEL - PLAN AND PROFILE 5+00 TO 16+00
80/20	100' CHANNEL - PLAN AND PROFILE 16+00 TO 27+00
80/21	100' CHANNEL - PLAN AND PROFILE 27+00 TO 38+00
80/22	100' CHANNEL - PLAN AND PROFILE 38+00 TO 49+77
80/23	CROSS SECTIONS 5+00 TO 7+50
80/24	CROSS SECTIONS 8+00 TO 10+50
80/25	CROSS SECTIONS 11+00 TO 13+50

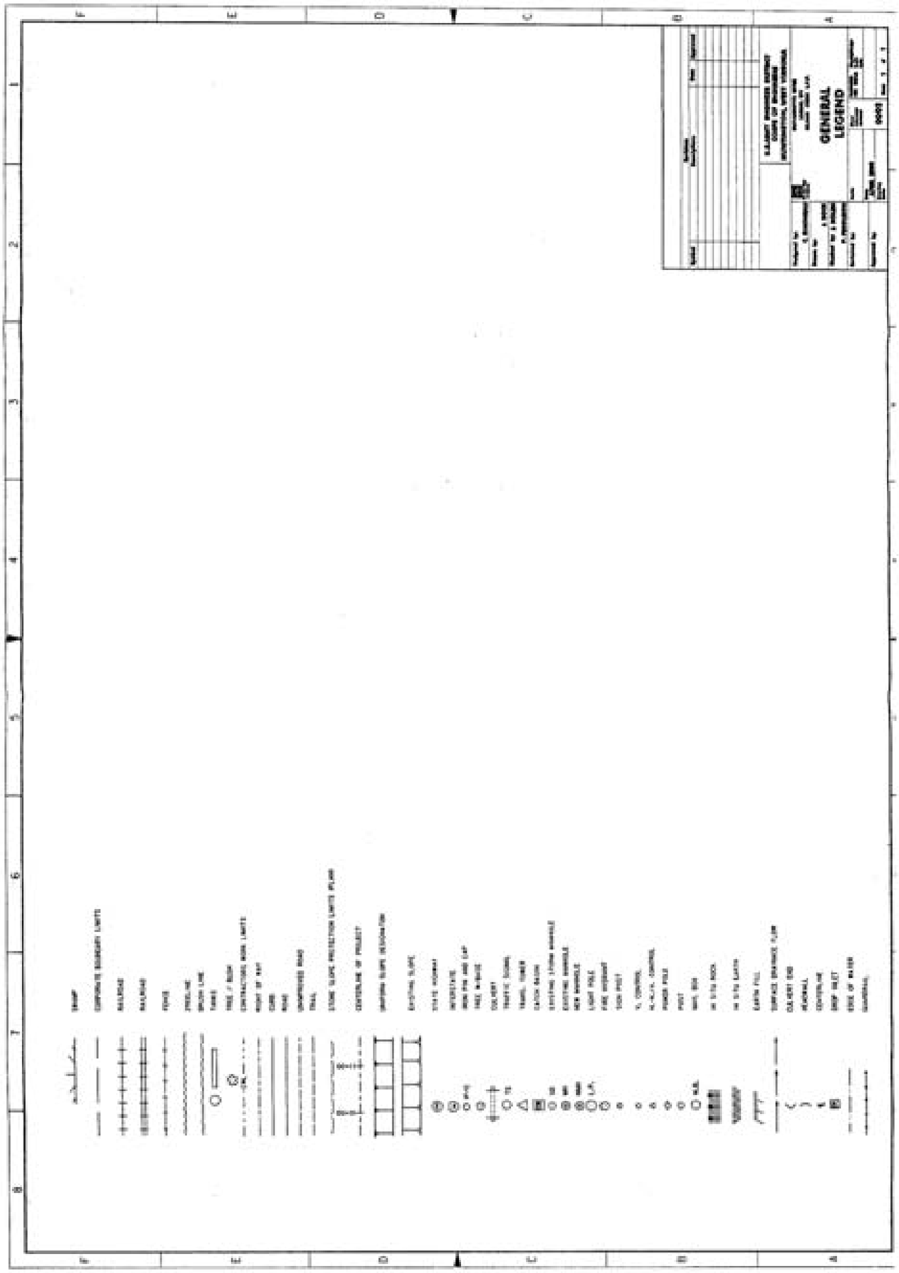
DRAWING NO.	TITLE
80/26	CROSS SECTIONS 14+00 TO 16+50
80/27	CROSS SECTIONS 17+00 TO 19+50
80/28	CROSS SECTIONS 20+00 TO 22+50
80/29	CROSS SECTIONS 23+00 TO 25+50
80/30	CROSS SECTIONS 26+00 TO 28+50
80/31	CROSS SECTIONS 29+00 TO 31+50
80/32	CROSS SECTIONS 32+00 TO 34+50
80/33	CROSS SECTIONS 35+00 TO 37+50
80/34	CROSS SECTIONS 38+00 TO 40+50
80/35	CROSS SECTIONS 41+00 TO 43+50
80/36	CROSS SECTIONS 44+00 TO 46+50
80/37	CROSS SECTIONS 47+00 TO 48+50

DRAWING NO.	TITLE

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA

GENERAL
INDEX

00/01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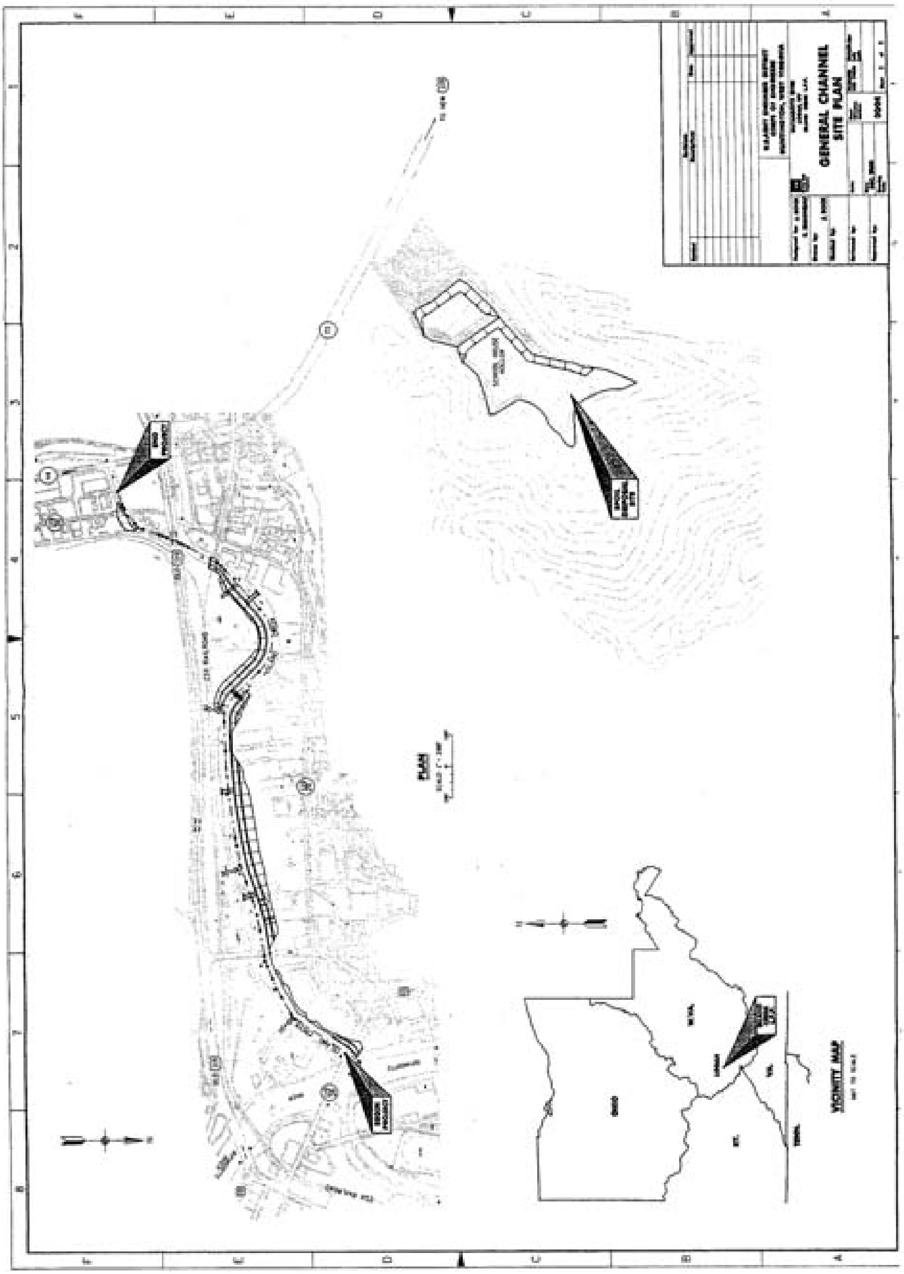
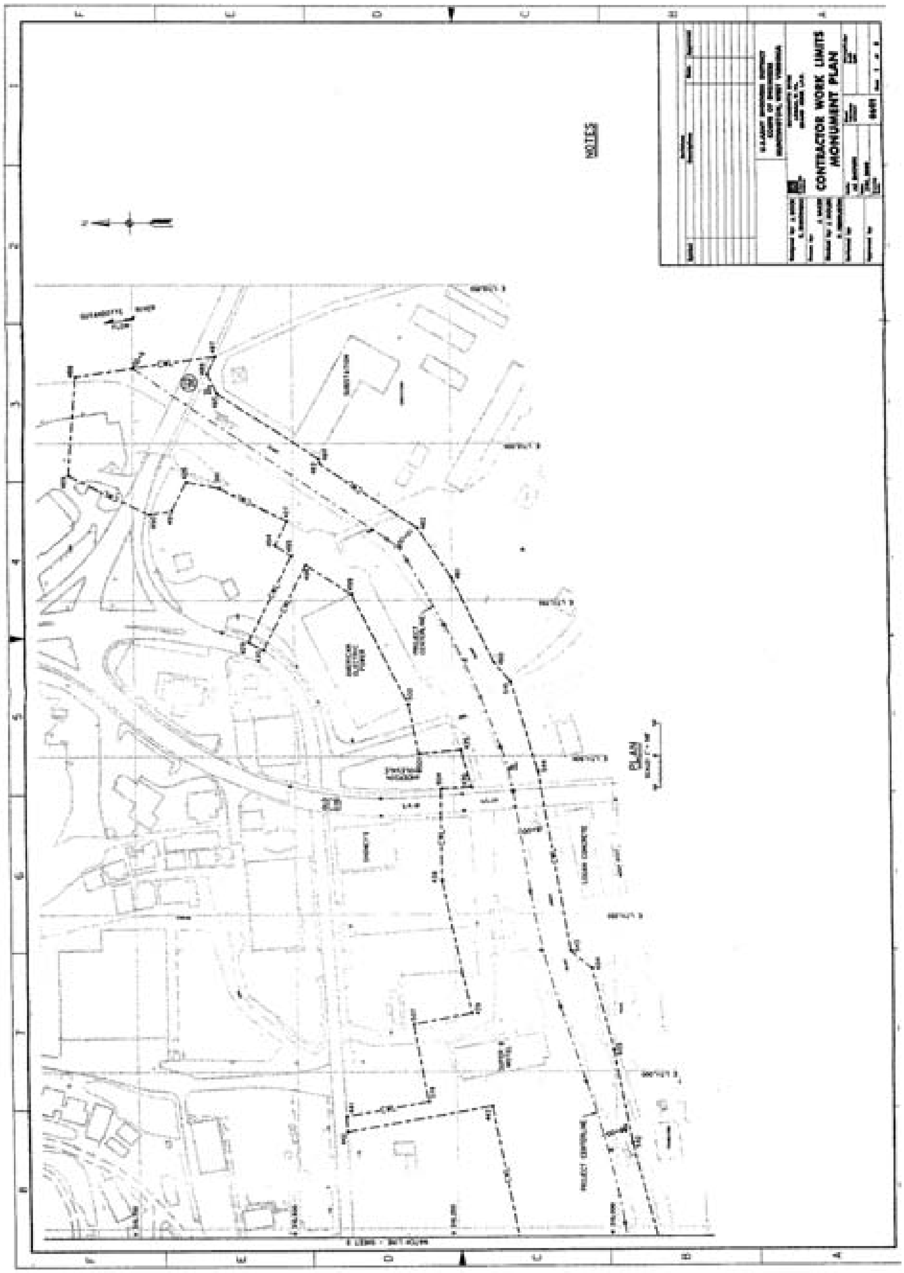
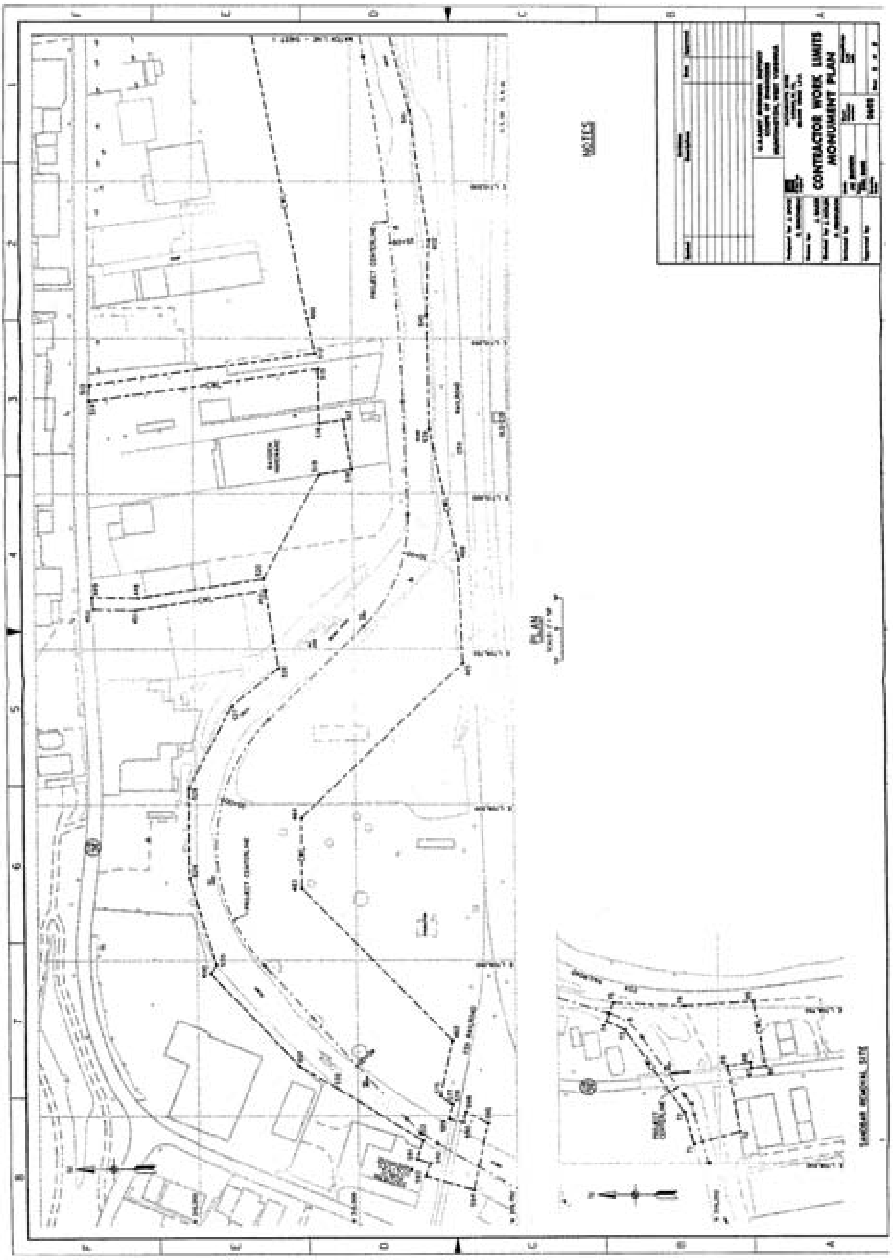
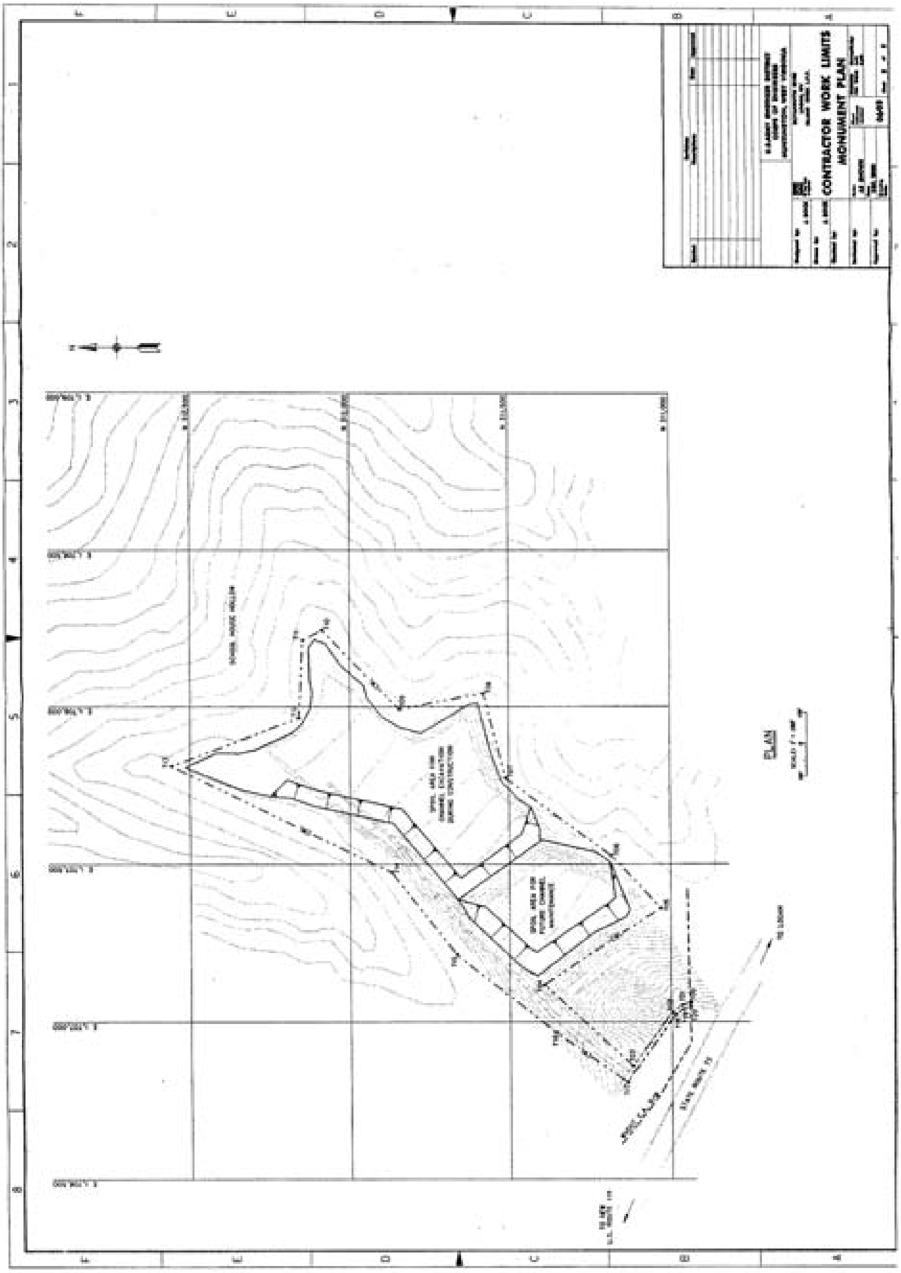
LEGEND


GENERAL CHANNEL
SITE PLAN
PLAN
VICINITY MAP


CONTRACTOR WORK LIMITS
MONUMENT PLAN
NOTES
PLAN


CONTRACTOR WORK LIMITS
MONUMENT PLAN


CONTRACTOR WORK LIMITS
MONUMENT PLAN
PLAN

PRIMARY CWL

Monument Name	Bearing	Length	Northing	Easting
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

CWL FOR SANDBAR REMOVAL AREA

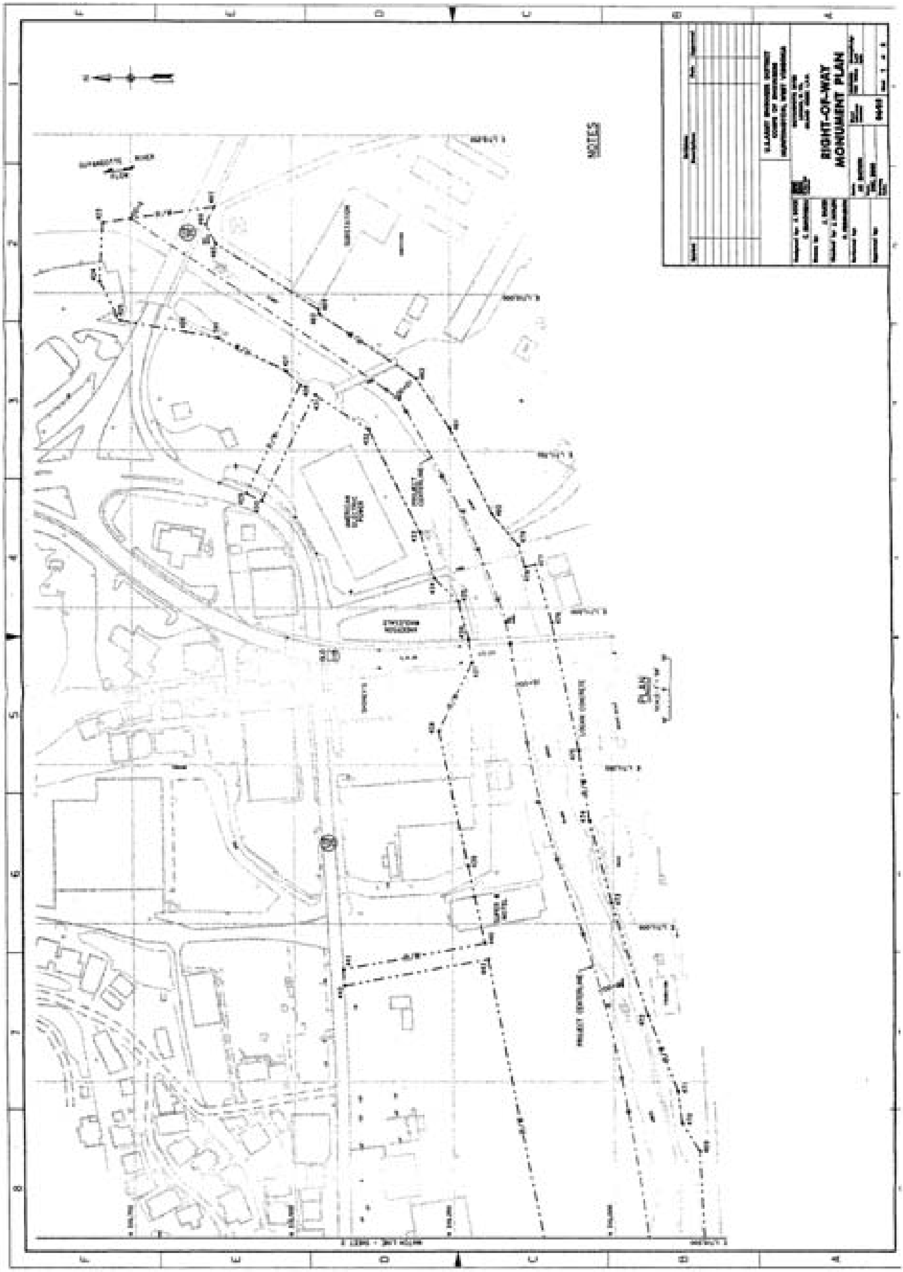
Monument Name	Bearing	Length	Northing	Easting
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

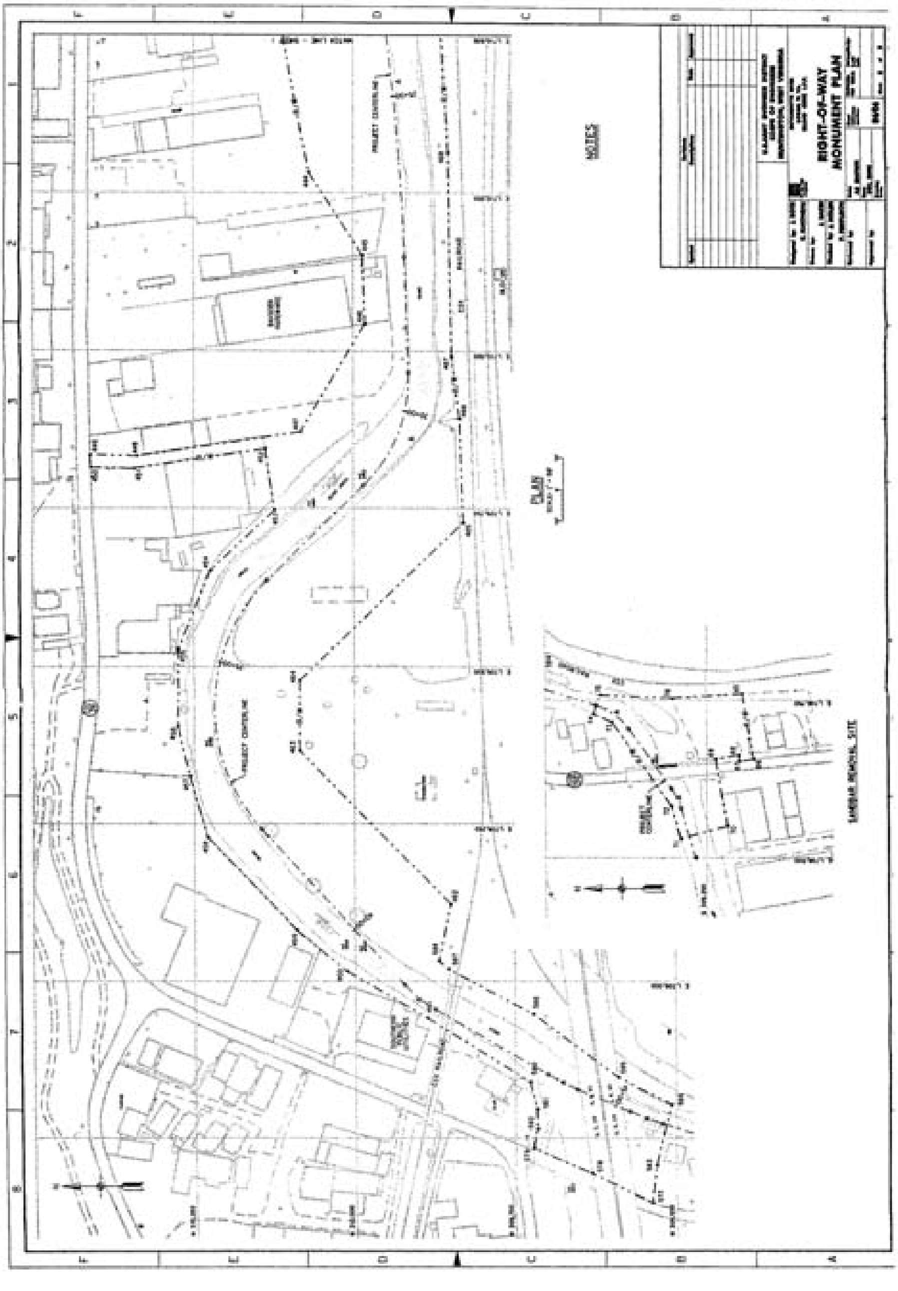
CWL FOR SPOIL SITE

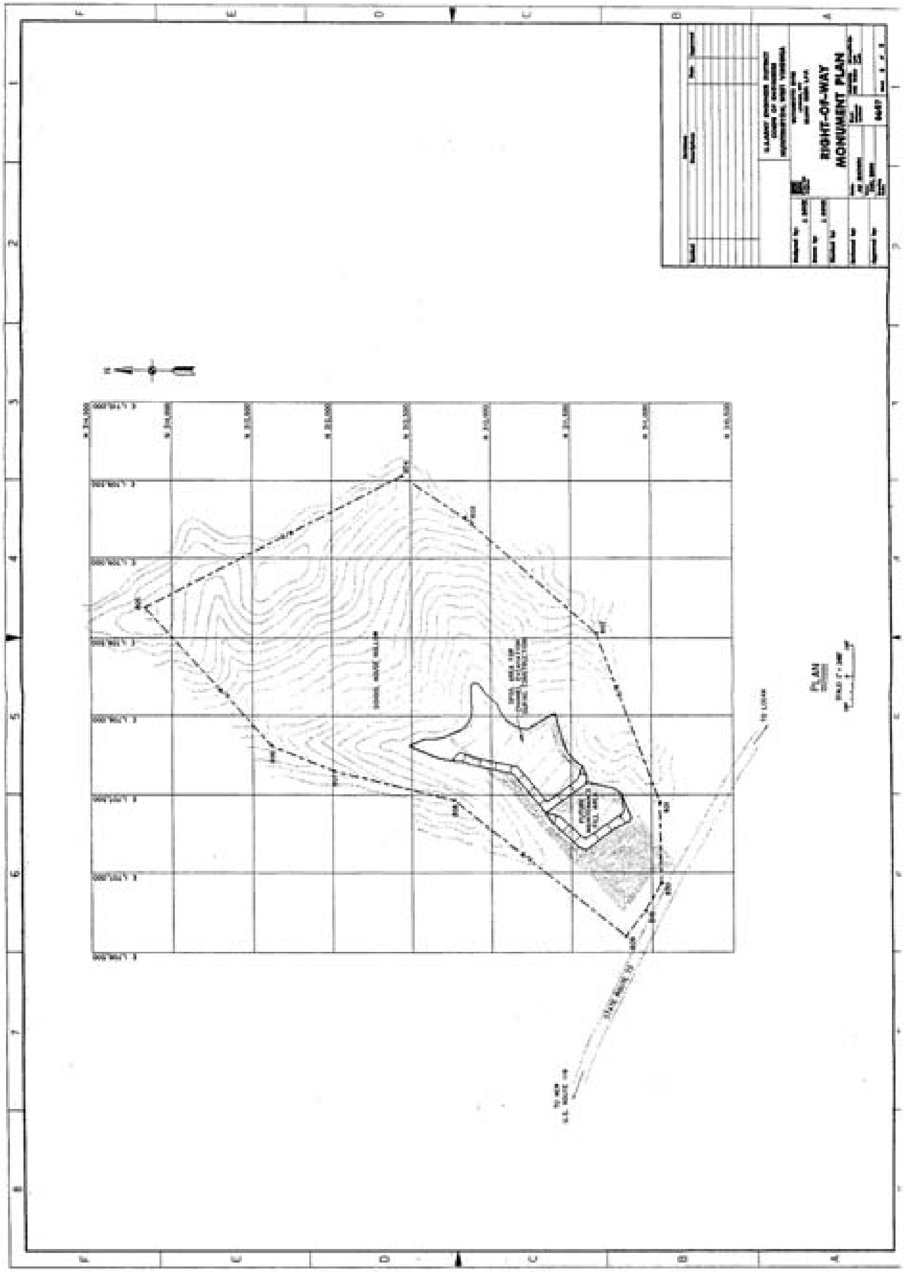
Monument Name	Bearing	Length	Northing	Easting
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA

CONTRACTOR WORK LIMITS
MONUMENT TABLE


NOTES
RIGHT-OF-WAY
MONUMENT PLAN
PLAN


NOTES
PLAN
RIGHT-OF-WAY
MONUMENT PLAN
PROJECT CENTERLINE


RIGHT-OF-WAY
MONUMENT PLAN
PLAN

PRIMARY RIGHT OF WAY

Monument Name	Bearing	Length	Northing	Easting
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

RIGHT OF WAY FOR SAND BAR REMOVAL AREA

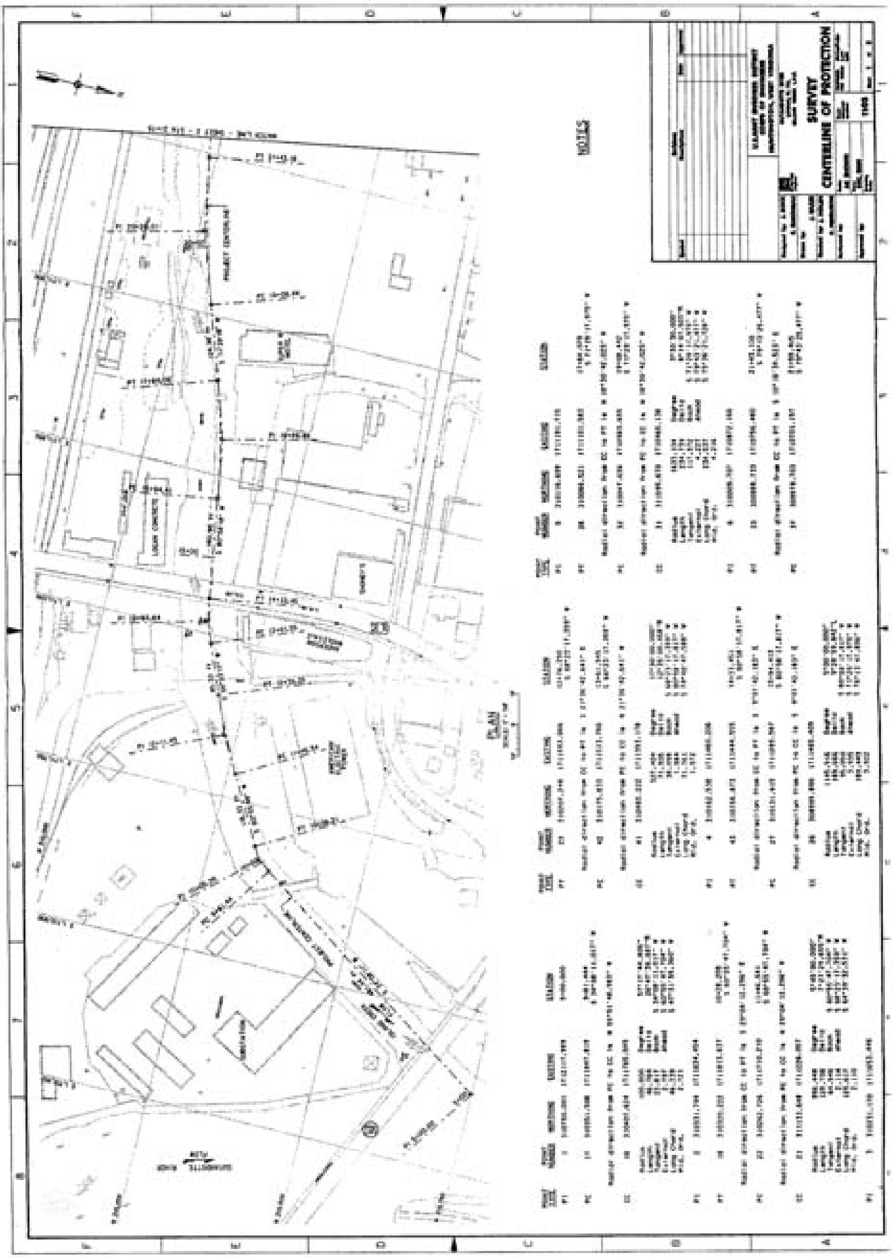
Monument Name	Bearing	Length	Northing	Easting
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

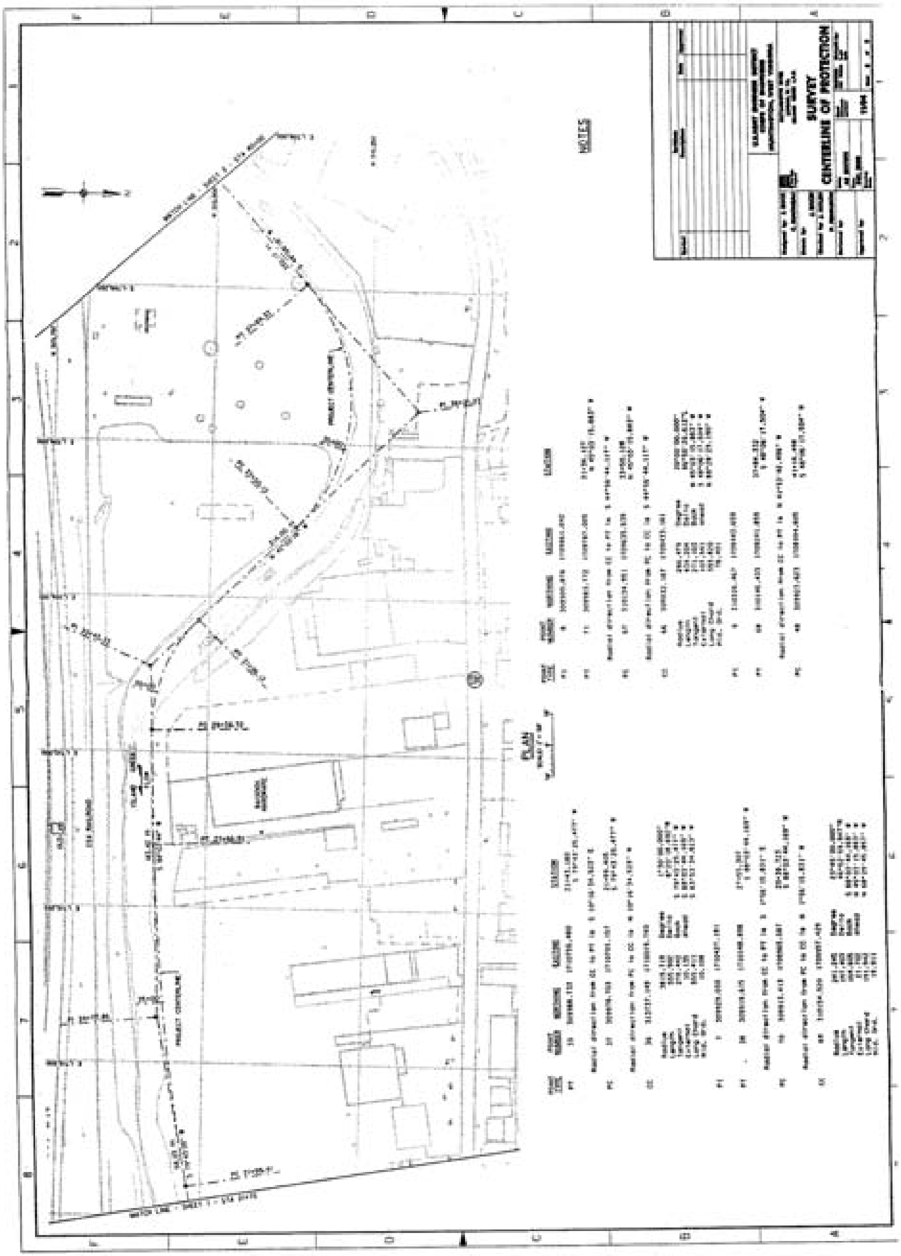
RIGHT OF WAY FOR SPOIL SITE

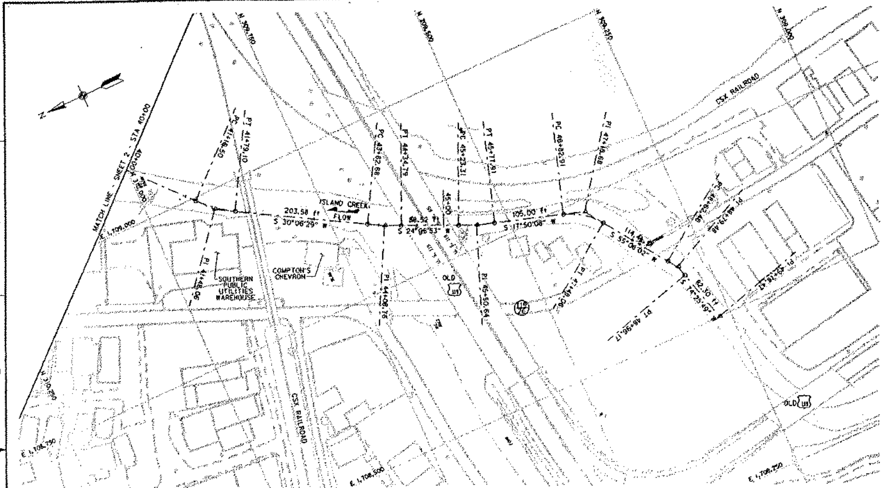
Monument Name	Bearing	Length	Northing	Easting
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

U.S.ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA

RIGHT-OF-WAY
MONUMENT TABLE


SURVEY
CENTERLINE OF PROTECTION
NOTES
PLAN


SURVEY
CENTERLINE OF PROTECTION
NOTES
PLAN



PLAN

SCALE: 1" = 50'

POINT TYPE	POINT NUMBER	NORTHING	EASTING	STATION
PT	68	310145.433	1709241.859	37+84.332 S 48°06'17.504" W

Radial direction from CC to PT is N 41°53'42.496" W

POINT TYPE	POINT NUMBER	NORTHING	EASTING	STATION
PC	48	309923.623	1708994.605	41+16.498 S 48°06'17.504" W

Radial direction from PC to CC is S 41°53'42.496" E

POINT TYPE	POINT NUMBER	NORTHING	EASTING	STATION
CC	47	309775.278	1709127.685	

Radius	199.290	Degree	28°45'00.000"
Length	62.598	Delta	17°59'48.829"L
Tangent	31.559	Back	S 48°06'17.504" W
External	2.463	Ahead	S 30°06'28.675" W
Long Chord	62.341		S 39°06'23.090" W
Mid. Ord.	2.453		

POINT TYPE	POINT NUMBER	NORTHING	EASTING	STATION
PI	10	309902.549	1708971.114	
PT	49	309875.248	1708959.283	41+79.095 S 30°06'28.675" W

Radial direction from CC to PT is N 59°53'31.325" W

POINT TYPE	POINT NUMBER	NORTHING	EASTING	STATION
PC	53	309699.132	1708853.159	43+82.679 S 30°06'28.675" W

Radial direction from PC to CC is S 59°53'31.325" E

POINT TYPE	POINT NUMBER	NORTHING	EASTING	STATION
CC	52	309449.207	1709284.164	

Radius	498.224	Degree	11°30'00.000"
Length	52.115	Delta	5°59'35.665"L
Tangent	26.081	Back	S 30°06'28.675" W
External	0.682	Ahead	S 24°06'53.010" W
Long Chord	52.091		S 27°06'40.842" W
Mid. Ord.	0.681		

POINT TYPE	POINT NUMBER	NORTHING	EASTING	STATION
PI	11	309676.569	1708840.076	
PT	54	309652.764	1708829.420	44+34.794 S 24°06'53.010" W

Radial direction from CC to PT is N 65°53'06.990" W

POINT TYPE	POINT NUMBER	NORTHING	EASTING	STATION
PC	56	309571.972	1708793.255	45+23.311 S 24°06'53.010" W

Radial direction from PC to CC is S 65°53'06.990" E

POINT TYPE	POINT NUMBER	NORTHING	EASTING	STATION
CC	55	309368.415	1709247.999	

Radius	498.224	Degree	11°30'00.000"
Length	54.601	Delta	6°16'44.715"L
Tangent	27.328	Back	S 24°06'53.010" W
External	0.749	Ahead	S 17°50'08.295" W
Long Chord	54.573		S 20°58'30.652" W
Mid. Ord.	0.748		

POINT TYPE	POINT NUMBER	NORTHING	EASTING	STATION
PI	12	309547.029	1708782.090	
PT	57	309521.015	1708773.720	45+77.912 S 17°50'08.295" W

Radial direction from CC to PT is N 72°09'51.705" W

POINT TYPE	POINT NUMBER	NORTHING	EASTING	STATION
PC	61	309421.066	1708741.561	46+82.907 S 17°50'08.295" W

Radial direction from PC to CC is N 72°09'51.705" W

POINT TYPE	POINT NUMBER	NORTHING	EASTING	STATION
CC	60	309451.719	1708646.291	

Radius	100.080	Degree	57°15'00.000"
Length	65.150	Delta	37°17'53.985"R
Tangent	33.776	Back	S 17°50'08.295" W
External	5.546	Ahead	S 55°08'02.280" W
Long Chord	64.006		S 36°29'05.287" W
Mid. Ord.	5.255		

POINT TYPE	POINT NUMBER	NORTHING	EASTING	STATION
PI	13	309388.913	1708731.216	
PT	62	309369.604	1708703.503	47+48.057 S 55°08'02.280" W

Radial direction from CC to PT is S 34°51'57.720" E

POINT TYPE	POINT NUMBER	NORTHING	EASTING	STATION
PC	64	309304.203	1708609.634	48+62.463 S 55°08'02.280" W

Radial direction from PC to CC is N 34°51'57.720" W

POINT TYPE	POINT NUMBER	NORTHING	EASTING	STATION
CC	63	309386.318	1708552.422	

Radius	100.080	Degree	57°15'00.000"
Length	33.705	Delta	19°17'46.500"R
Tangent	17.014	Back	S 55°08'02.280" W
External	1.436	Ahead	S 74°25'48.780" W
Long Chord	33.546		S 64°46'55.530" W
Mid. Ord.	1.416		

POINT TYPE	POINT NUMBER	NORTHING	EASTING	STATION
PI	14	309294.477	1708595.674	
PT	65	309289.910	1708519.285	48+96.168 S 74°25'48.780" W

Radial direction from CC to PT is S 15°34'11.220" E

POINT TYPE	POINT NUMBER	NORTHING	EASTING	STATION
PI	15	309267.819	1708500.001	49+78.472

NOTES

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA

GUYANDOTTE RIVER
LOGAN, W. VA.
ISLAND CREEK L.P.P.

SURVEY
CENTERLINE OF PROTECTION

Designed by: J. BOCK, C. BUNONEAU

Drawn by: J. BAKER

Checked by: J. NOLEN, F. FERGUSON

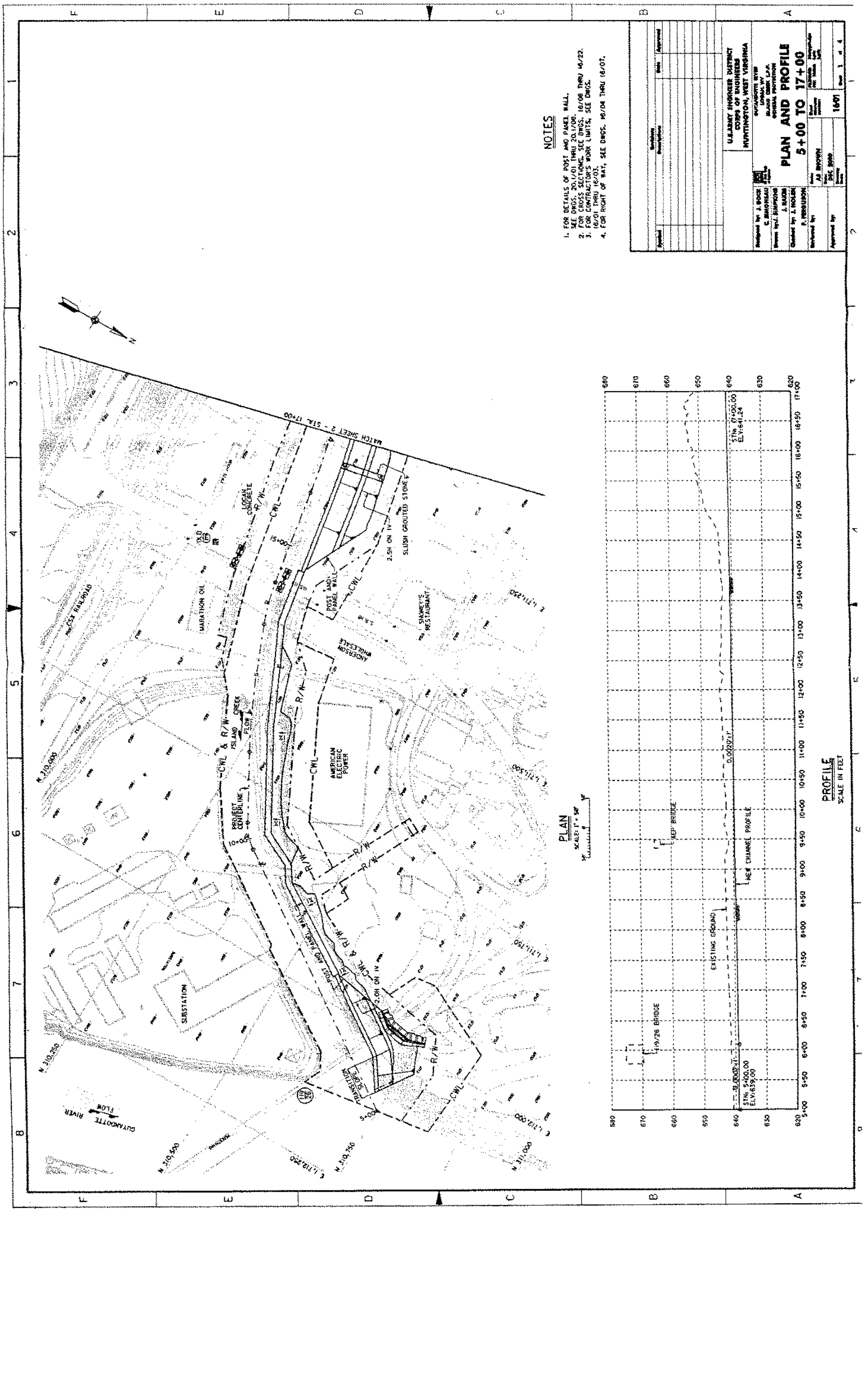
Reviewed by:

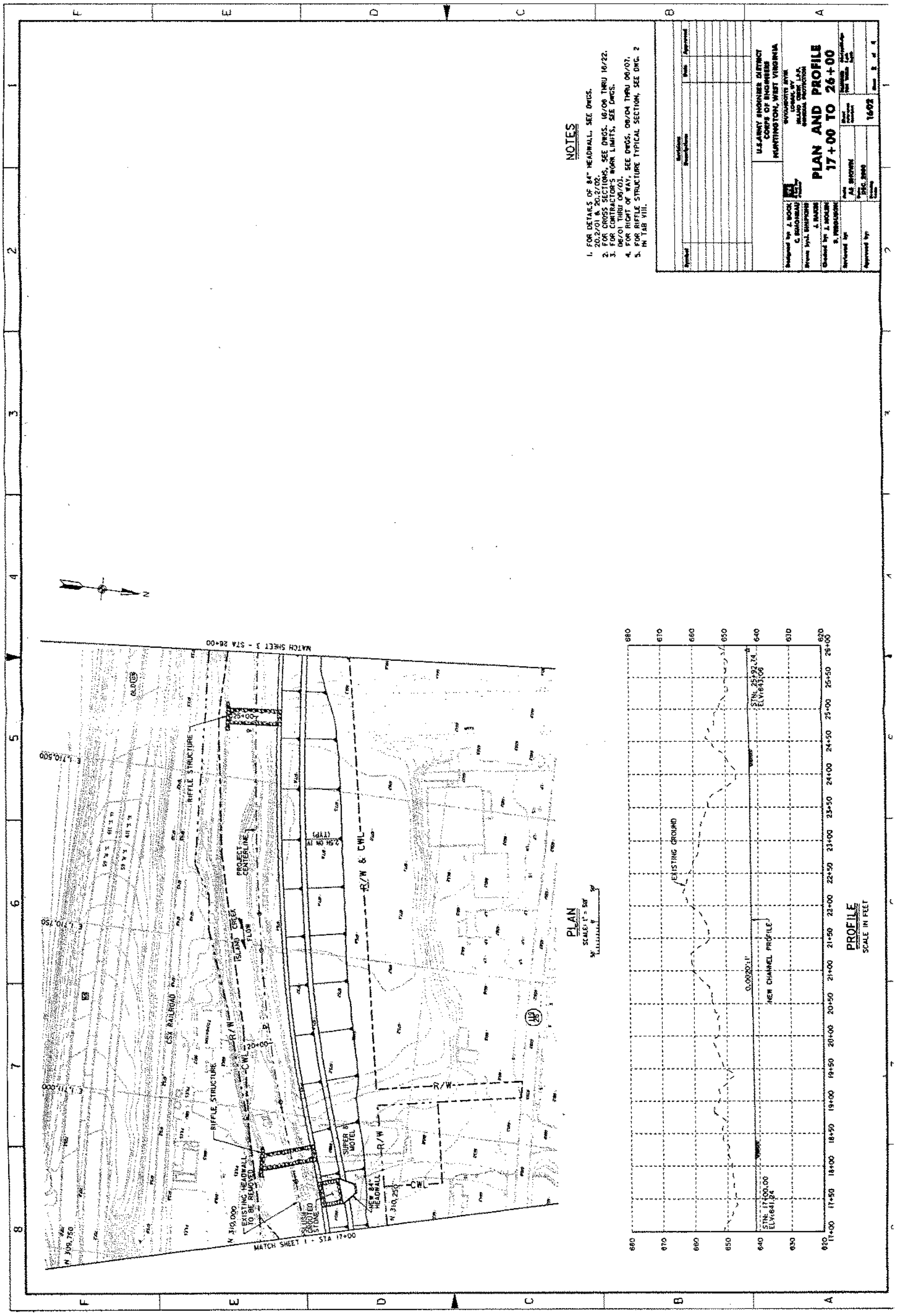
Approved by:

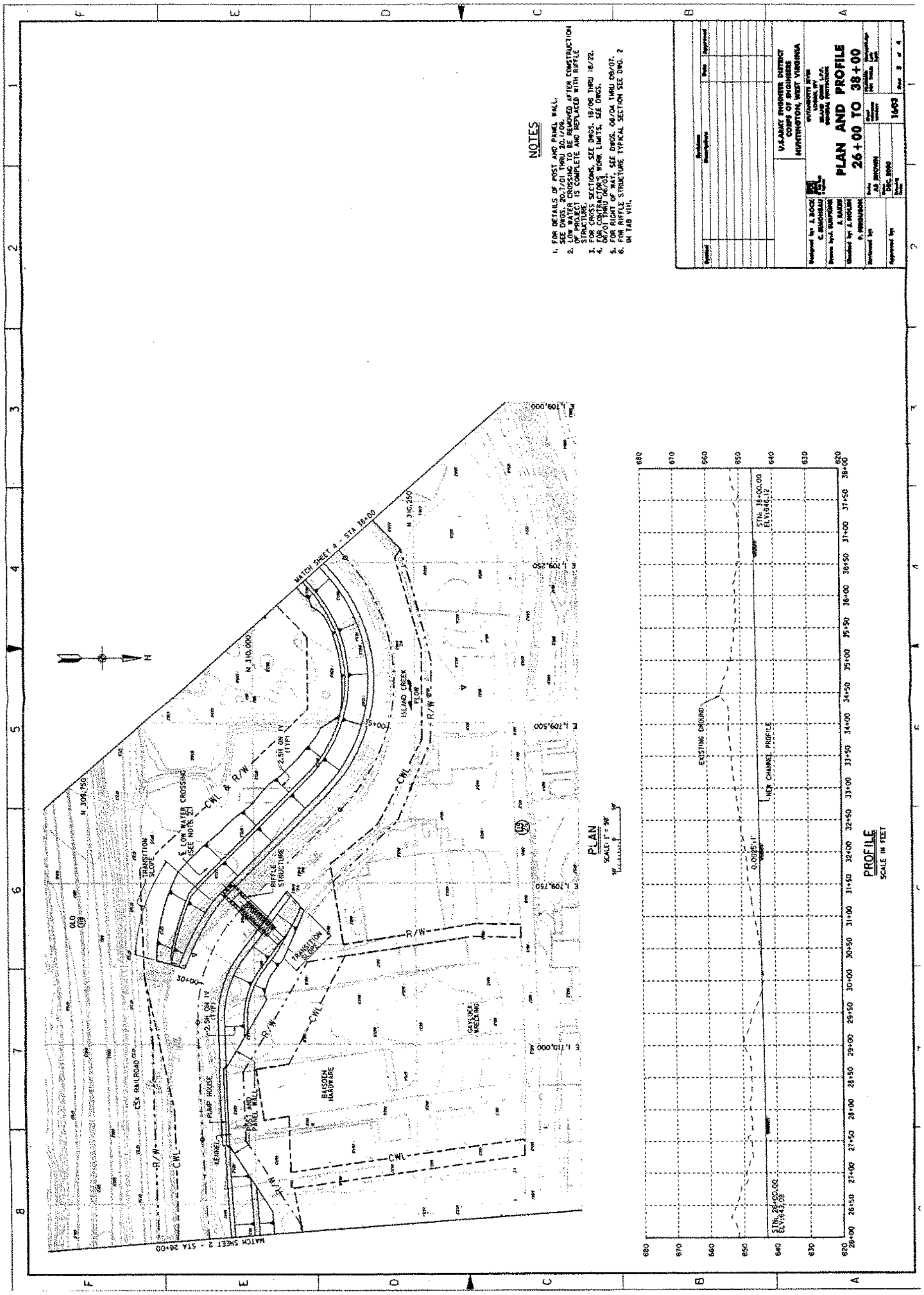
Scale: AS SHOWN

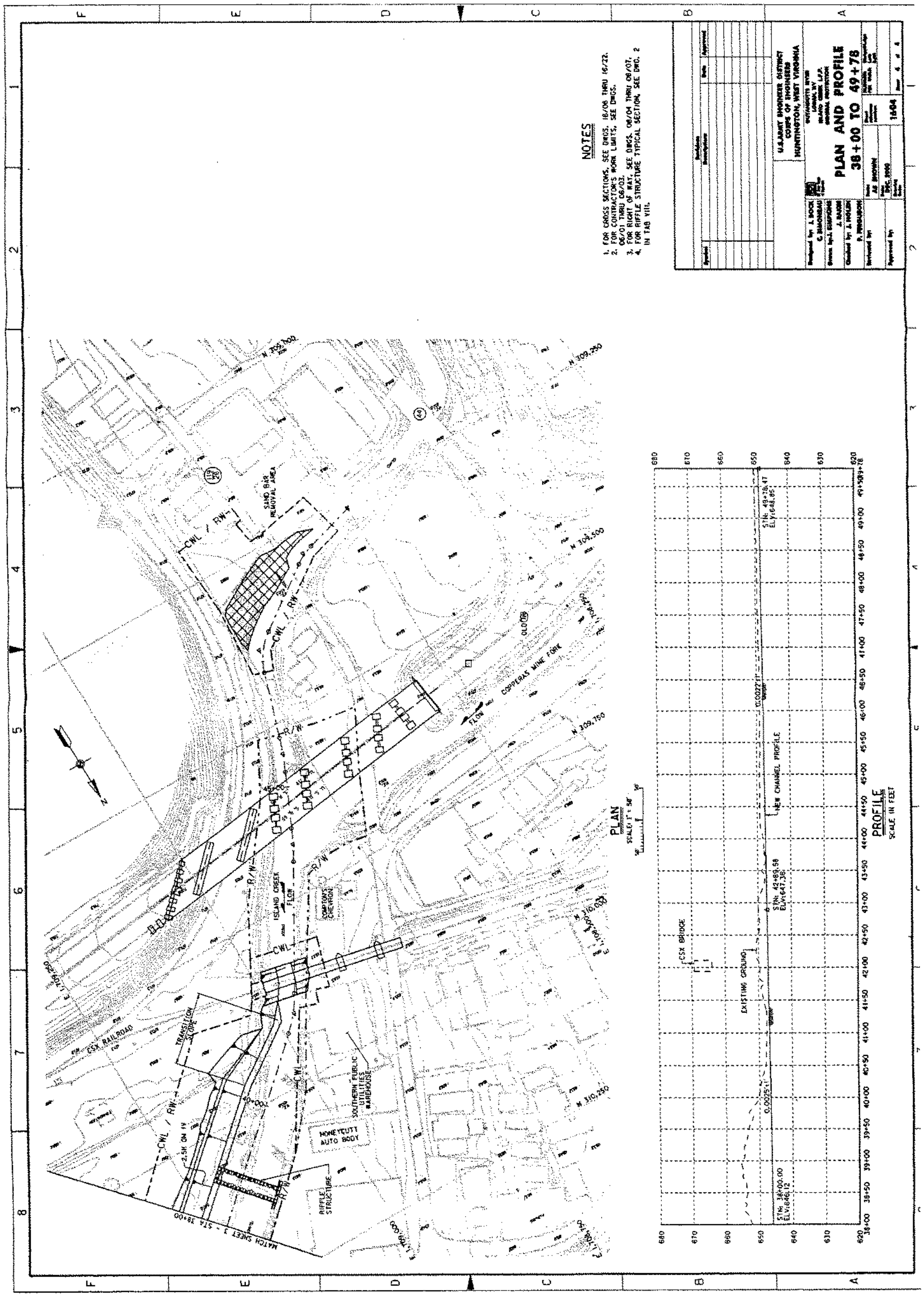
Date: DEC. 2000

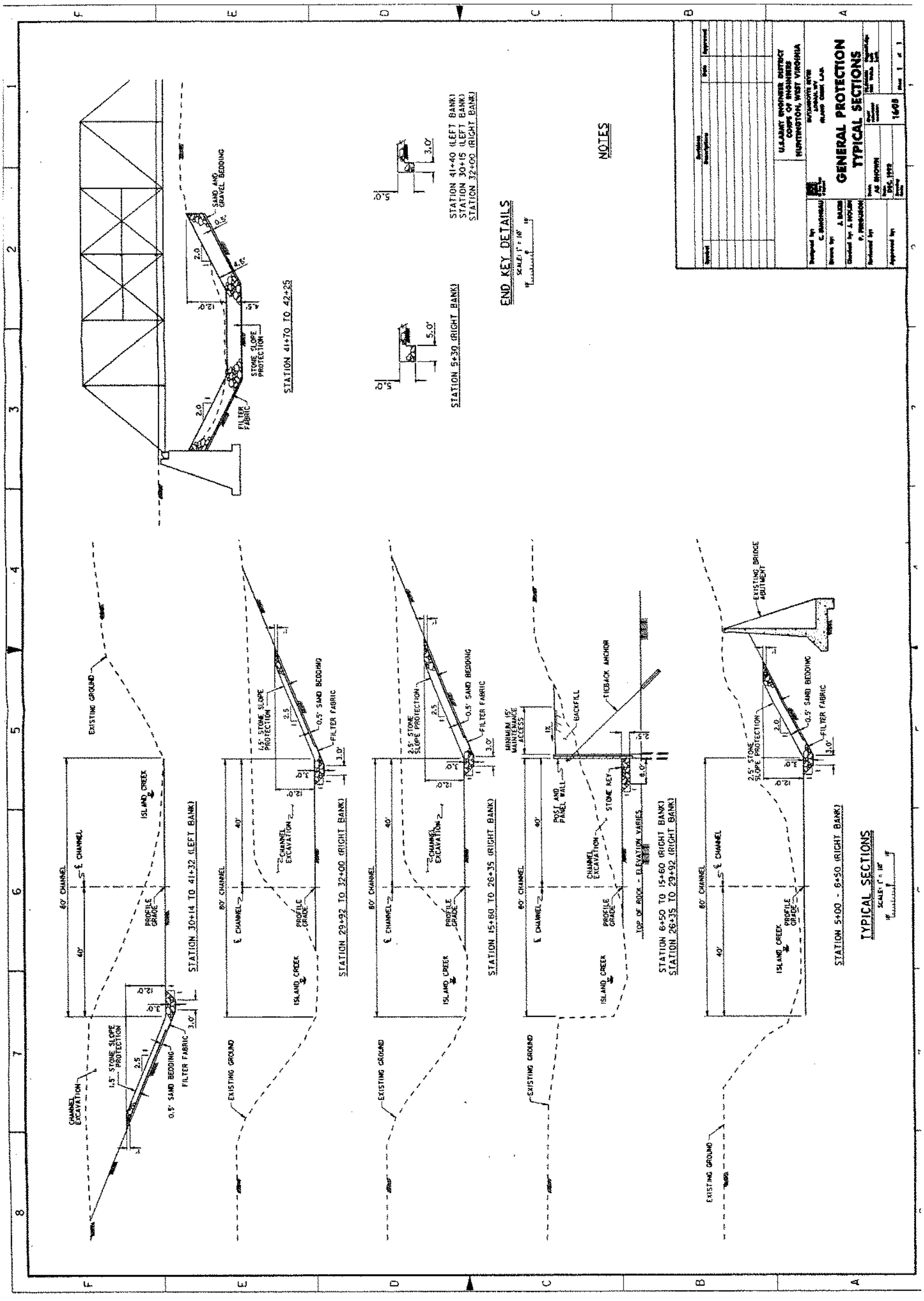
1105


NOTES
1. FOR DETAILS OF POST AND PANEL WALL, SEE DWGS. 20.1/01 THRU 20.1/08.
2. FOR CROSS SECTIONS, SEE DWGS. 16/08 THRU 16/22.
3. FOR CONTRACTOR'S WORK LIMITS, SEE DWGS. 16/01 THRU 16/03.
4. FOR RIGHT OF WAY, SEE DWGS. 16/04 THRU 16/07.
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
PLAN AND PROFILE
5+00 TO 17+00
PLAN
PROFILE
SCALE IN FEET
CSX RAILROAD
MARATHON OIL
LOGAN CONCRETE
ISLAND CREEK
PROJECT CENTERLINE
AMERICAN ELECTRIC POWER
ANDERSON WHOLESALE
SHONEY'S RESTAURANT
POST AND PANEL WALL
SLUSH GROUTED STONE
SUBSTATION
GUYANDOTTE RIVER
EXISTING GROUND
NEW CHANNEL PROFILE

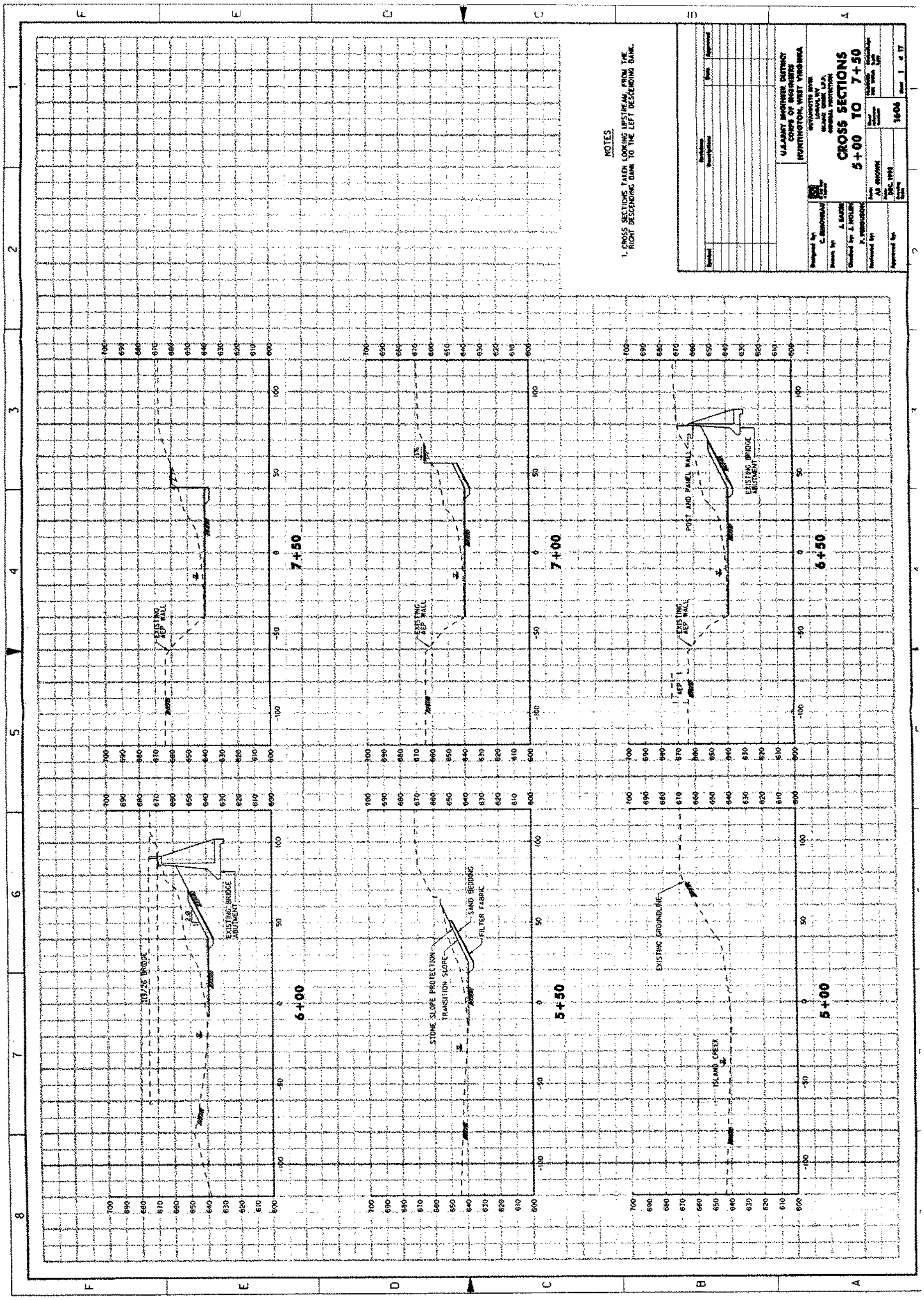

NOTES
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
PLAN AND PROFILE
17+00 TO 26+00
PLAN
PROFILE
SCALE IN FEET
EXISTING GROUND
NEW CHANNEL PROFILE
MATCH SHEET 1 - STA 17+00
MATCH SHEET 3 - STA 26+00
CSX RAILROAD
RIFFLE STRUCTURE
PROJECT CENTERLINE
SUPER 8 MOTEL
R/W & CWL

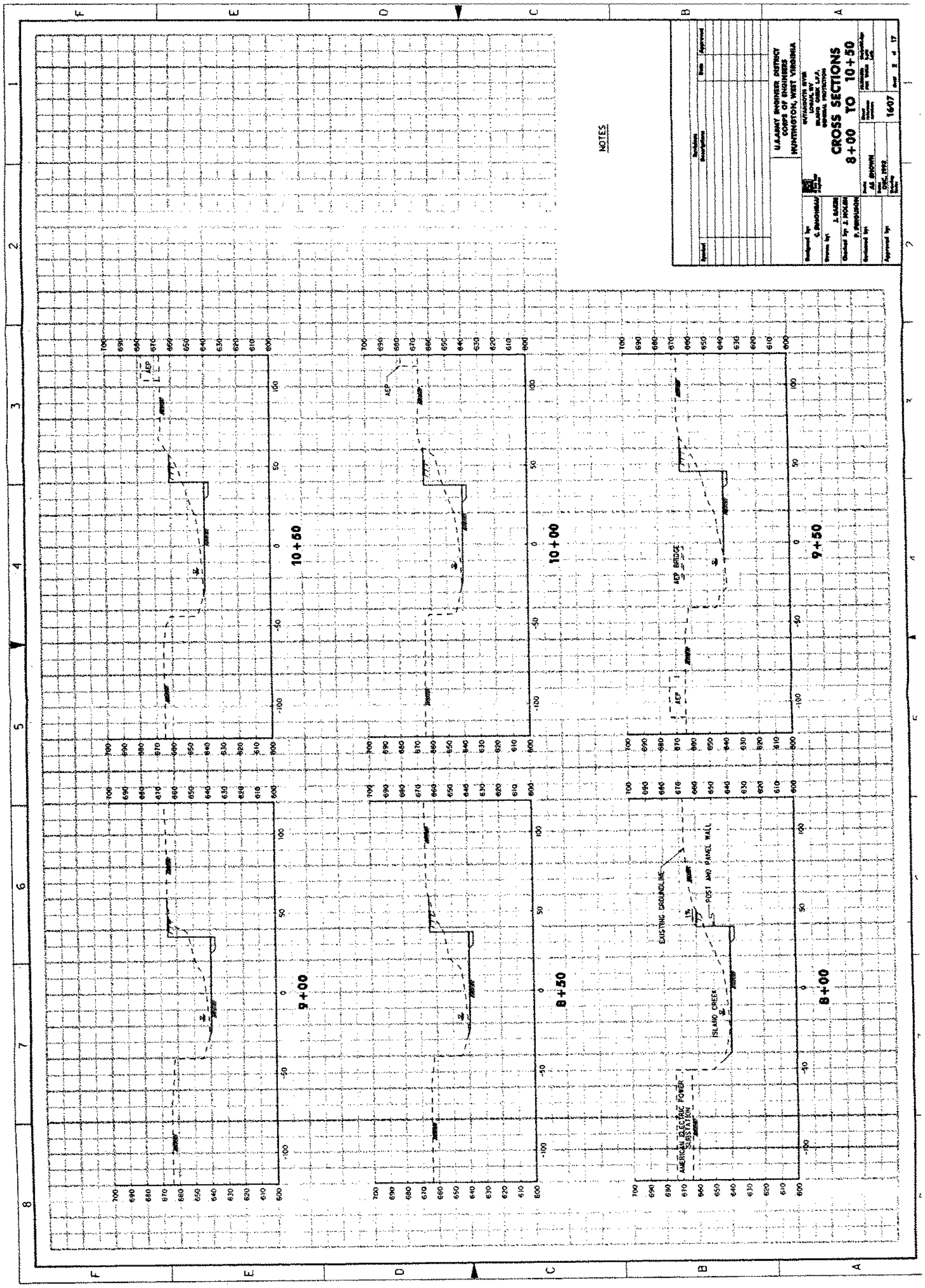

NOTES
PLAN AND PROFILE
26+00 TO 38+00
PLAN
PROFILE
SCALE IN FEET
EXISTING GROUND
NEW CHANNEL PROFILE
ISLAND CREEK
RIFFLE STRUCTURE
TRANSITION SLOPE
CSX RAILROAD
PUMP HOUSE
KENNEL
BASCOM HARDWARE

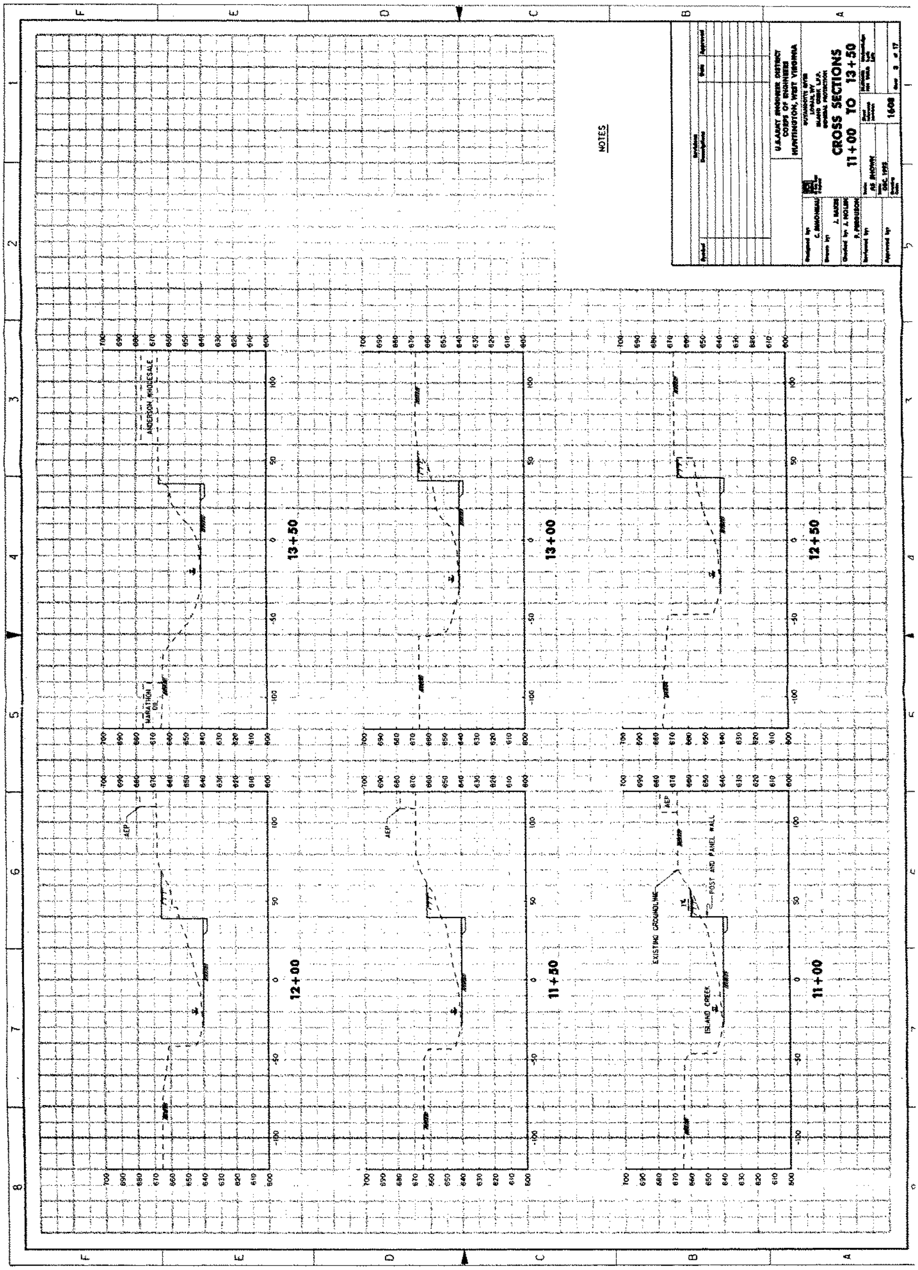

NOTES
1. FOR CROSS SECTIONS, SEE DWGS. 16/06 THRU 16/22.
2. FOR CONTRACTOR'S WORK LIMITS, SEE DWGS. 06/01 THRU 06/03.
3. FOR RIGHT OF WAY, SEE DWGS. 08/04 THRU 08/07.
4. FOR RIFFLE STRUCTURE TYPICAL SECTION, SEE DWG. 2 IN TAB VIII.
U.S.ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
PLAN AND PROFILE
38+00 TO 49+78
PLAN
PROFILE
SCALE IN FEET
CSX RAILROAD
ISLAND CREEK
COPPERAS MINE FORK
SAND BAR REMOVAL AREA
TRANSITION SLOPE
HONEYCUTT AUTO BODY
SOUTHERN PUBLIC UTILITIES WAREHOUSE
RIFFLE STRUCTURE
CSX BRIDGE
EXISTING GROUND
NEW CHANNEL PROFILE
MATCH SHEET 3 - STA 38+00

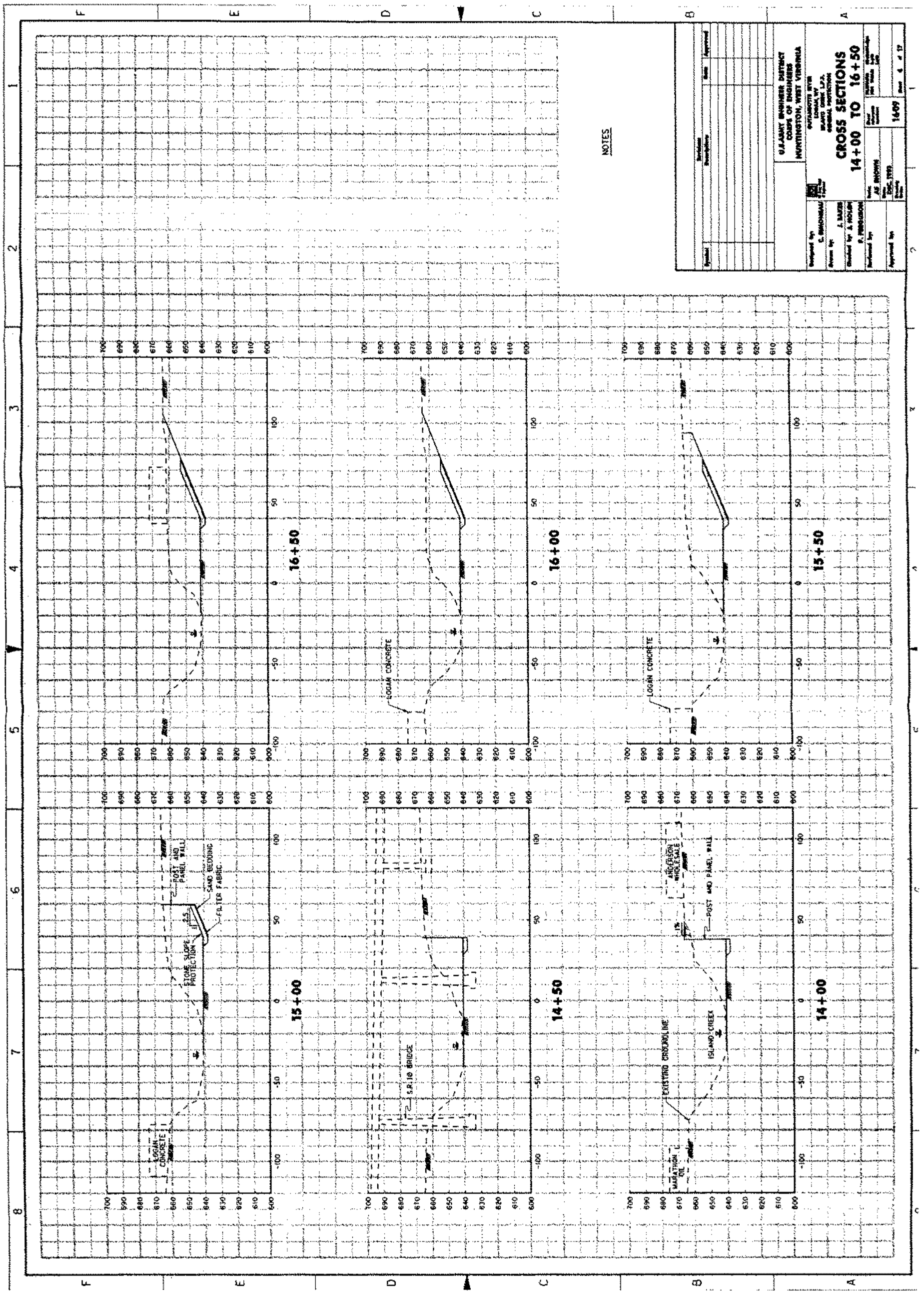


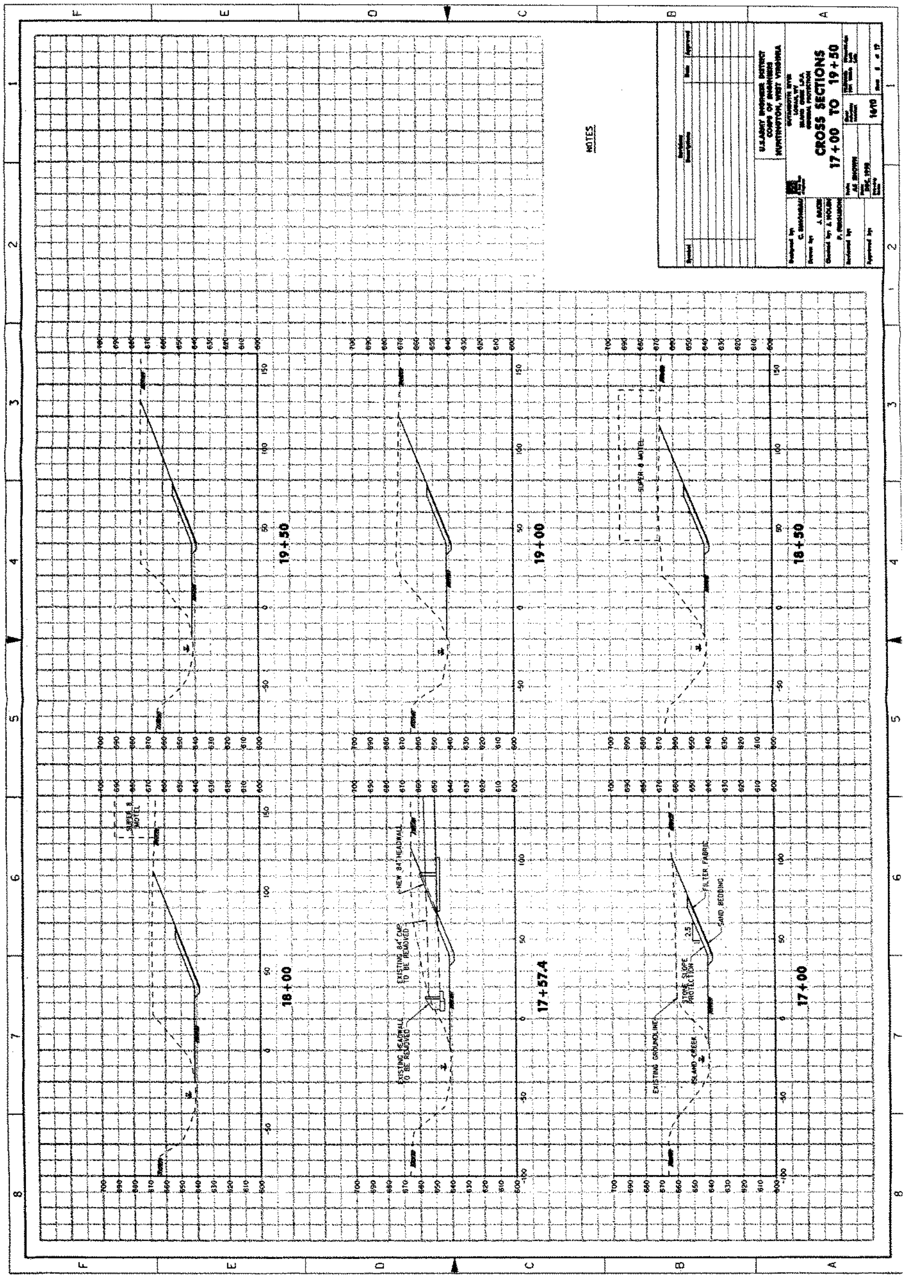
GENERAL PROTECTION
TYPICAL SECTIONS
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
NOTES
END KEY DETAILS
STATION 41+40 (LEFT BANK)
STATION 30+15 (LEFT BANK)
STATION 32+00 (RIGHT BANK)
STATION 5+30 (RIGHT BANK)
STATION 41+70 TO 42+25
SAND AND GRAVEL BEDDING
STONE SLOPE PROTECTION
FILTER FABRIC
STATION 30+14 TO 41+32 (LEFT BANK)
STATION 29+92 TO 32+00 (RIGHT BANK)
STATION 15+60 TO 26+35 (RIGHT BANK)
STATION 6+50 TO 15+60 (RIGHT BANK)
STATION 26+35 TO 29+92 (RIGHT BANK)
STATION 5+00 - 6+50 (RIGHT BANK)
TYPICAL SECTIONS
80' CHANNEL
EXISTING GROUND
CHANNEL EXCAVATION
PROFILE GRADE
ISLAND CREEK
0.5' SAND BEDDING
1.5' STONE SLOPE PROTECTION
2.5' STONE SLOPE PROTECTION
TIEBACK ANCHOR
BACKFILL
POST AND PANEL WALL
STONE KEY
TOP OF ROCK - ELEVATION VARIES
MINIMUM 15' MAINTENANCE ACCESS
EXISTING BRIDGE ABUTMENT

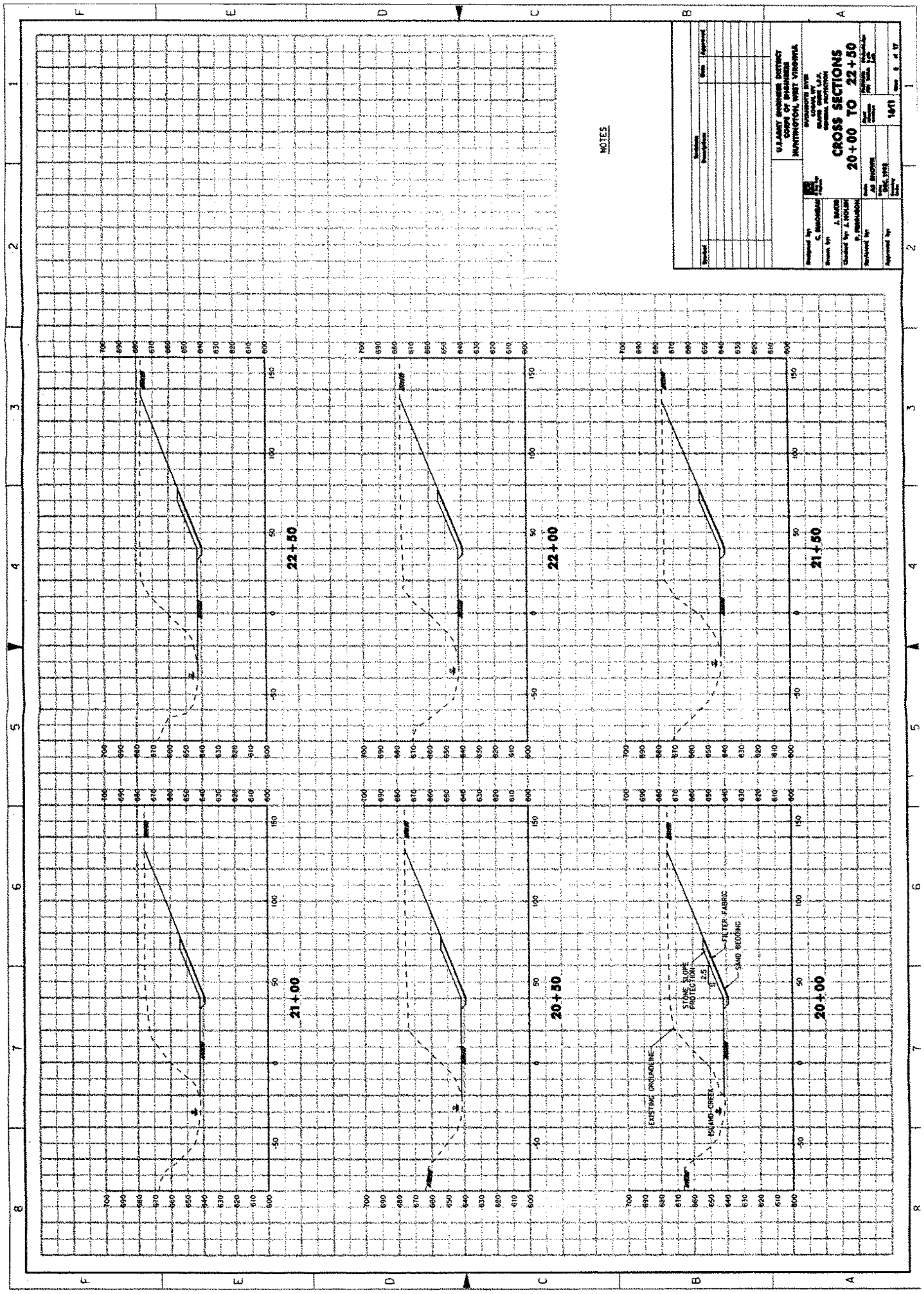

NOTES
1. CROSS SECTIONS TAKEN LOOKING UPSTREAM, FROM THE RIGHT DESCENDING BANK TO THE LEFT DESCENDING BANK.
CROSS SECTIONS
5+00 TO 7+50
7+50
7+00
6+50
6+00
5+50
5+00
EXISTING AEP WALL
POST AND PANEL WALL
EXISTING BRIDGE ABUTMENT
STONE SLOPE PROTECTION
TRANSITION SLOPE
SAND BEDDING
FILTER FABRIC
EXISTING GROUNDLINE
ISLAND CREEK

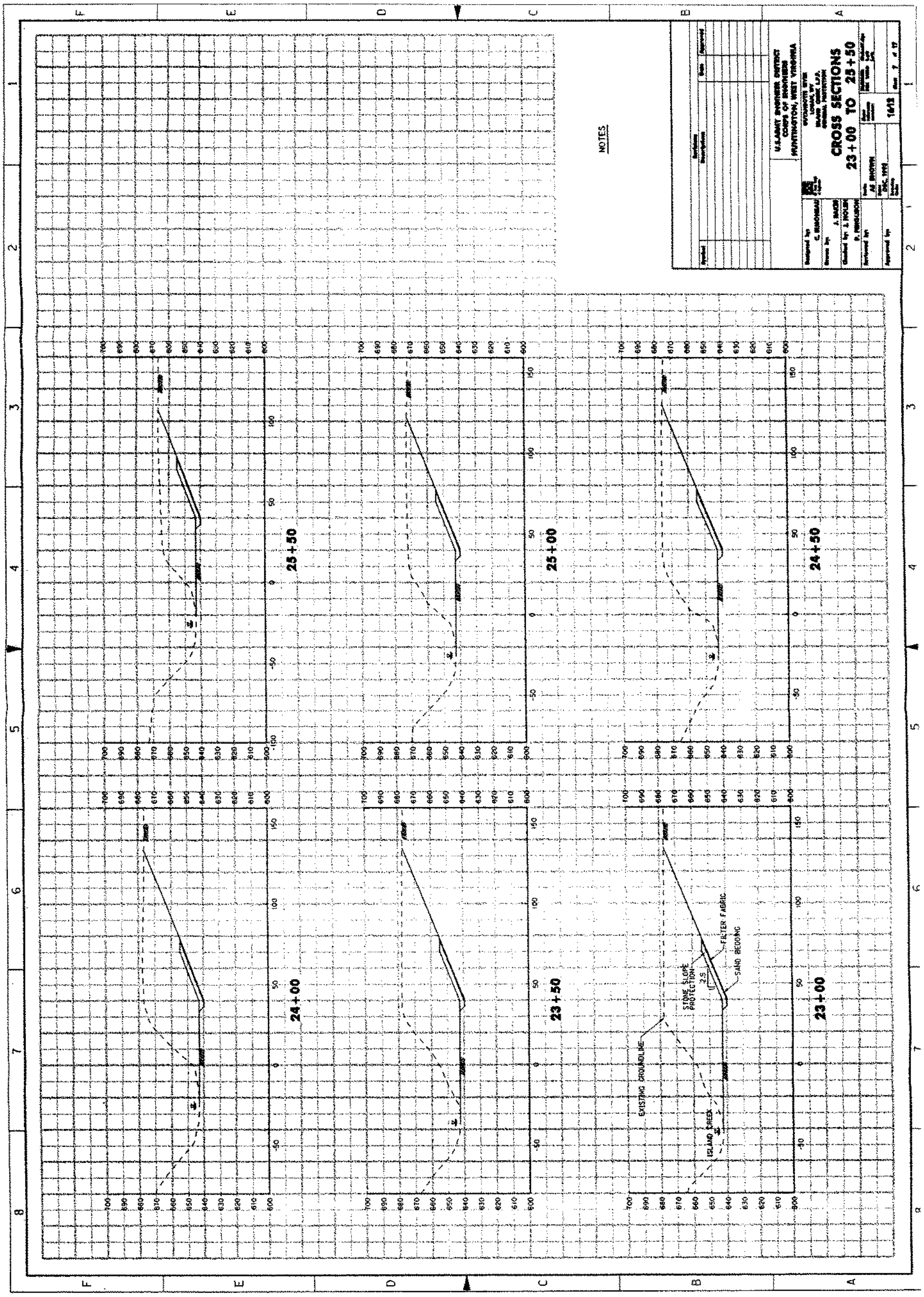

NOTES
CROSS SECTIONS
8+00 TO 10+50
10+50
10+00
9+50
9+00
8+50
8+00
AEP BRIDGE
EXISTING GROUNDLINE
POST AND PANEL WALL
ISLAND CREEK
AMERICAN ELECTRIC POWER SUBSTATION

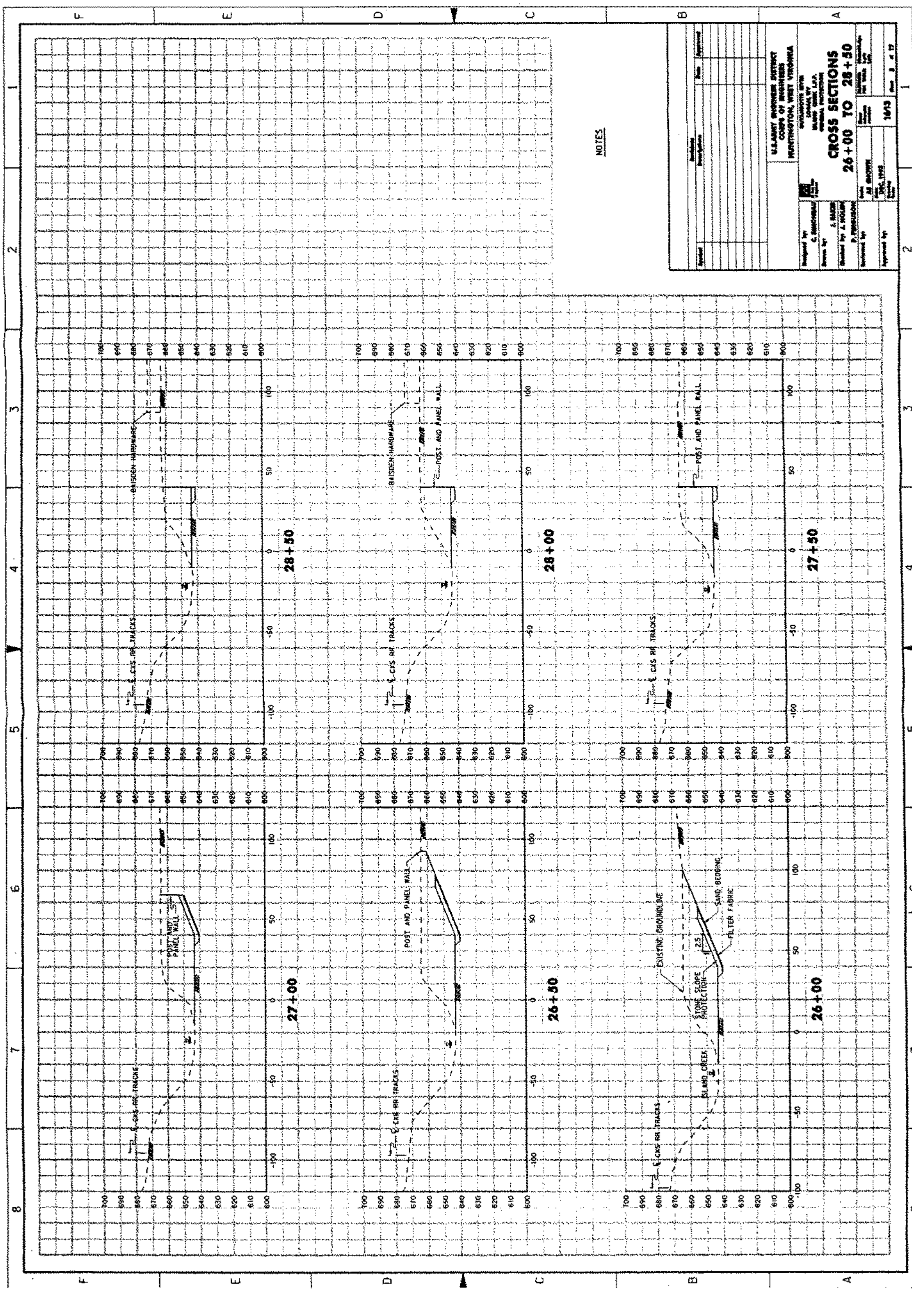

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
CROSS SECTIONS
11+00 TO 13+50
NOTES
13+50
13+00
12+50
12+00
11+50
11+00
ANDERSON WHOLESALE
MARATHON OIL
AEP
EXISTING GROUNDLINE
POST AND PANEL WALL
ISLAND CREEK

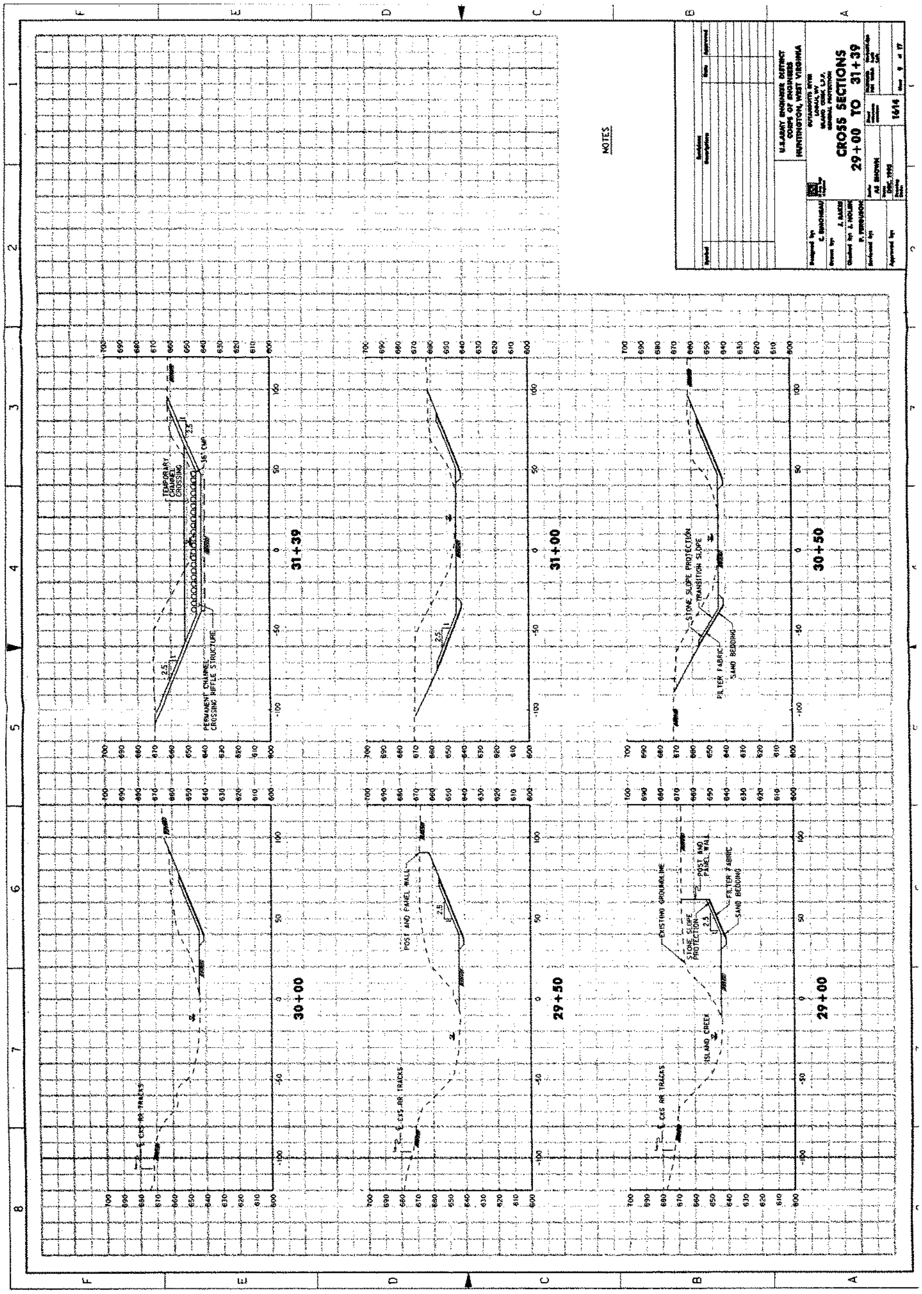

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
CROSS SECTIONS
14+00 TO 16+50
NOTES
16+50
16+00
15+50
15+00
14+50
14+00
LOGAN CONCRETE
POST AND PANEL WALL
SAND BEDDING
FILTER FABRIC
STONE SLOPE PROTECTION
S.R.10 BRIDGE
EXISTING GROUNDLINE
ISLAND CREEK
ANDERSON WHOLESALE
MARATHON OIL

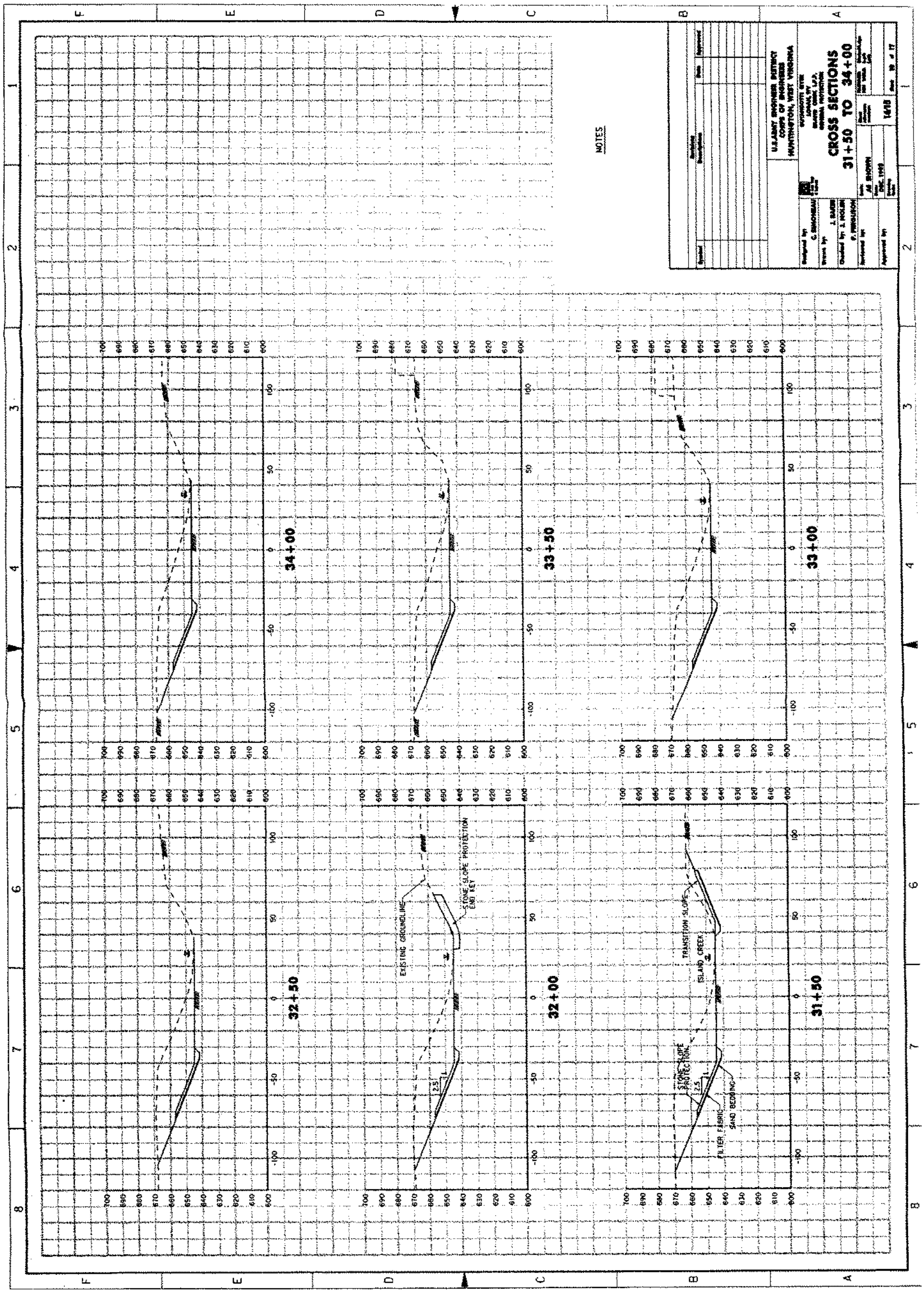

NOTES
CROSS SECTIONS
17+00 TO 19+50
19+50
19+00
18+50
18+00
17+57.4
17+00
SUPER 8 MOTEL
EXISTING GROUNDLINE
STONE SLOPE PROTECTION
FILTER FABRIC
SAND BEDDING
ISLAND CREEK

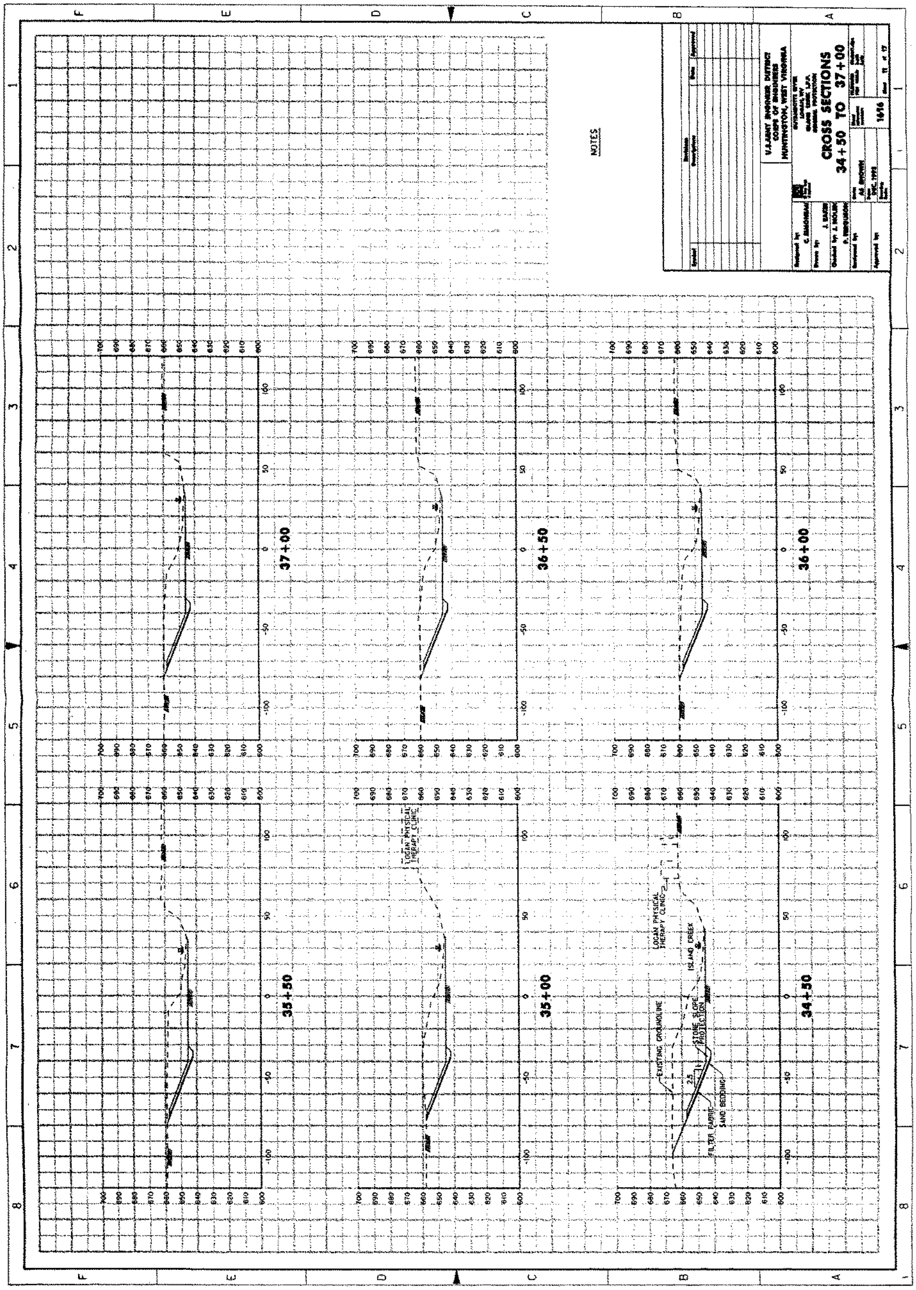

21+00
22+50
20+50
22+00
20+00
21+50
EXISTING GROUNDLINE
STONE SLOPE PROTECTION
2.5
1
FILTER FABRIC
SAND BEDDING
ISLAND CREEK
NOTES
U.S.ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
CROSS SECTIONS
20+00 TO 22+50
AS SHOWN
DEC. 1992

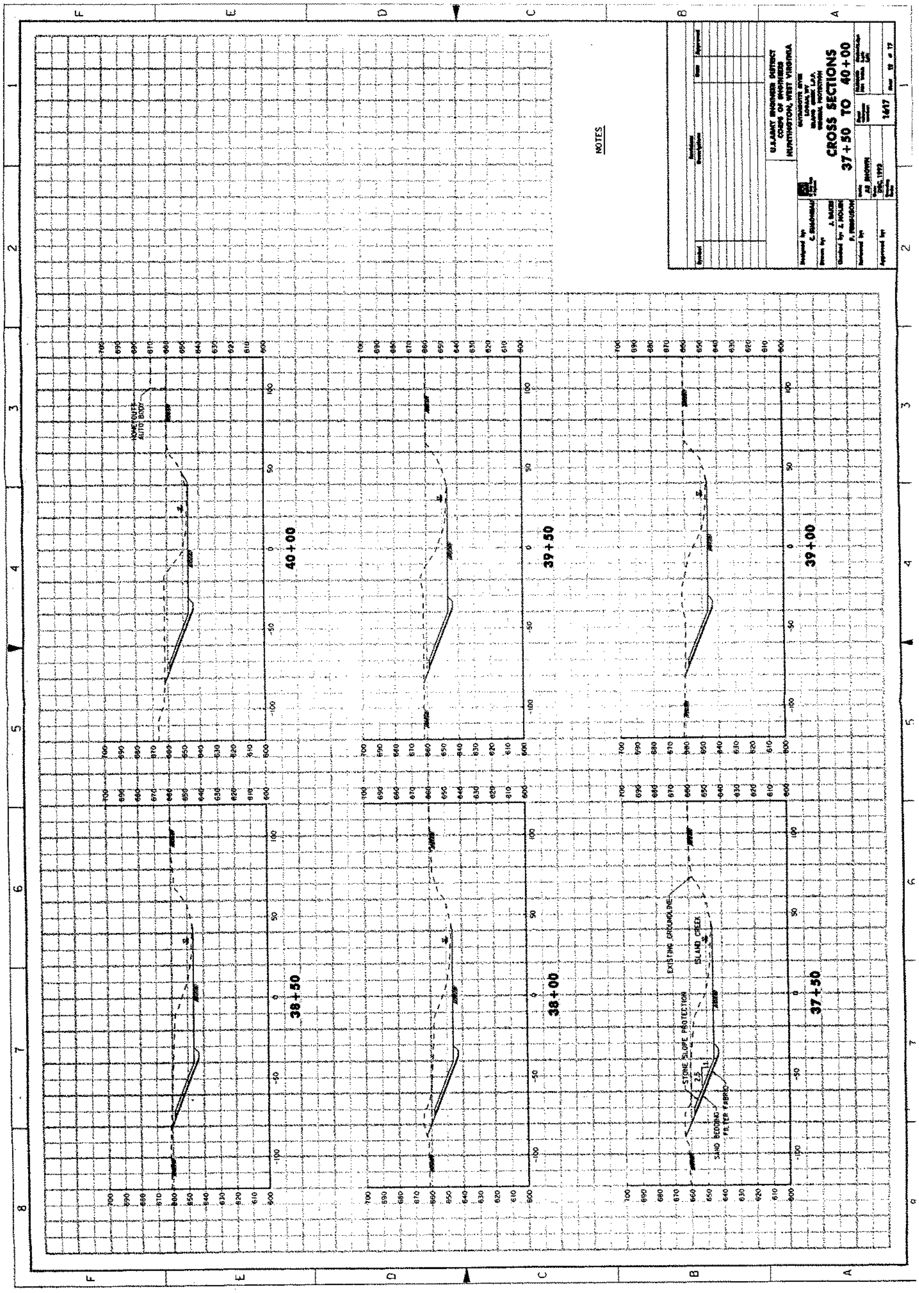

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
CROSS SECTIONS
23+00 TO 25+50
NOTES
25+50
25+00
24+50
24+00
23+50
23+00
EXISTING GROUNDLINE
STONE SLOPE PROTECTION
FILTER FABRIC
SAND BEDDING
ISLAND CREEK

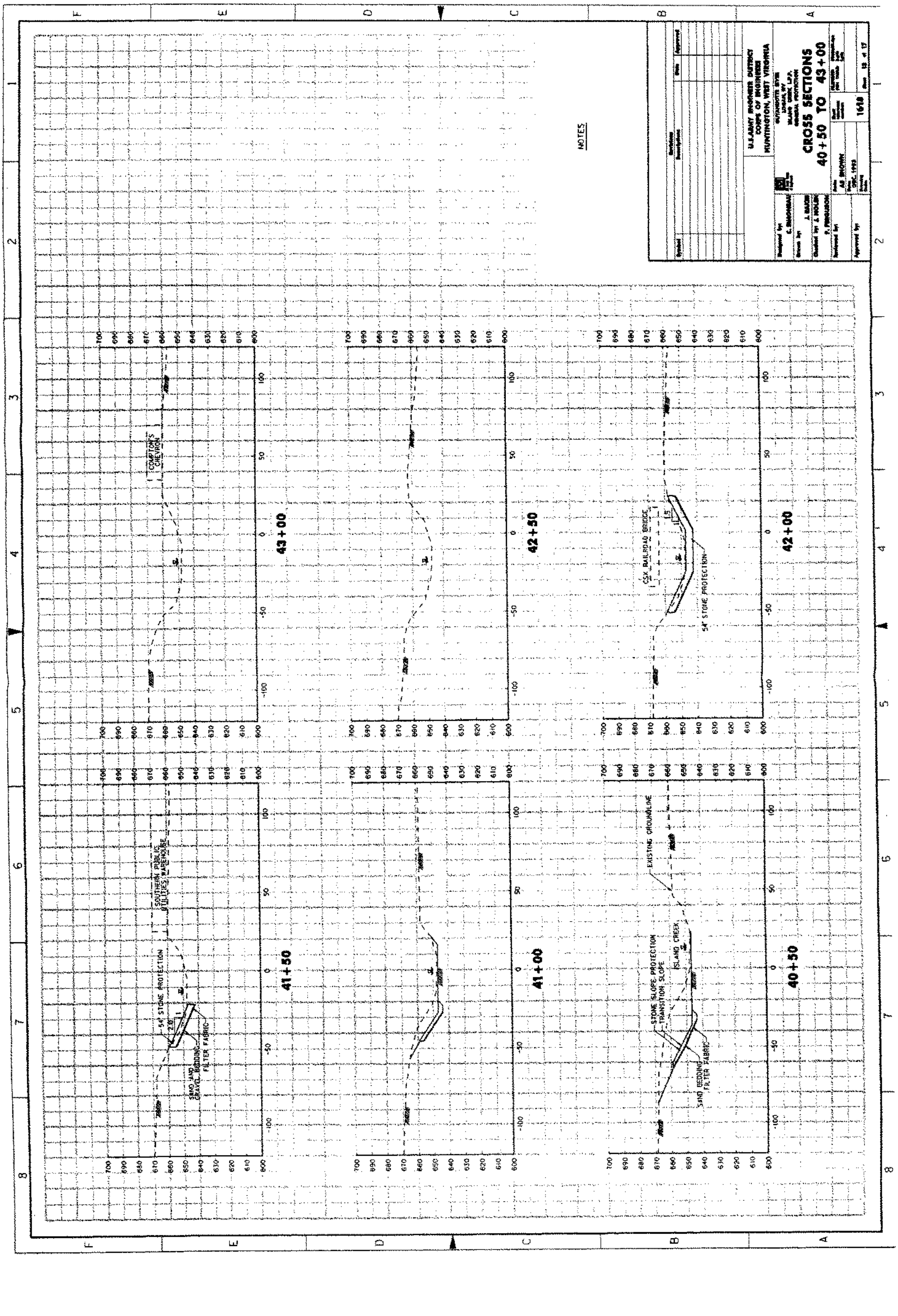

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
CROSS SECTIONS
26+00 TO 28+50
NOTES
28+50
28+00
27+50
27+00
26+50
26+00
POST AND PANEL WALL
EXISTING GROUNDLINE
SAND BEDDING
FILTER FABRIC
STONE SLOPE PROTECTION

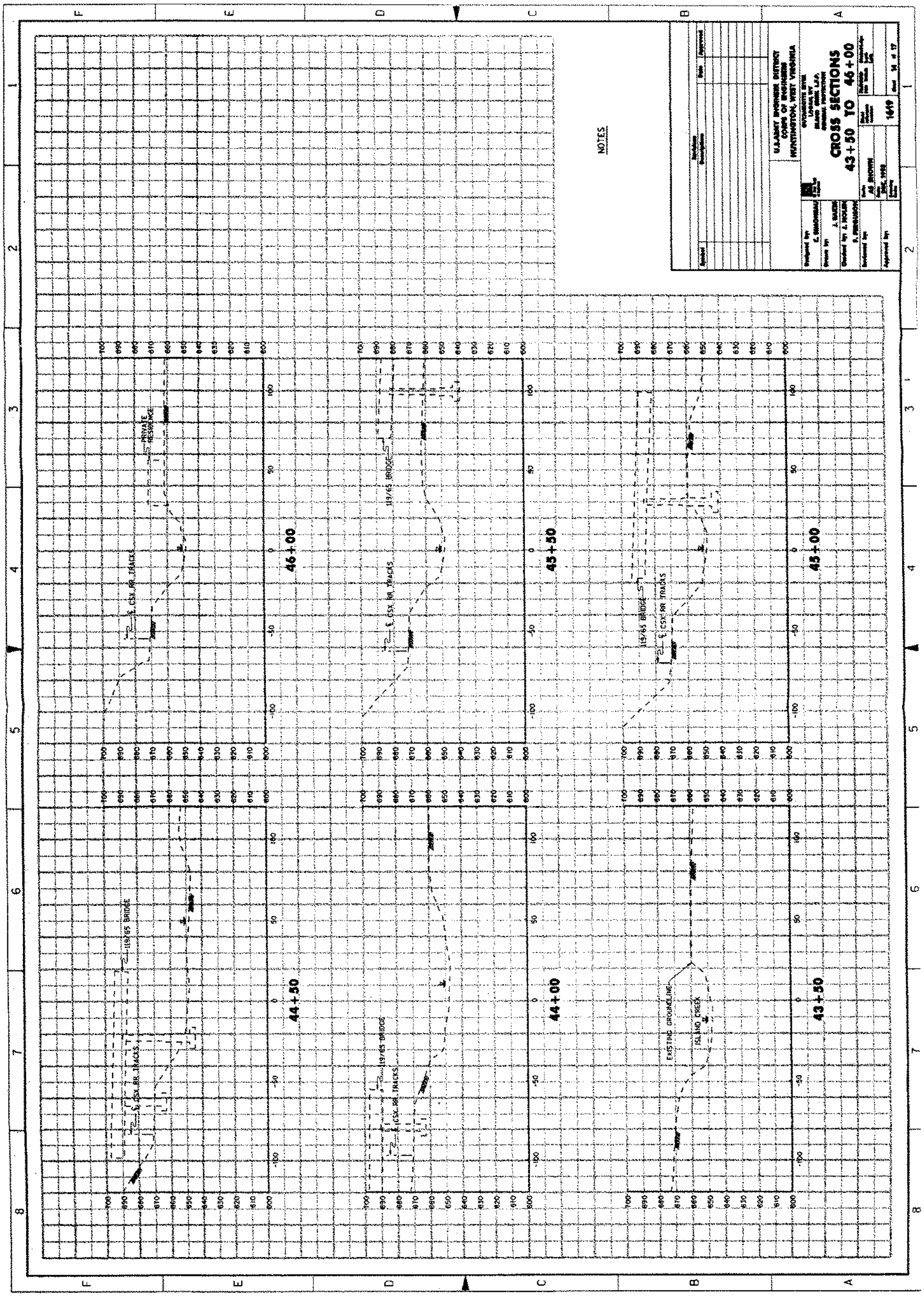

NOTES
CROSS SECTIONS
29+00 TO 31+39
31+39
31+00
30+50
30+00
29+50
29+00
TEMPORARY CHANNEL CROSSING
PERMANENT CHANNEL CROSSING RIFFLE STRUCTURE
STONE SLOPE PROTECTION
TRANSITION SLOPE
FILTER FABRIC
SAND BEDDING
POST AND PANEL WALL
EXISTING GROUNDLINE
ISLAND CREEK

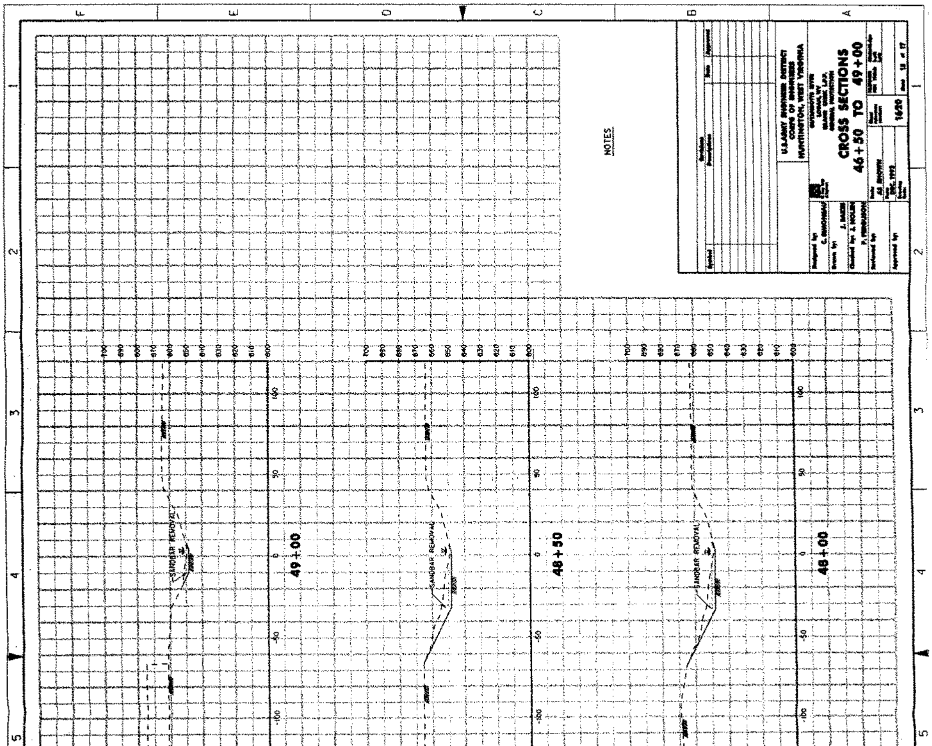

NOTES
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
CROSS SECTIONS
31+50 TO 34+00
34+00
33+50
33+00
32+50
32+00
31+50
EXISTING GROUNDLINE
STONE SLOPE PROTECTION END KEY
TRANSITION SLOPE
ISLAND CREEK
STONE SLOPE PROTECTION
FILTER FABRIC
SAND BEDDING

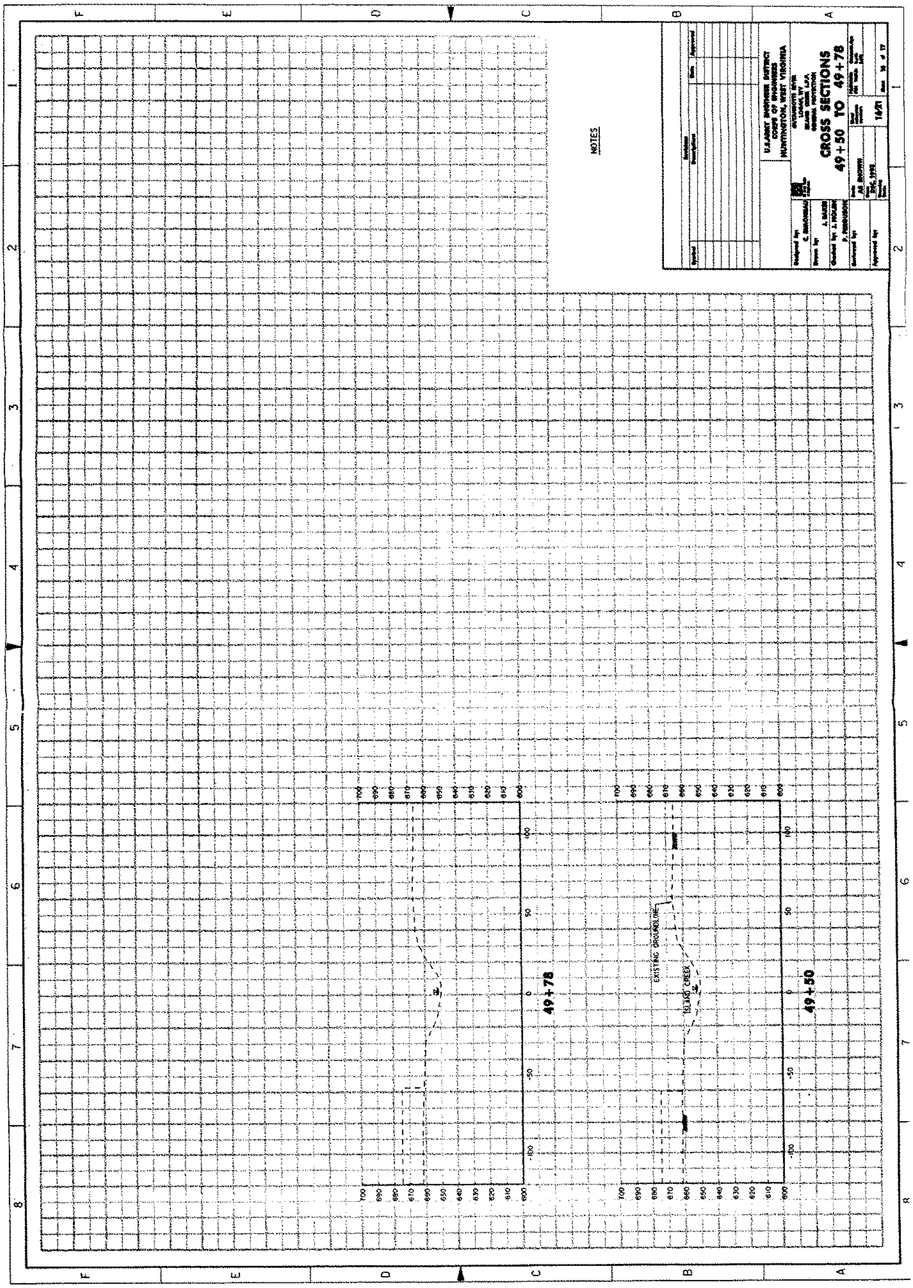

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
CROSS SECTIONS
34+50 TO 37+00
NOTES
37+00
36+50
36+00
35+50
35+00
34+50
LOGAN PHYSICAL THERAPY CLINIC
ISLAND CREEK
EXISTING GROUNDLINE
STONE SLOPE PROTECTION
FILTER FABRIC
SAND BEDDING

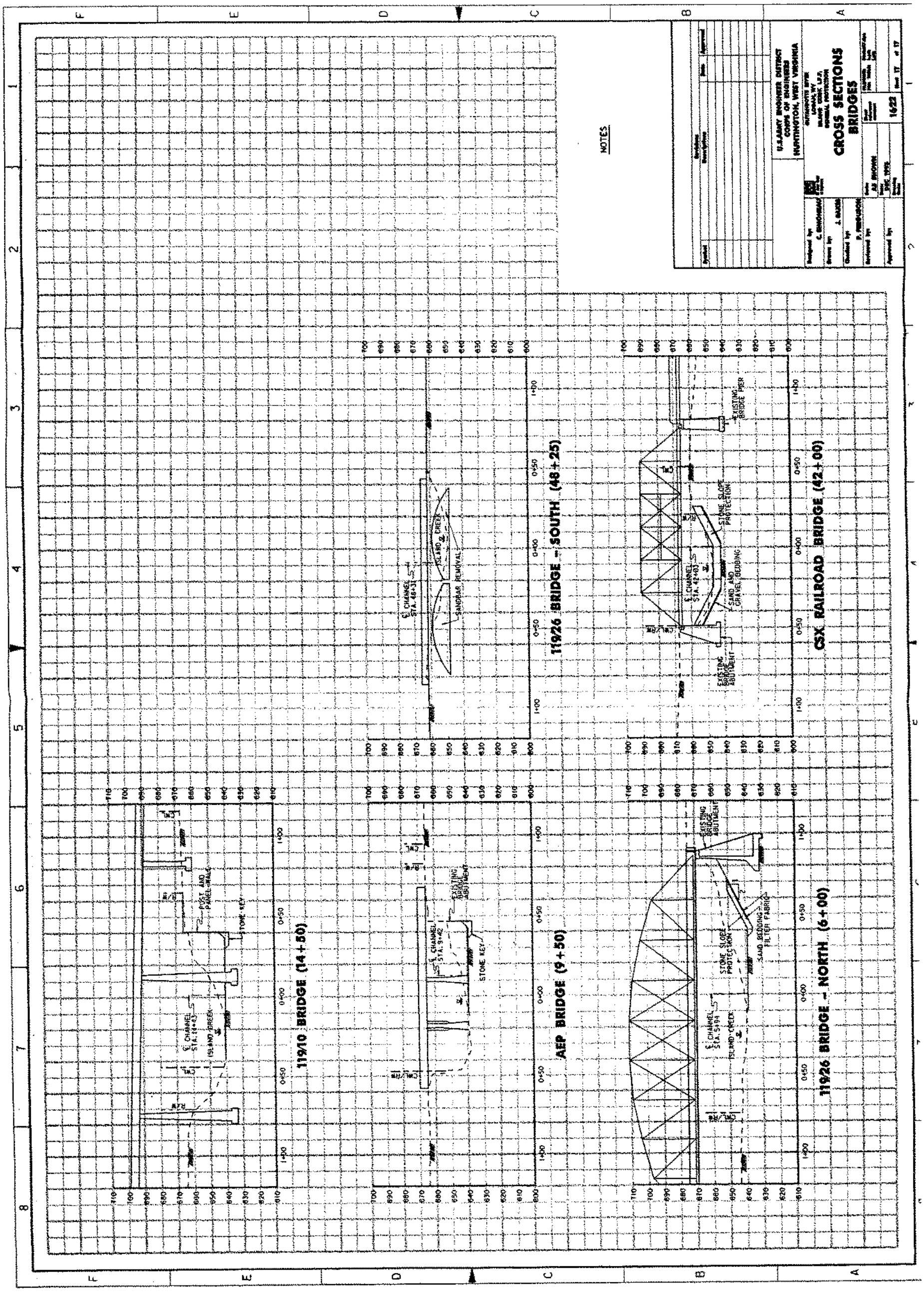

NOTES
U.S.ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
CROSS SECTIONS
37+50 TO 40+00
40+00
39+50
39+00
38+50
38+00
37+50
HOMETOUTT AUTO BODY
EXISTING GROUNDLINE
ISLAND CREEK
STONE SLOPE PROTECTION
SAND BEDDING
FILTER FABRIC

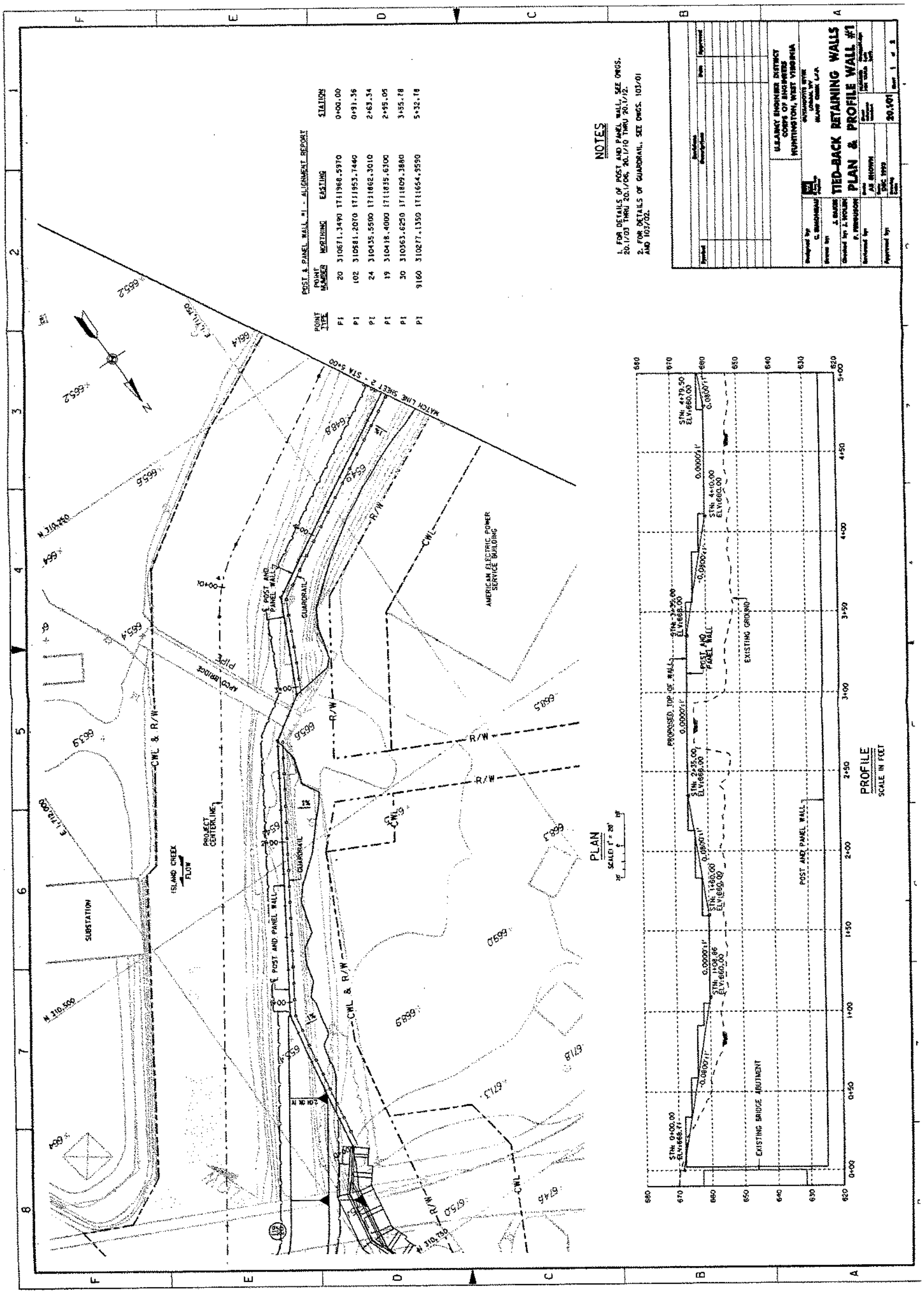

NOTES
U.S.ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
CROSS SECTIONS
40+50 TO 43+00
43+00
COMPTON'S CHEVRON
42+50
42+00
CSX RAILROAD BRIDGE
54' STONE PROTECTION
41+50
SOUTHERN PUBLIC UTILITIES WAREHOUSE
SAND AND GRAVEL BEDDING
FILTER FABRIC
41+00
40+50
EXISTING GROUNDLINE
ISLAND CREEK
STONE SLOPE PROTECTION
TRANSITION SLOPE
SAND BEDDING
FILTER FABRIC

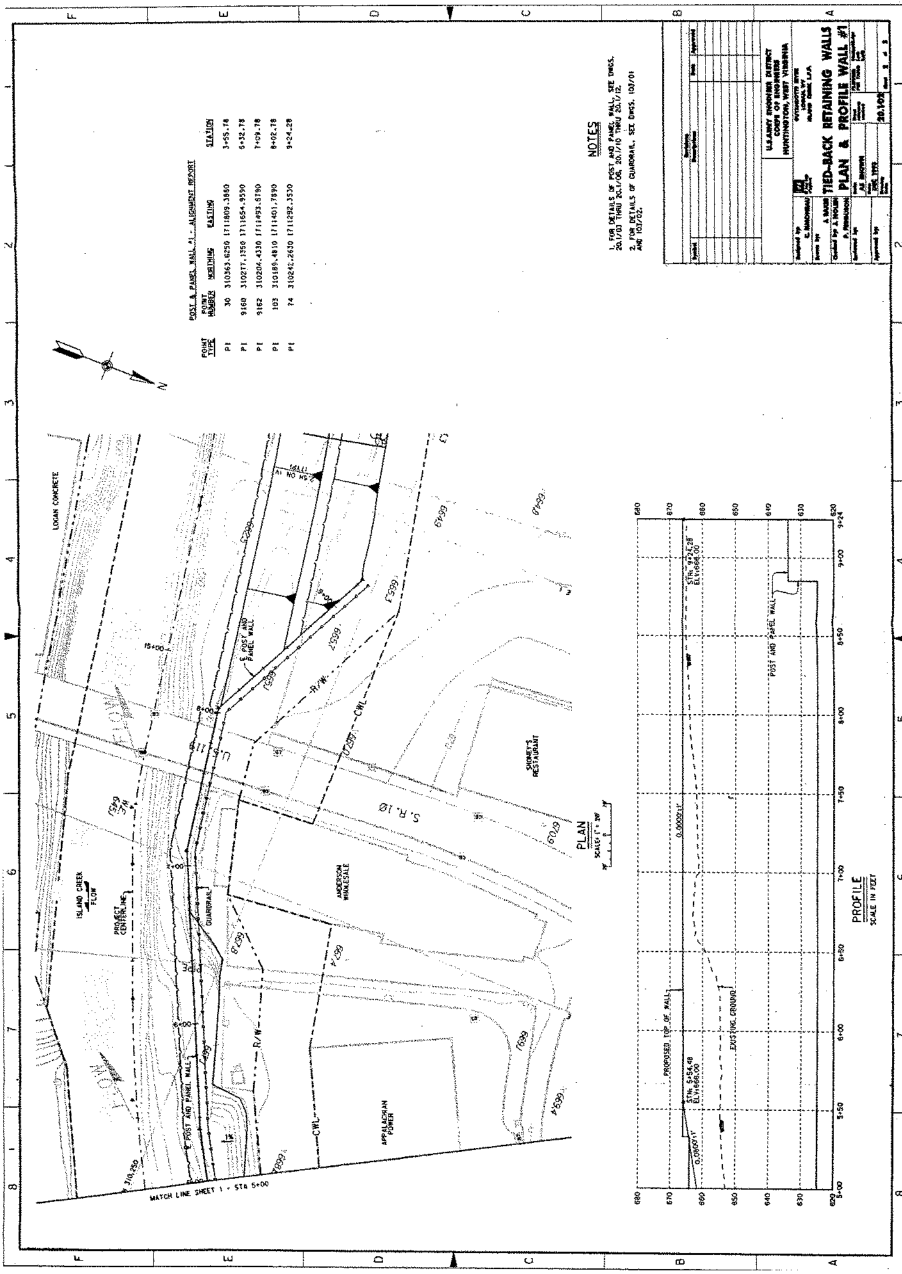

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
CROSS SECTIONS
43+50 TO 46+00
NOTES
46+00
45+50
45+00
44+50
44+00
43+50
CSX RR TRACKS
PRIVATE RESIDENCE
11/65 BRIDGE
EXISTING GROUNDLINE
ISLAND CREEK

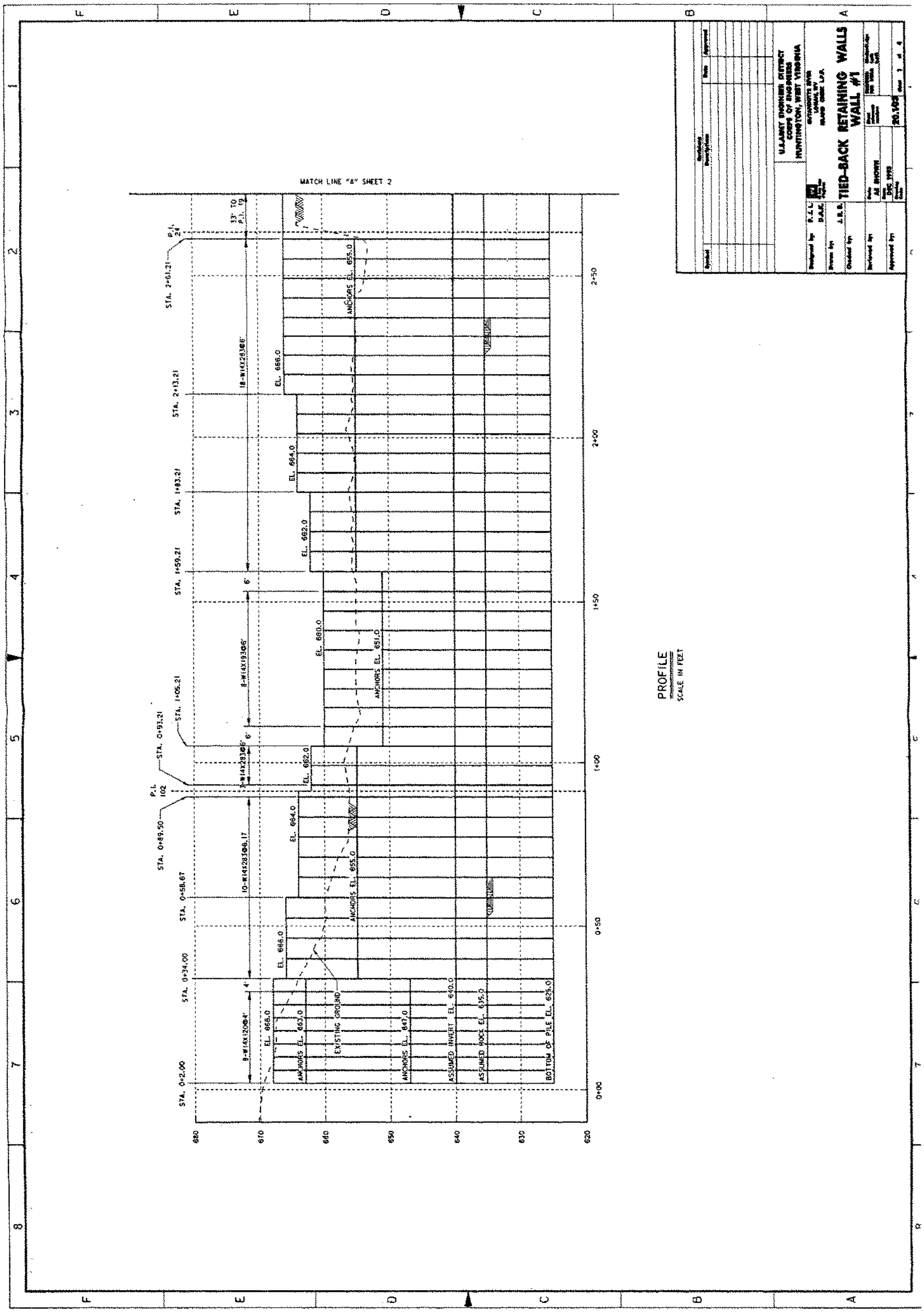

NOTES
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
CROSS SECTIONS
46+50 TO 49+00
1620
49+00
48+50
48+00
47+50
47+00
46+50
SANDBAR REMOVAL
PRIVATE RESIDENCE
CSX RR TRACKS
EXISTING GROUNDLINE
ISLAND CREEK

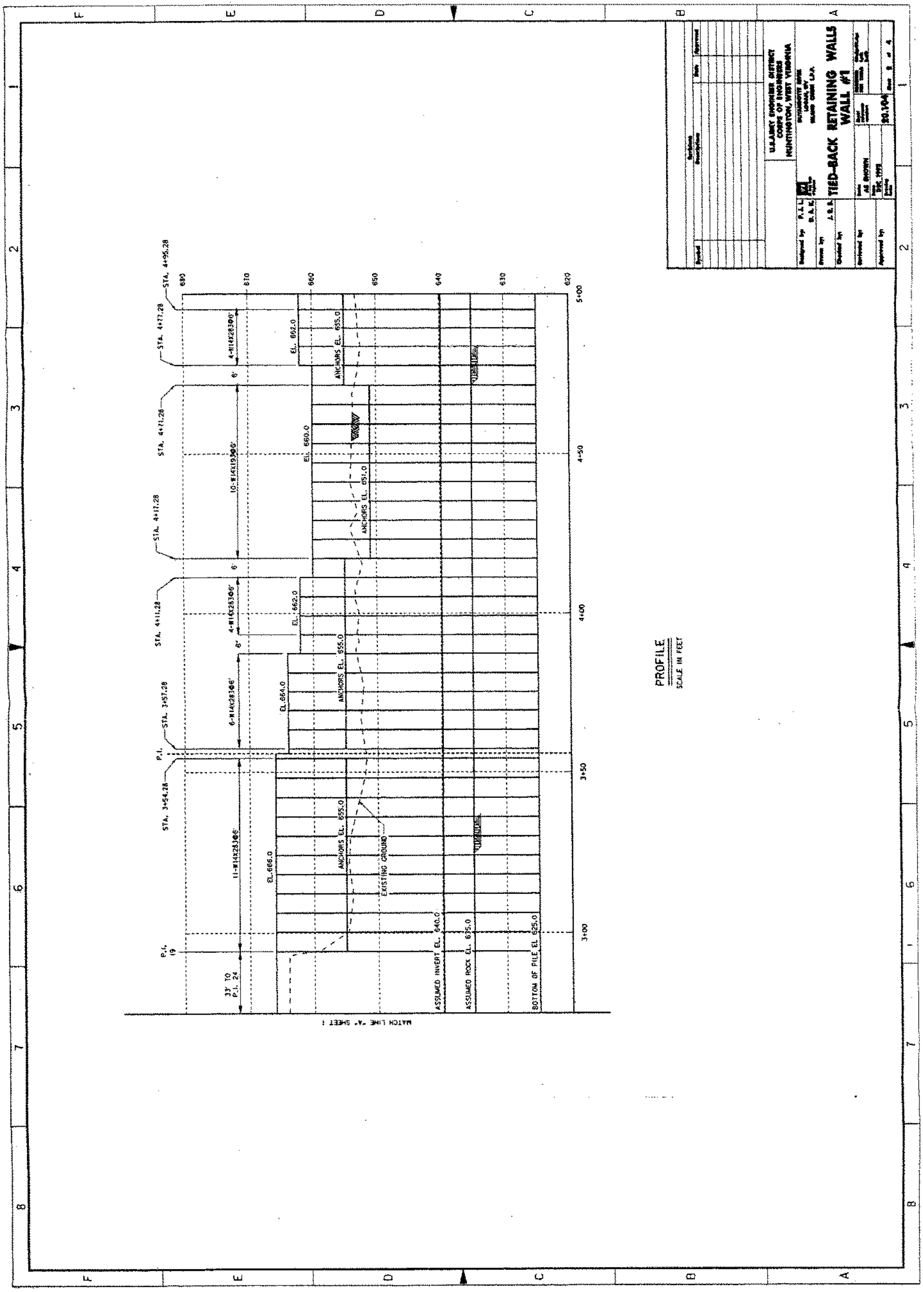

NOTES
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
CROSS SECTIONS
49+50 TO 49+78
49+78
49+50
EXISTING GROUNDLINE
ISLAND CREEK

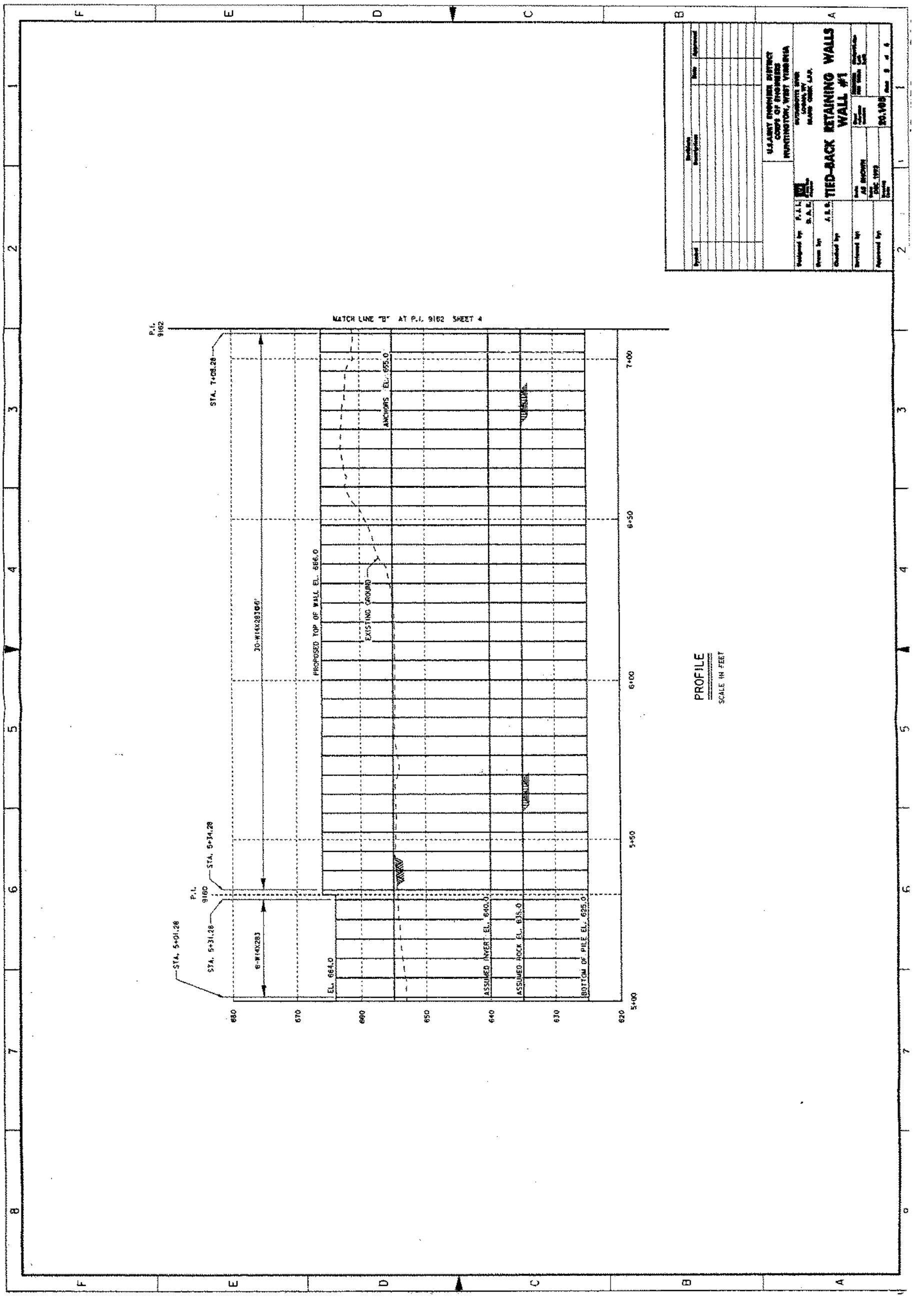

NOTES
CROSS SECTIONS
BRIDGES
119/26 BRIDGE - SOUTH (48+25)
CSX RAILROAD BRIDGE (42+00)
119/10 BRIDGE (14+50)
AEP BRIDGE (9+50)
119/26 BRIDGE - NORTH (6+00)

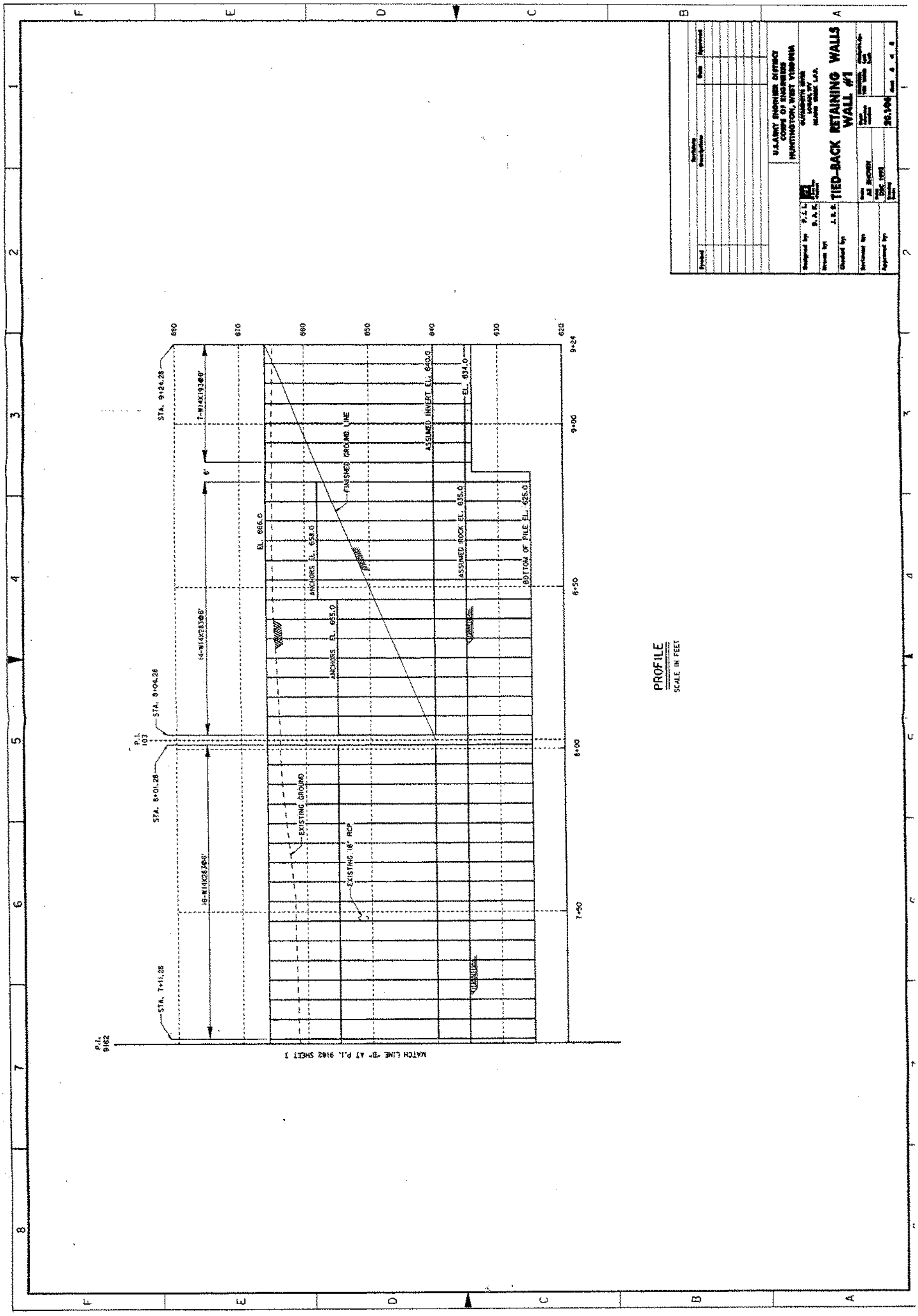

POST & PANEL WALL #1 - ALIGNMENT REPORT
POINT TYPE | POINT NUMBER | NORTHING | EASTING | STATION
PI | 20 | 310671.3490 | 1711968.5970 | 0+00.00
PI | 102 | 310581.2070 | 1711953.7440 | 0+93.36
PI | 24 | 310435.5500 | 1711862.3010 | 2+63.34
PI | 19 | 310418.4000 | 1711839.6300 | 2+95.05
PI | 30 | 310363.6250 | 1711809.3880 | 3+55.78
PI | 9160 | 310277.1350 | 1711654.5550 | 5+32.18
NOTES
1. FOR DETAILS OF POST AND PANEL WALL, SEE DWGS. 20.1/03 THRU 20.1/06, 20.1/10 THRU 20.1/12.
2. FOR DETAILS OF GUARDRAIL, SEE DWGS. 103/01 AND 103/02.
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
TIED-BACK RETAINING WALLS
PLAN & PROFILE WALL #1
20.1/01
MATCH LINE SHEET 2 - STA 5+00
AMERICAN ELECTRIC POWER SERVICE BUILDING
POST AND PANEL WALL
GUARDRAIL
CWL & R/W
PROJECT CENTERLINE
ISLAND CREEK FLOW
SUBSTATION
APCO BRIDGE
PIPE
PLAN
PROFILE
SCALE IN FEET
PROPOSED TOP OF WALL
EXISTING GROUND
EXISTING BRIDGE ABUTMENT
STN: 0+00.00 ELV:668.21
STN: 1+08.86 ELV:660.00
STN: 1+60.00 ELV:660.00
STN: 2+35.00 ELV:666.00
STN: 3+35.00 ELV:666.00
STN: 4+10.00 ELV:660.00
STN: 4+79.50 ELV:660.00

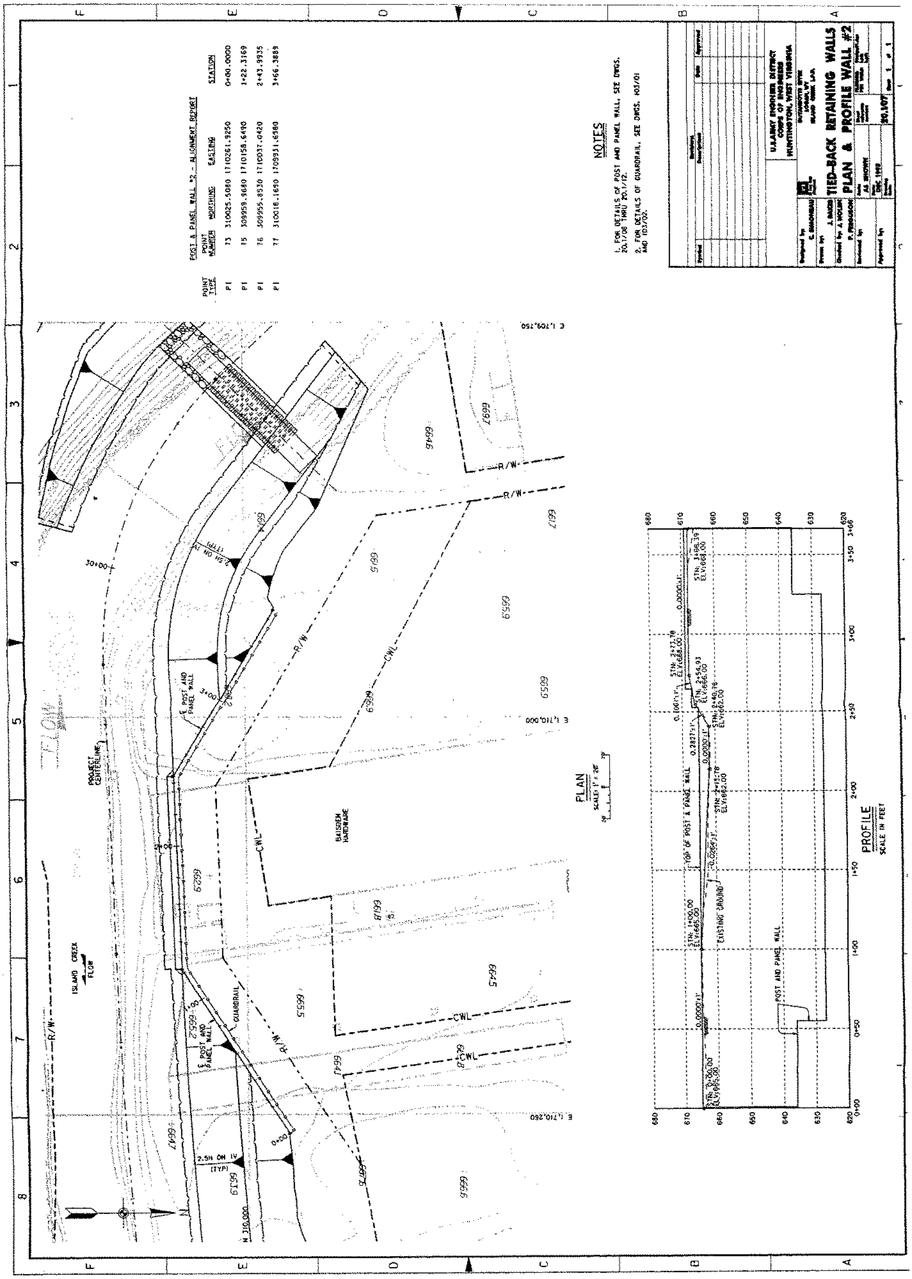

LOGAN CONCRETE
ISLAND CREEK FLOW
PROJECT CENTERLINE
℄ POST AND PANEL WALL
GUARDRAIL
MATCH LINE SHEET 1 - STA 5+00
R/W
CWL
APPALACHIAN POWER
ANDERSON WHOLESALE
S.R. 10
SHONEY'S RESTAURANT
℄ POST AND PANEL WALL
N
POST & PANEL WALL #1 - ALIGNMENT REPORT
POINT TYPE | POINT NUMBER | NORTHING | EASTING | STATION
PI | 30 | 310363.6250 | 1711809.3860 | 3+55.78
PI | 9160 | 310277.1350 | 1711654.9590 | 6+32.78
PI | 9162 | 310204.4330 | 1711493.6790 | 7+09.78
PI | 103 | 310189.4810 | 1711401.7890 | 8+02.78
PI | 74 | 310242.2630 | 1711292.3530 | 9+24.28
PLAN
SCALE: 1" = 20'
NOTES
1. FOR DETAILS OF POST AND PANEL WALL, SEE DWGS. 20.1/03 THRU 20.1/06, 20.1/10 THRU 20.1/12.
2. FOR DETAILS OF GUARDRAIL, SEE DWGS. 103/01 AND 103/02.
PROPOSED TOP OF WALL
0.0800'±1'
STA: 5+54.48 ELV: 666.00
0.0000'±1'
STA: 9+24.28 ELV: 666.00
EXISTING GROUND
POST AND PANEL WALL
PROFILE
SCALE IN FEET
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
TIED-BACK RETAINING WALLS
PLAN & PROFILE WALL #1
AS SHOWN
20.102

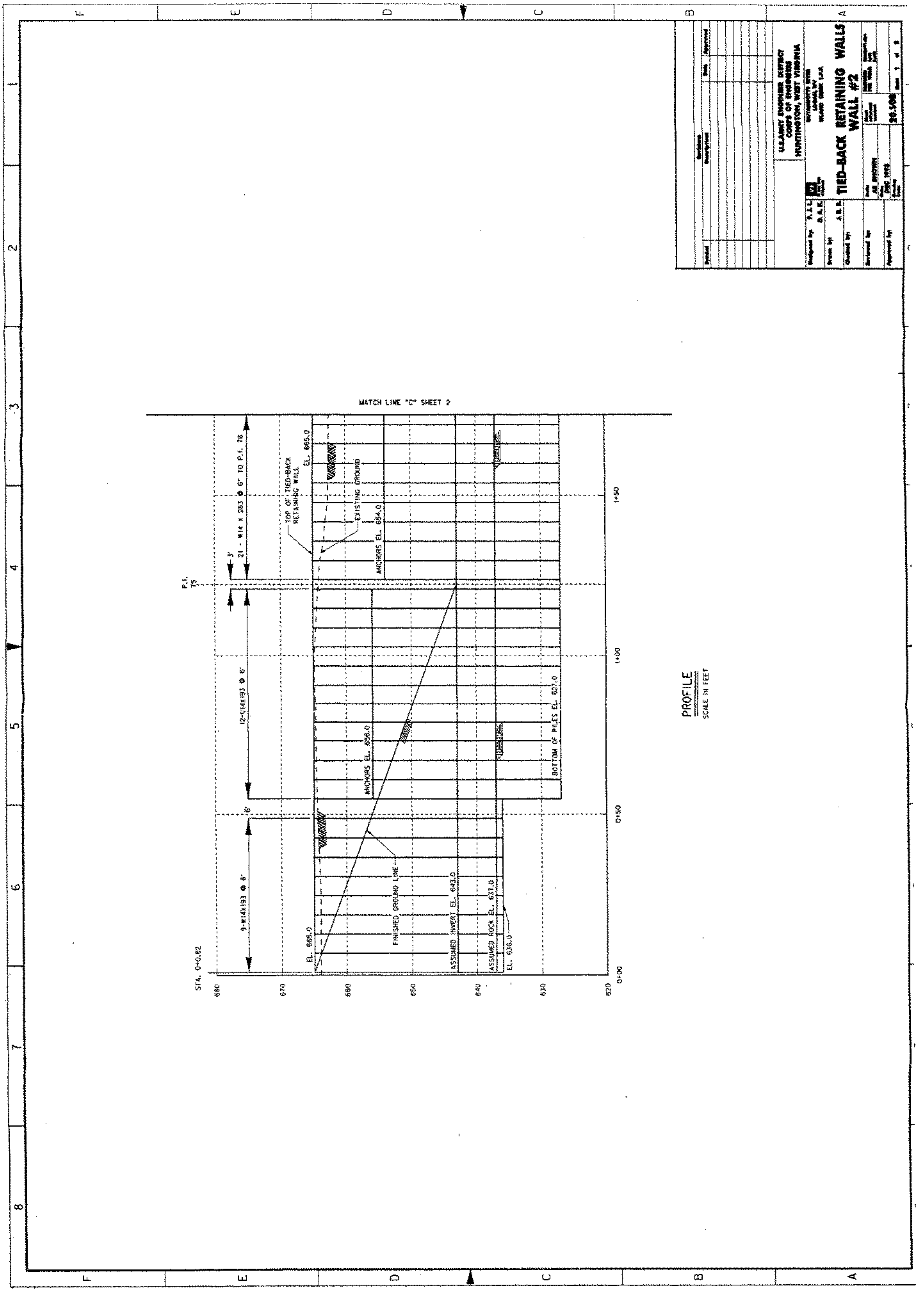

MATCH LINE "A" SHEET 2
PROFILE
SCALE IN FEET
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
TIED-BACK RETAINING WALLS
WALL #1
EXISTING GROUND
BOTTOM OF PILE EL. 625.0
ASSUMED ROCK EL. 635.0
ASSUMED INVERT EL. 640.0

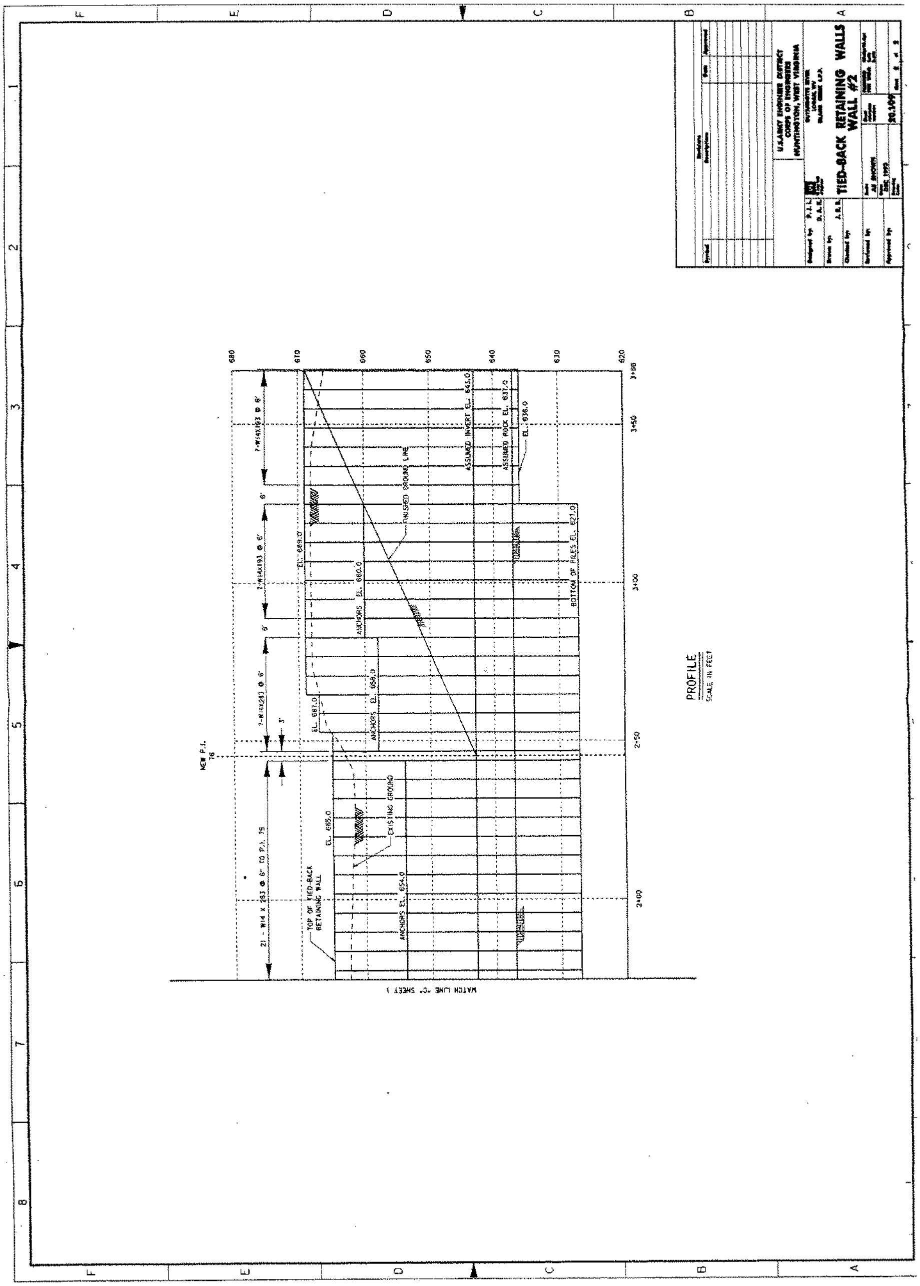

PROFILE
SCALE IN FEET
TIED-BACK RETAINING WALLS
WALL #1
EXISTING GROUND
ASSUMED INVERT EL. 640.0
ASSUMED ROCK EL. 635.0
BOTTOM OF PILE EL. 625.0
MATCH LINE "A" SHEET 1

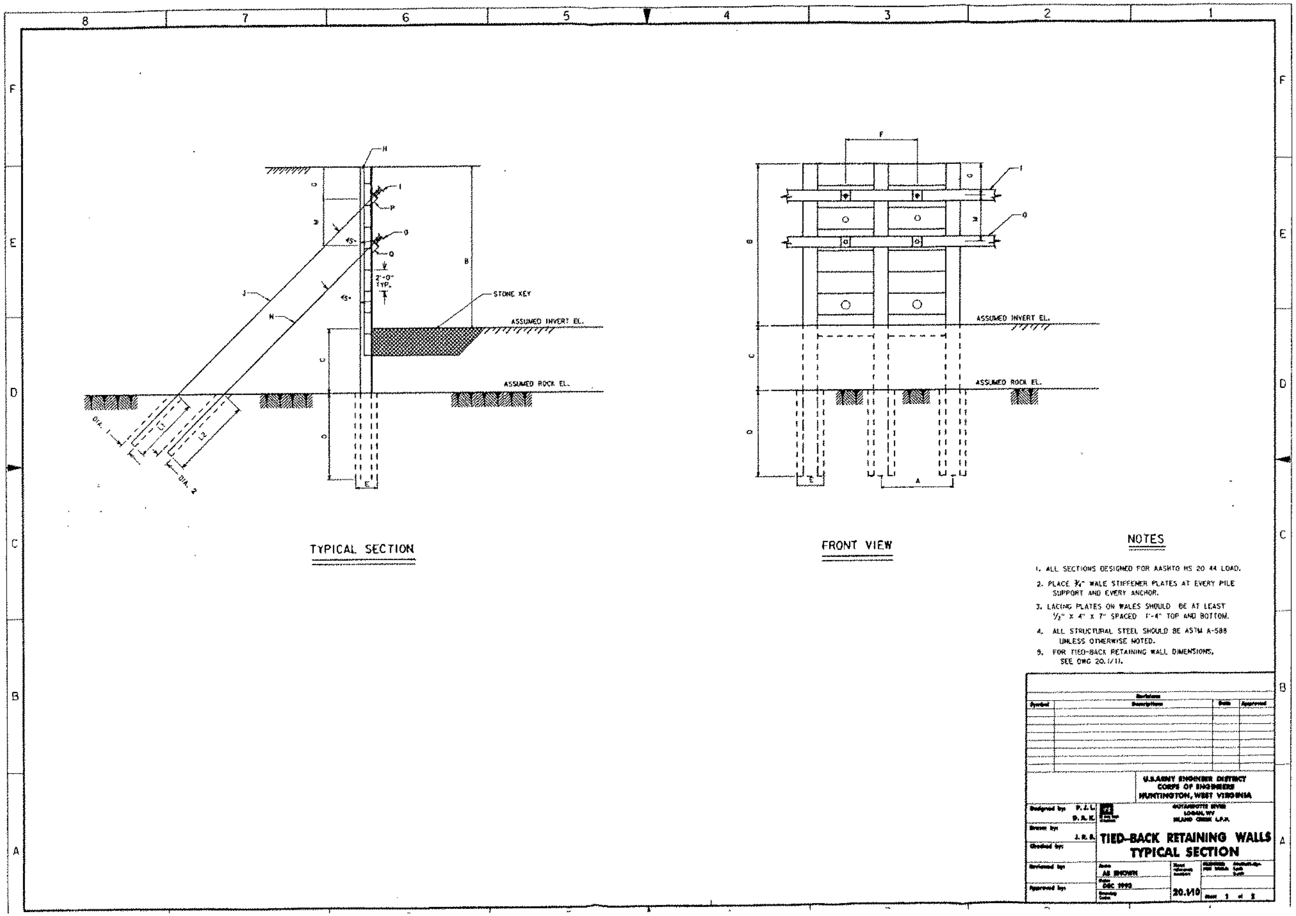

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
TIED-BACK RETAINING WALLS
WALL #1
MATCH LINE "B" AT P.I. 9162 SHEET 4
PROPOSED TOP OF WALL EL. 666.0
EXISTING GROUND
ANCHORS EL. 655.0
ASSUMED INVERT EL. 640.0
ASSUMED ROCK EL. 635.0
BOTTOM OF PILE EL. 625.0
PROFILE
SCALE IN FEET


PROFILE
SCALE IN FEET
TIED-BACK RETAINING WALLS
WALL #1
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
FINISHED GROUND LINE
EXISTING GROUND
EXISTING 18" RCP
ASSUMED INVERT EL. 640.0
ASSUMED ROCK EL. 635.0
BOTTOM OF PILE EL. 625.0
ANCHORS EL. 658.0
ANCHORS EL. 655.0
EL. 666.0
EL. 634.0
STA. 9+24.28
STA. 8+04.28
STA. 8+01.28
STA. 7+11.28
7-W14X193@6'
14-W14X283@6'
16-W14X283@6'
MATCH LINE "B" AT P.I. 9162 SHEET 3


POST & PANEL WALL #2 - ALIGNMENT REPORT
POINT TYPE | POINT NUMBER | NORTHING | EASTING | STATION
PI 73 310025.5080 1710261.9250 0+00.0000
PI 75 309959.9680 1710158.6490 1+22.3169
PI 76 309955.8530 1710037.0420 2+43.9935
PI 77 310016.1690 1709931.6980 3+66.3889
NOTES
1. FOR DETAILS OF POST AND PANEL WALL, SEE DWGS. 20.1/08 THRU 20.1/12.
2. FOR DETAILS OF GUARDRAIL, SEE DWGS. 103/01 AND 103/02.
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
TIED-BACK RETAINING WALLS
PLAN & PROFILE WALL #2
ISLAND CREEK
FLOW
PROJECT CENTERLINE
POST AND PANEL WALL
GUARDRAIL
R/W
CWL
BAISDEN HARDWARE
2.5H ON 1V (TYP)
PLAN
EXISTING GROUND
TOP OF POST & PANEL WALL
PROFILE
SCALE IN FEET


MATCH LINE "C" SHEET 2
TOP OF TIED-BACK RETAINING WALL
EXISTING GROUND
EL. 665.0
ANCHORS EL. 654.0
12-W14X193 @ 6'
9-W14X193 @ 6'
ANCHORS EL. 656.0
FINISHED GROUND LINE
ASSUMED INVERT EL. 643.0
ASSUMED ROCK EL. 637.0
EL. 636.0
BOTTOM OF PILES EL. 627.0
STA. 0+0.82
PROFILE
SCALE IN FEET
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
TIED-BACK RETAINING WALLS
WALL #2


TIED-BACK RETAINING WALLS
WALL #2
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
PROFILE
SCALE IN FEET
TOP OF TIED-BACK RETAINING WALL
EXISTING GROUND
FINISHED GROUND LINE
ANCHORS EL. 660.0
ANCHORS EL. 658.0
ANCHORS EL. 654.0
EL. 669.0
EL. 667.0
EL. 665.0
ASSUMED INVERT EL. 643.0
ASSUMED ROCK EL. 637.0
EL. 636.0
BOTTOM OF PILES EL. 627.0
7-W14X193 @ 8'
7-W14X193 @ 6'
7-W14X283 @ 6'
21 - W14 x 283 @ 6' TO P.I. 75
NEW P.I. 76
MATCH LINE "C" SHEET 1
2+00
2+50
3+00
3+50
3+88


TYPICAL SECTION
STONE KEY
ASSUMED INVERT EL.
ASSUMED ROCK EL.
2'-0" TYP.
45°
DIA. 1
DIA. 2
FRONT VIEW
NOTES
1. ALL SECTIONS DESIGNED FOR AASHTO HS 20 44 LOAD.
2. PLACE 3/4" WALE STIFFENER PLATES AT EVERY PILE SUPPORT AND EVERY ANCHOR.
3. LACING PLATES ON WALES SHOULD BE AT LEAST 1/2" x 4" x 7" SPACED 1'-4" TOP AND BOTTOM.
4. ALL STRUCTURAL STEEL SHOULD BE ASTM A-588 UNLESS OTHERWISE NOTED.
5. FOR TIED-BACK RETAINING WALL DIMENSIONS, SEE DWG 20.1/11.
U.S.ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
TIED-BACK RETAINING WALLS
TYPICAL SECTION
AS SHOWN
DEC 1993
20.1/10

WALL #1

STATIONING	WALL SECTIONS
STA. 0+2.00 TO 0+34.00	32 FT.
STA. 0+34.00 TO 0+89.50	26 FT.
STA. 0+93.21 TO 1+05.21	26 FT.
STA. 1+05.21 TO 1+59.21	20 FT.
STA. 1+59.21 TO 2+61.21	26 FT.
STA. 2+94.28 TO 3+54.28	26 FT.
STA. 3+57.28 TO 4+11.28	26 FT.
STA. 4+11.28 TO 4+71.28	20 FT.
STA. 4+71.28 TO 5+31.28	26 FT.
STA. 5+34.28 TO 7+08.28	26 FT.
STA. 7+11.28 TO 8+01.28	26 FT.
STA. 8+04.28 TO 8+82.28	26 FT.
STA. 8+82.28 TO 9+24.28	8 FT.

WALL #2

STATIONING	WALL SECTIONS
STA. 0+0.82 TO 0+54.82	8 FT.
STA. 0+54.82 TO 1+20.82	20 FT.
STA. 1+23.82 TO 2+43.82	26 FT.
STA. 2+46.82 TO 2+82.82	26 FT.
STA. 2+82.82 TO 3+24.82	20 FT.
STA. 3+24.82 TO 3+66.82	8 FT.

TIEBACK WALL DIMENSIONS

ITEM	WALL #1 - STA. 0+00 TO STA. 9+9.28				WALL #2 - STA.0+00 TO STA. 3+66		
	8 FT SEC.	20 FT. SEC.	26 FT. SEC.	32 FT. SEC.	8 FT SEC	20 FT SEC	26 FT SEC
A	0'-0"	6'-0"	6'-0"	4'-0"	8'-0"	6'-0"	6'-0"
B ***	8'-0"	20'-0"	26'-0"	32'-0"	8'-0"	20'-0"	26'-0"
C	23'	5'-0"	5'-0"	5'-0"	24'-0"	6'-0"	6'-0"
D	1'-0"	10'-0"	10'-0"	10'-0"	1'-0"	10'-0"	10'-0"
E	2'-6" **	2'-6" **	2'-6" **	2'-6"	2'-6"	2'-6" **	2'-6" **
F	6'-0"	6'-0"	6'-0"	4'-0"	6'-0"	6'-0"	6'-0"
G	-	9'-0"	11-0"	9'-0"	-	9'-0"	11-0"
H	W14X193	W14X193	W14X283	W14X120	W14X193	W14X193	W14X283
I	-	2-MC18X42.7	2-MC18X42.7	2-MC10X22	-	2-MC18X42.7	2-MC18X42.7
J	-	1-3/4" BAR	1-3/4" BAR	1-3/8" BAR	-	1-3/4" BAR	1-3/4" BAR
K *	-	2"X9"	1-3/4"X10" **	2-1/2" X 9"	-	2"X9"	1-3/4"X10" **
L1	-	34'	35'	23'	-	34'	35'
L2	-	-	-	40'	-	-	-
M	-	-	-	16'	-	-	-
N	-	-	-	1-3/4" BAR	-	-	-
O	-	-	-	2-MC18X42.7	-	-	-
P	-	W12X87 **	W1 2 X 8 7	W12X87	-	W12X87 **	W12X87
Q	-	-	-	W12X87	-	-	-
DIA. 1	-	6"	8"	6"	-	6"	8"
DIA. 2	-	-	-	8"	-	-	-

* WASHERS ** TO BE REVIEWED *** MAXIMUM HEIGHT

Symbol	Revisions Description	Date	Approved

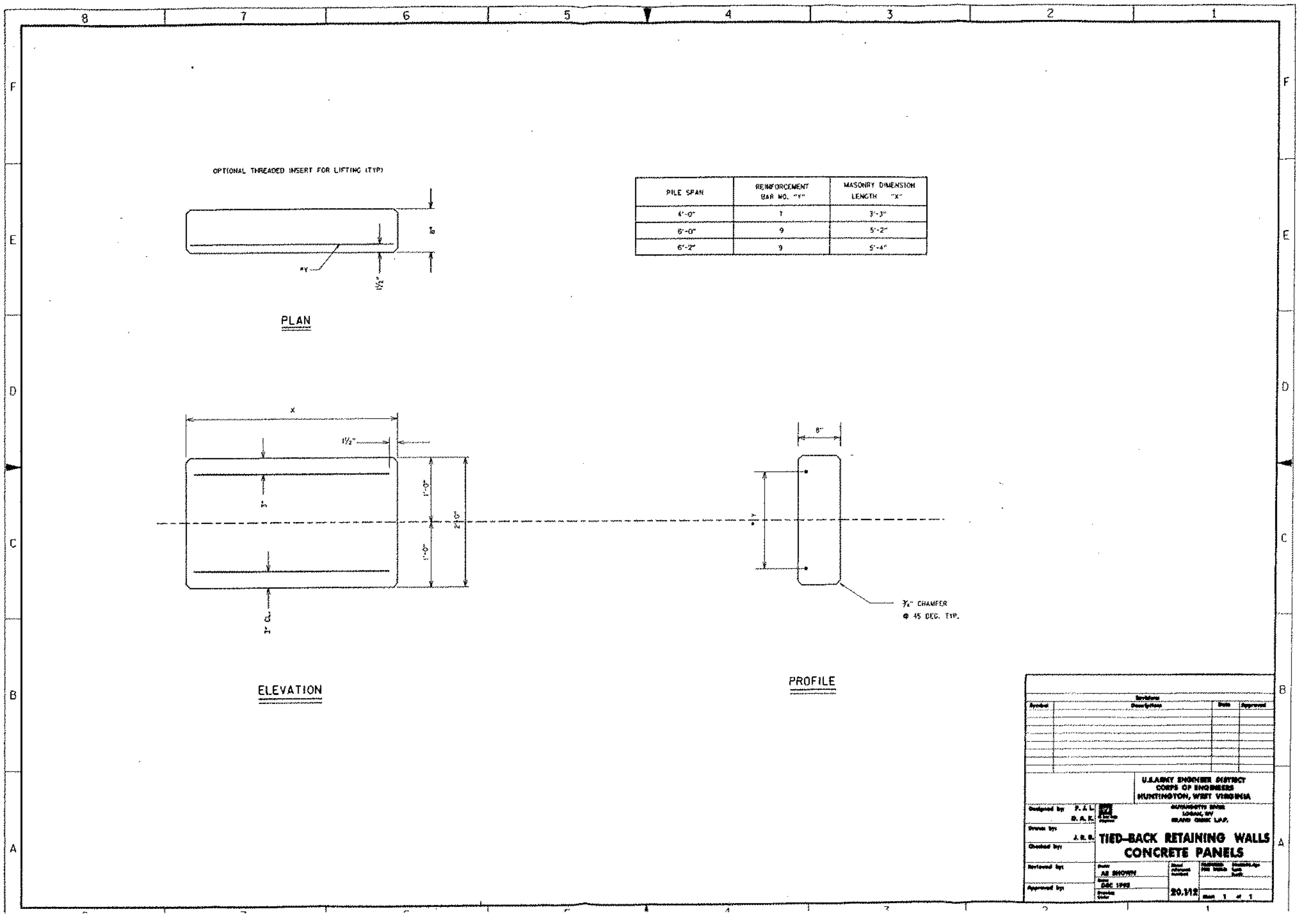
U.S.ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA

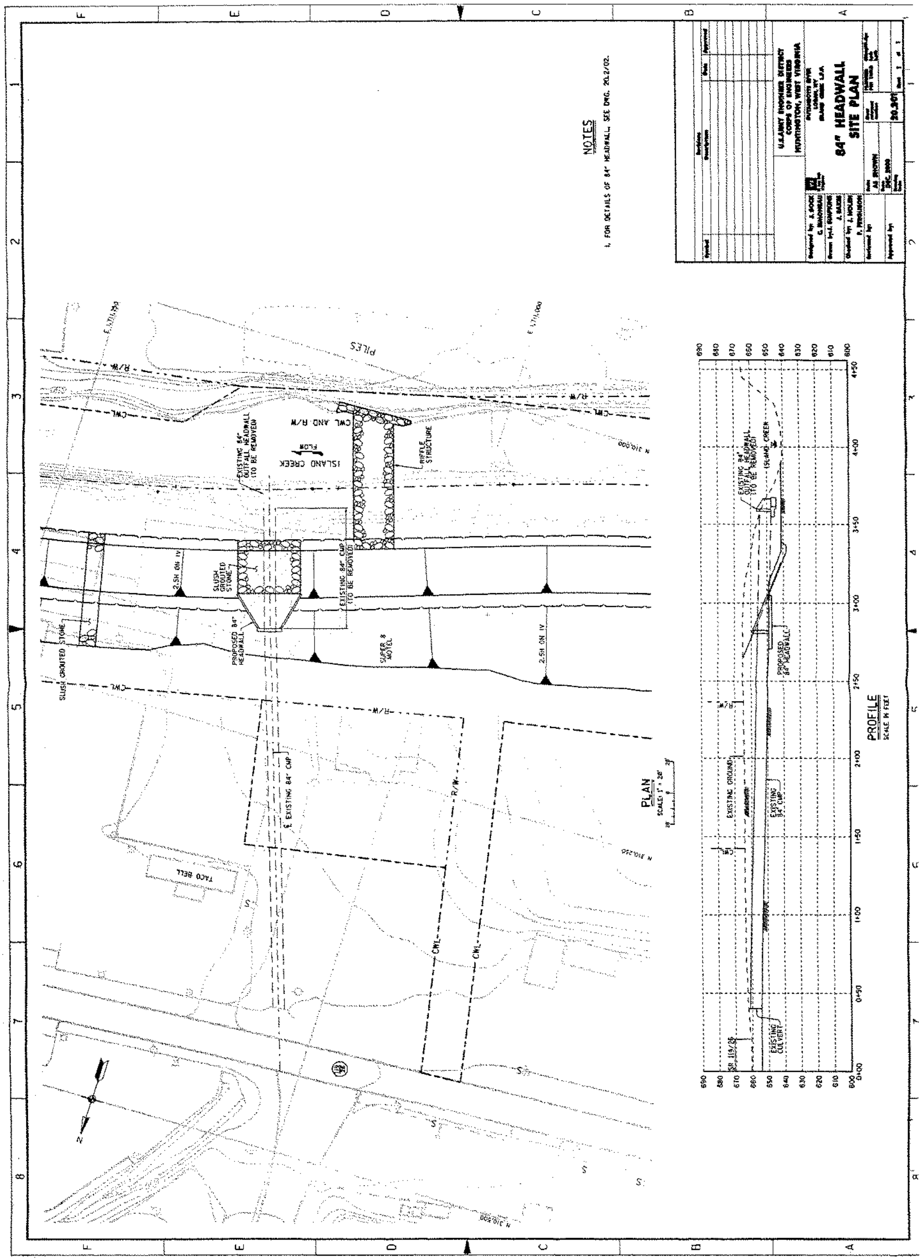
Designed by: P.J.L. / D.A.K.
Drawn by: J.E.S.
Checked by:
Reviewed by:
Approved by:

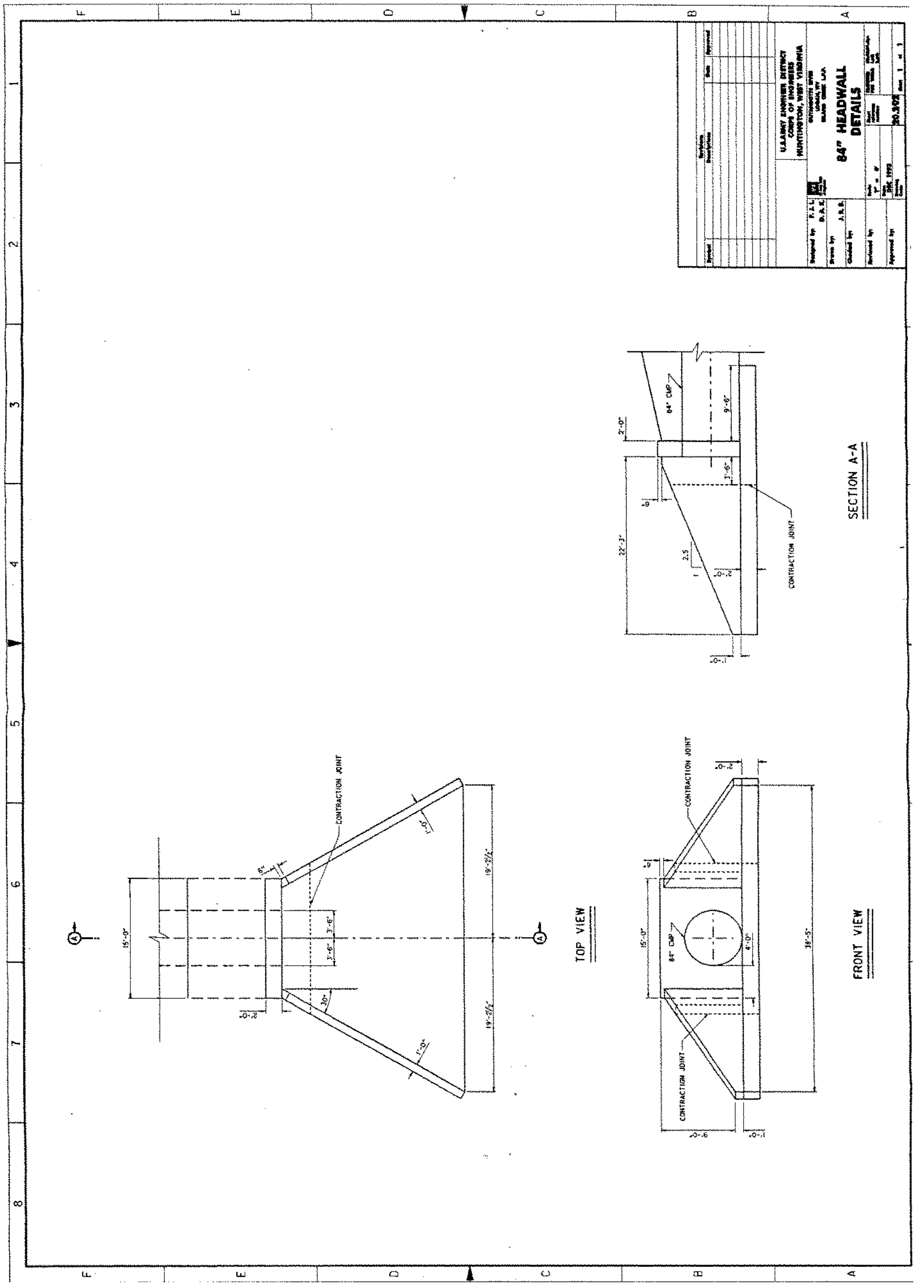
GUYANDOTTE RIVER
LOGAN, WV
ISLAND CREEK L.P.P.

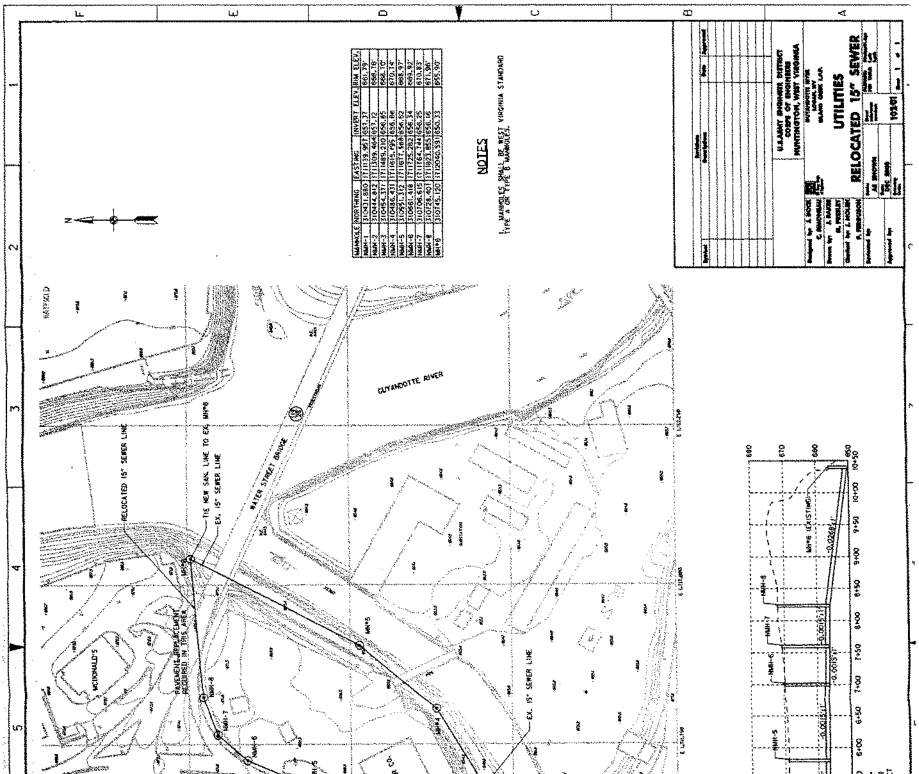
TIED-BACK RETAINING WALLS TYPICAL SECTION

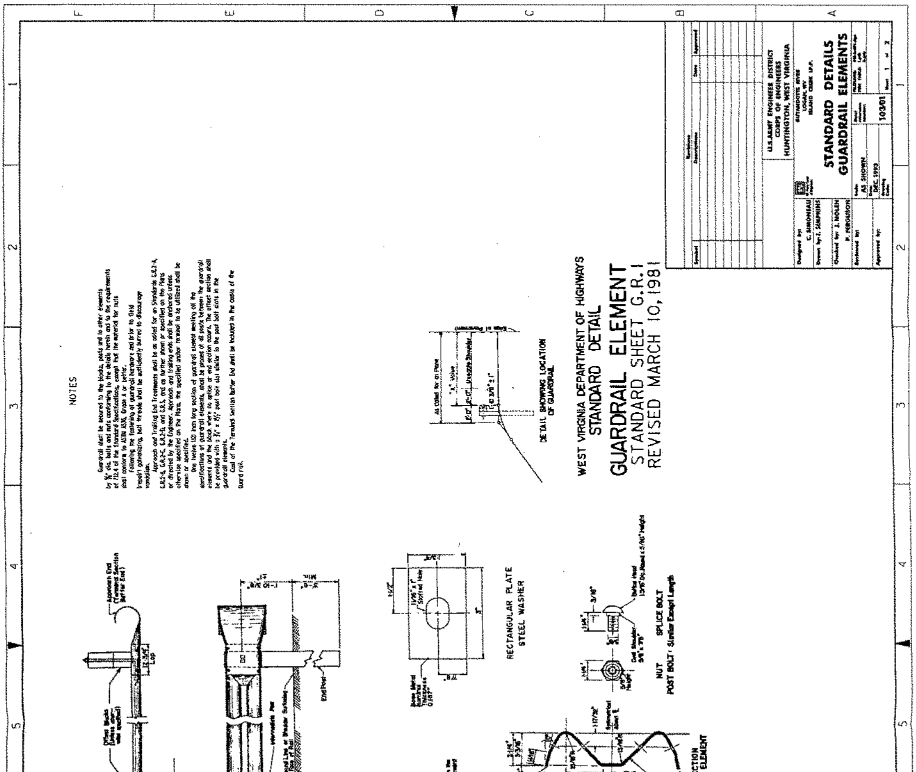
Scale: NONE
Date: DEC 1993
Sheet reference number: 20.1/11
Sheet 2 of 2

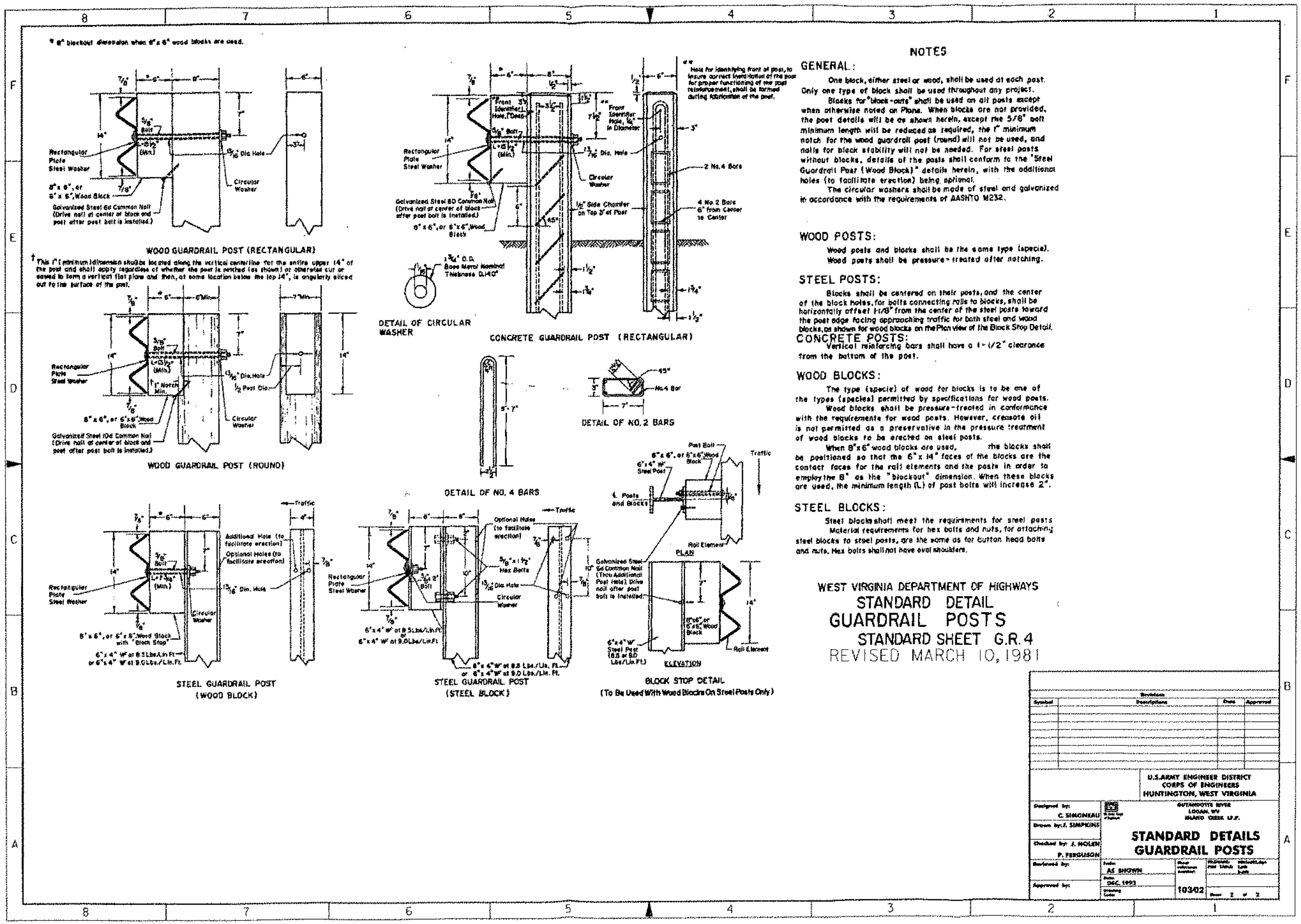

OPTIONAL THREADED INSERT FOR LIFTING (TYP)
PLAN
ELEVATION
PROFILE
3/4" CHAMFER
@ 45 DEG. TYP.
PILE SPAN
REINFORCEMENT BAR NO. "Y"
MASONRY DIMENSION LENGTH "X"
4'-0" | 7 | 3'-3"
6'-0" | 9 | 5'-2"
6'-2" | 9 | 5'-4"
U.S.ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
TIED-BACK RETAINING WALLS
CONCRETE PANELS
AS SHOWN
20.112

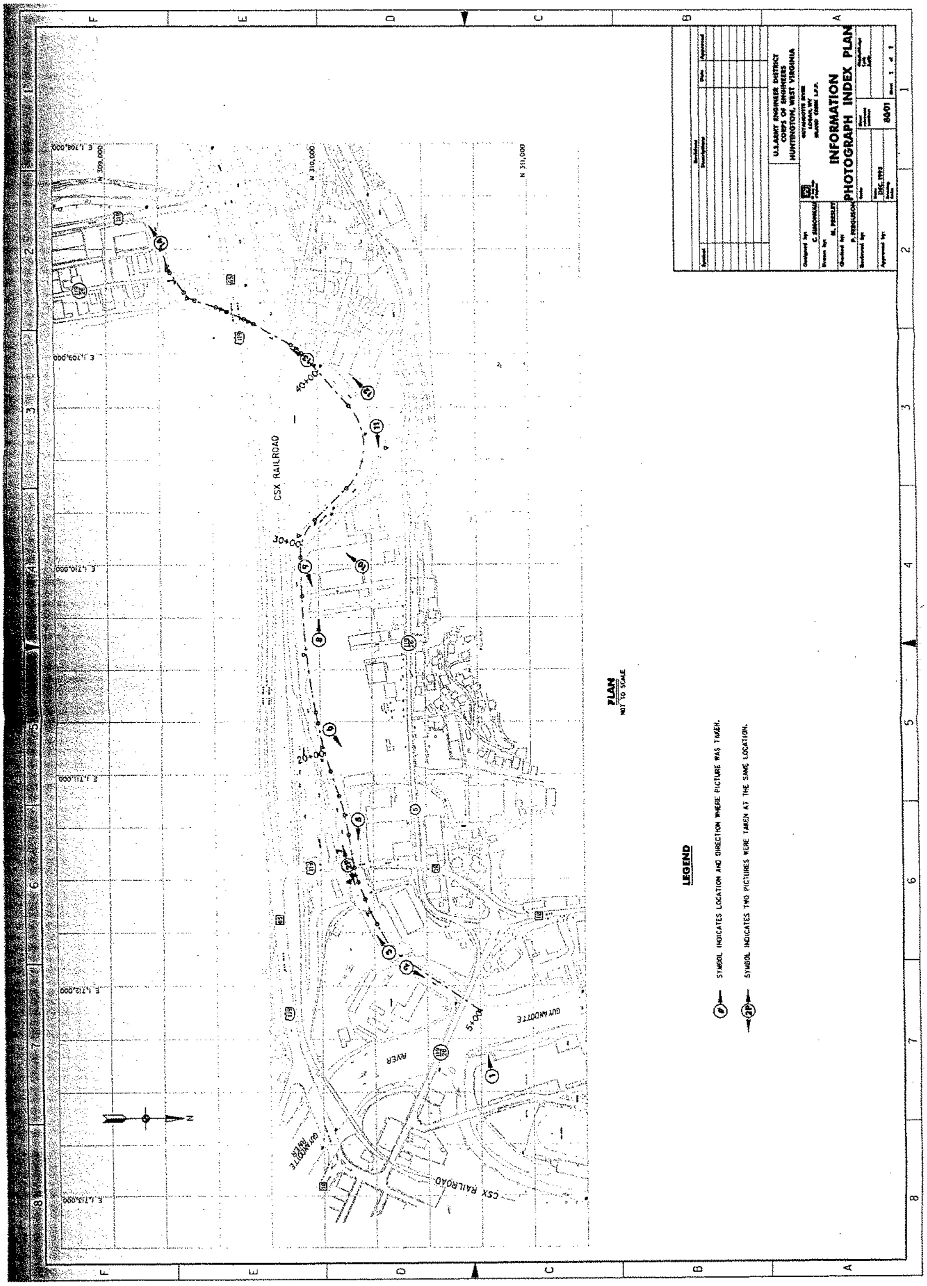

NOTES
1. FOR DETAILS OF 84" HEADWALL, SEE DWG. 20.2/02.
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
84" HEADWALL
SITE PLAN
ISLAND CREEK
FLOW
PILES
CWL AND R/W
EXISTING 84" OUTFALL HEADWALL (TO BE REMOVED)
RIFFLE STRUCTURE
EXISTING 84" CMP (TO BE REMOVED)
SLUSH GROUTED STONE
PROPOSED 84" HEADWALL
2.5H ON 1V
SUPER 8 MOTEL
SLUSH GROUTED STONE
EXISTING 84" CMP
TACO BELL
R/W
CWL
PLAN
PROFILE
EXISTING GROUND
EXISTING 84" CMP
EXISTING CULVERT
PROPOSED 84" HEADWALL
ISLAND CREEK


U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
84" HEADWALL
DETAILS
SECTION A-A
TOP VIEW
FRONT VIEW
CONTRACTION JOINT
84" CMP
15'-0"
19'-2½"
3'-6"
30°
1'-0"
22'-3"
9'-6"
2'-0"
4'-0"
38'-5"


MANHOLE | NORTHING | EASTING | INVERT ELEV. | RIM ELEV.
MMH-1 | 310431.880 | 1711139.957 | 651.37 | 661.79'
MMH-2 | 310444.812 | 1711309.464 | 657.12 | 666.16'
MMH-3 | 310454.377 | 1711489.210 | 656.85 | 668.70'
MMH-4 | 310486.431 | 1711615.195 | 656.86 | 670.14'
MMH-5 | 310551.312 | 1711677.588 | 656.52 | 668.97'
MMH-6 | 310561.418 | 1711725.282 | 656.34 | 669.92'
MMH-7 | 310706.615 | 1711764.744 | 656.25 | 670.83'
MMH-8 | 310728.401 | 1711823.855 | 656.16 | 671.96'
MH*6 | 310745.120 | 1712040.591 | 650.33 | 655.90'
NOTES
1. MANHOLES SHALL BE WEST VIRGINIA STANDARD TYPE A OR TYPE B MANHOLES.
U.S.ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
UTILITIES
RELOCATED 15" SEWER
GUYANDOTTE RIVER
WATER STREET BRIDGE
RELOCATED 15" SEWER LINE
TIE NEW SAN. LINE TO EX. MH*6
EX. 15" SEWER LINE
PAVEMENT REPLACEMENT REQUIRED IN THIS AREA
McDONALD'S
AMERICAN ELECTRIC POWER CO.
ANDERSON WHOLESALE
SHONEY'S
TACO BELL
SUPER 8 MOTEL
ISLAND CREEK
PLAN
SCALE 1" = 50'
PROFILE
SCALE IN FEET
15" R.C.P. (TYP.)


TYPICAL GUARDRAIL INSTALLATION
(UNANCHORED ENDS-WOOD POSTS AND BLOCKS SHOWN)
PLAN
NOTES
WEST VIRGINIA DEPARTMENT OF HIGHWAYS
STANDARD DETAIL
GUARDRAIL ELEMENT
STANDARD SHEET G.R.1
REVISED MARCH 10, 1981
DETAIL SHOWING LOCATION OF GUARDRAIL
RECTANGULAR PLATE
STEEL WASHER
NUT
SPLICE BOLT
ELEVATION
OFFSET SECTION
RAIL SPLICE
SECTION
RAIL ELEMENT
TERMINAL SECTION BUFFER END
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
STANDARD DETAILS
GUARDRAIL ELEMENTS
AS SHOWN
DEC. 1993


* 8" blockout dimension when 8" x 6" wood blocks are used.
WOOD GUARDRAIL POST (RECTANGULAR)
† This 1" (minimum) dimension shall be located along the vertical centerline for the entire upper 14" of the post and shall apply regardless of whether the post is notched (as shown) or otherwise cut or sawed to form a vertical flat plane and then, at some location below the top 14", is angularly sliced out to the surface of the post.
WOOD GUARDRAIL POST (ROUND)
STEEL GUARDRAIL POST (WOOD BLOCK)
DETAIL OF CIRCULAR WASHER
CONCRETE GUARDRAIL POST (RECTANGULAR)
DETAIL OF NO. 4 BARS
DETAIL OF NO. 2 BARS
STEEL GUARDRAIL POST (STEEL BLOCK)
BLOCK STOP DETAIL
(To Be Used With Wood Blocks On Steel Posts Only)
NOTES
GENERAL:
One block, either steel or wood, shall be used at each post. Only one type of block shall be used throughout any project.
Blocks for "block-outs" shall be used on all posts except when otherwise noted on Plans. When blocks are not provided, the post details will be as shown herein, except the 5/8" bolt minimum length will be reduced as required, the 1" minimum notch for the wood guardrail post (round) will not be used, and nails for block stability will not be needed. For steel posts without blocks, details of the posts shall conform to the "Steel Guardrail Post (Wood Block)" details herein, with the additional holes (to facilitate erection) being optional.
The circular washers shall be made of steel and galvanized in accordance with the requirements of AASHTO M232.
WOOD POSTS:
Wood posts and blocks shall be the same type (specie). Wood posts shall be pressure-treated after notching.
STEEL POSTS:
Blocks shall be centered on their posts, and the center of the block holes, for bolts connecting rails to blocks, shall be horizontally offset 1-1/8" from the center of the steel posts toward the post edge facing approaching traffic for both steel and wood blocks, as shown for wood blocks on the Plan view of the Block Stop Detail.
CONCRETE POSTS:
Vertical reinforcing bars shall have a 1-1/2" clearance from the bottom of the post.
WOOD BLOCKS:
The type (specie) of wood for blocks is to be one of the types (species) permitted by specifications for wood posts.
Wood blocks shall be pressure-treated in conformance with the requirements for wood posts. However, creosote oil is not permitted as a preservative in the pressure treatment of wood blocks to be erected on steel posts.
When 8"x6" wood blocks are used, the blocks shall be positioned so that the 6" x 14" faces of the blocks are the contact faces for the rail elements and the posts in order to employ the 8" as the "blockout" dimension. When these blocks are used, the minimum length (L) of post bolts will increase 2".
STEEL BLOCKS:
Steel blocks shall meet the requirements for steel posts.
Material requirements for hex bolts and nuts, for attaching steel blocks to steel posts, are the same as for button head bolts and nuts. Hex bolts shall not have oval shoulders.
WEST VIRGINIA DEPARTMENT OF HIGHWAYS
STANDARD DETAIL
GUARDRAIL POSTS
STANDARD SHEET G.R.4
REVISED MARCH 10, 1981
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
STANDARD DETAILS
GUARDRAIL POSTS
AS SHOWN
DEC. 1993
103/02



U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
INFORMATION
PHOTOGRAPH INDEX PLAN
PLAN
NOT TO SCALE
LEGEND
SYMBOL INDICATES LOCATION AND DIRECTION WHERE PICTURE WAS TAKEN.
SYMBOL INDICATES TWO PICTURES WERE TAKEN AT THE SAME LOCATION.
CSX RAILROAD
GUYANDOTTE
RIVER
CSX RAILROAD
40+00
30+00
20+00
5+00

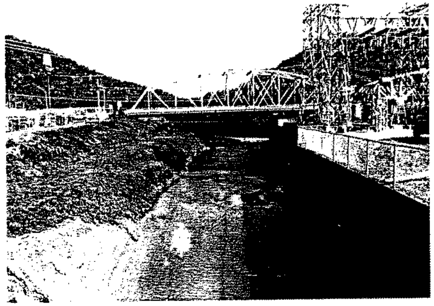


PHOTO NO. 2

PHOTOGRAPH TAKEN ON APCO BRIDGE (APPROXIMATE STATION 9 +50) LOOKING TOWARD GUYANDOTTE RIVER. TIED-BACK RETAINING WALL TO BE CONSTRUCTED OPPOSITE OF EXISTING RETAINING WALL SHOWN.

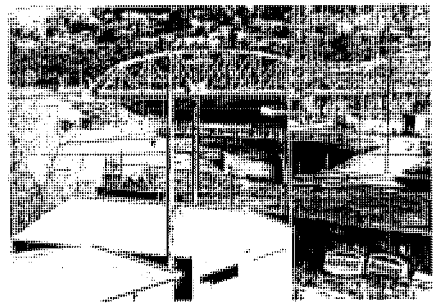


PHOTO NO. 4

PHOTOGRAPH TAKEN ON 119/10 BRIDGE LOOKING TOWARD GUYANDOTTE RIVER. APCO BRIDGE (APPROXIMATE STATION 9 +50) FOREGROUND, 119/26 NORTH BRIDGE (APPROXIMATE STATION 5+50) BACKGROUND.

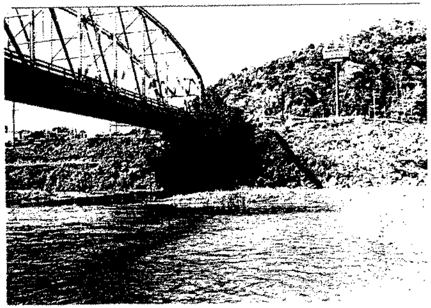


PHOTO NO. 1

BEGINNING OF PROJECT (STATION 5+00). 2H:1V CHANNEL EXCAVATION WITH SSP ON RIGHT SIDE OF BRIDGE.

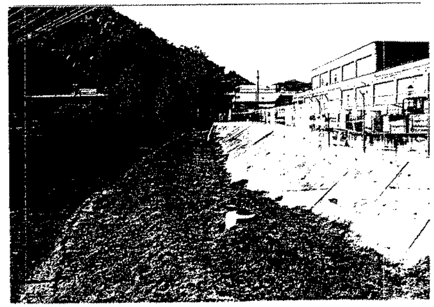


PHOTO NO. 3

PHOTOGRAPH TAKEN ON APCO BRIDGE (APPRXIMATE STATION 9 +50). RETAINING WALL BEHIND APCO BUILDING WILL BE PARTIALLY REMOVED AND SEWER LINE WILL BE RELOCATED. TIED-BACK RETAINING WALL WILL BE CONSTRUCTED ON RIGHT BANK.

NOTES

Symbol	Descriptions	Date	Approved

U.S.ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA

Designed by: C. SIMONEAU
Drawn by: J. SIMPKINS
Checked by: J. NOLEN
P. FERGUSON
Reviewed by:
Approved by:

GUYANDOTTE RIVER
LOGAN, WV
ISLAND CREEK LPP

PHOTOGRAPHS 1 THRU 4

Scale: AS SHOWN
Date: DEC. 199[illegible]
Sheet reference number: 80-02
Sheet 1 of 4

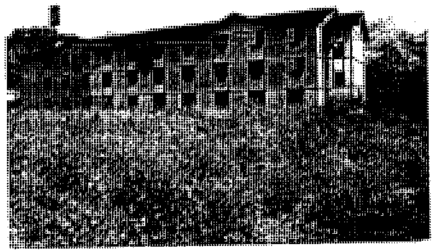


PHOTO NO. 6

SUPER 8 MOTEL AT APPROXIMATE STATION 18+50 (TO BE REMOVED.)

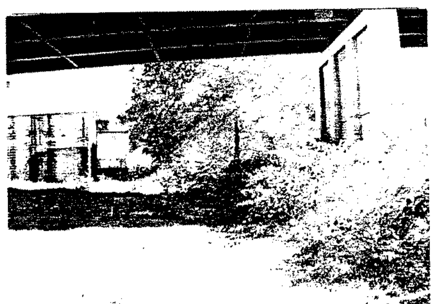


PHOTO NO. 5

AREA UNDER 119/10 BRIDGE AT APPROXIMATE STATION 14+50. TIED-BACK RETAINING WALL WILL PASS UNDER THIS SPAN.

PHOTO NO. 7

CHANNEL AS SEEN FROM 119/10 BRIDGE (STATION 14+50) LOOKING UPSTREAM.

NOTES

Symbol	Descriptions	Date	Approved

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA

Designed by: C. SIMONEAU
Drawn by: J. SIMPKINS
Checked by: J. NOLEN
P. FERGUSON
Reviewed by:
Approved by:

LOGAN, WV

PHOTOGRAPHS
5 THRU 7

Scale: AS SHOWN
Date: DEC. 1992

8003

Sheet 2 of 4

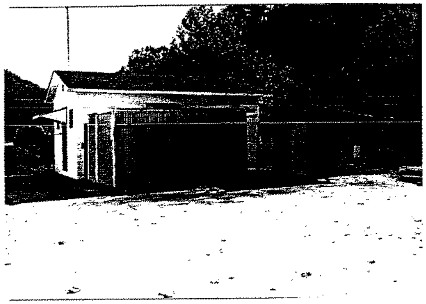


PHOTO NO. 9

COMBINATION KENNEL AND PUMP HOUSE BEHIND BAISDEN HARDWARE STORE (TO BE REMOVED.)

PHOTO NO. 11

LOCATION OF PROPOSED LOW WATER CROSSING AT STATION 31+39.

PHOTO NO. 8

BAISDEN HARDWARE STORE AND COMBINATION KENNEL AND PUMP HOUSE AT APPROXIMATE STATION 28+00. WORK WILL TRANSITION TO OPPOSITE BANK JUST UPSTREAM OF THESE STRUCTURES.

PHOTO NO. 10

JUNKYARD LOCATED UPSTREAM AND ADJACENT TO BAISDEN HARDWARE. (APPROXIMATE STATION 29+50)

NOTES

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA

LOGAN, WV

PHOTOGRAPHS
8 THRU 11

Scale: AS SHOWN

80/04

Sheet 3 of 4

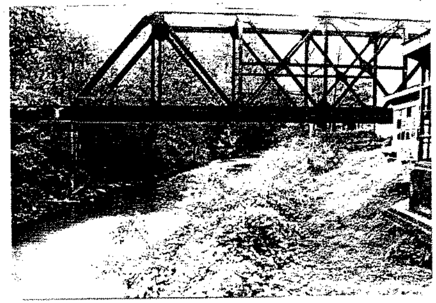


PHOTO NO. 13

CSX RAILROAD BRIDGE AT STATION 42+00.

PHOTO NO. 12

AREA UPSTREAM OF LOW WATER CROSSING. SLOPE WILL BE LAID BACK ON 2.5H:1V AND COVERED WITH 18" SSP.

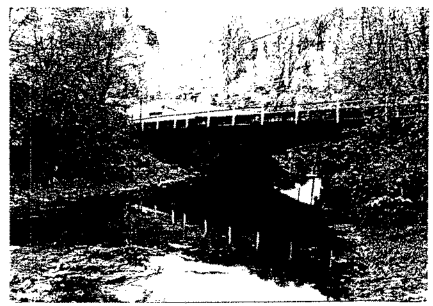


PHOTO NO. 14

SAND BAR REMOVAL AREA AT STATION 48+15

NOTES

Symbol	Description	Date	Approved

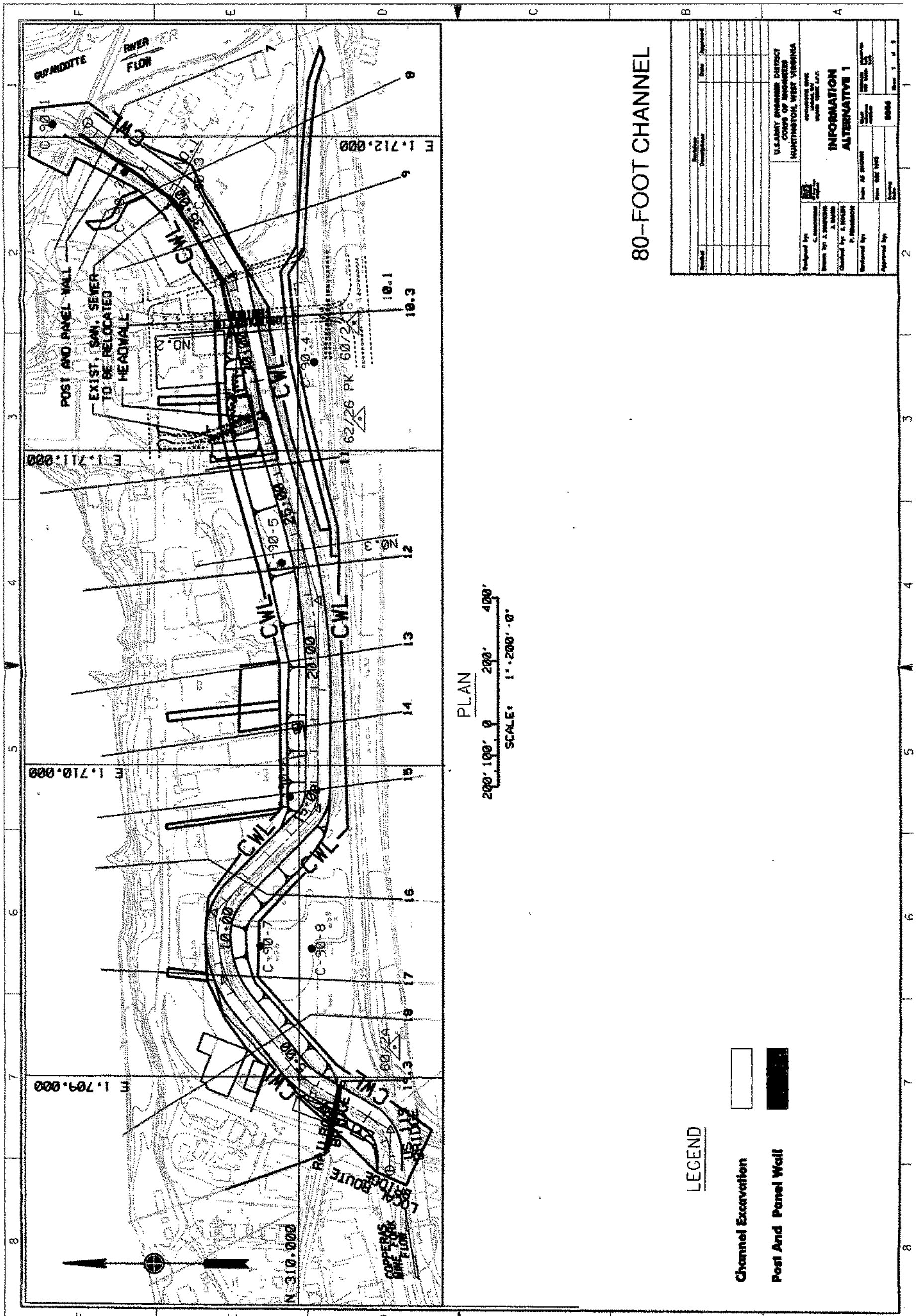
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA

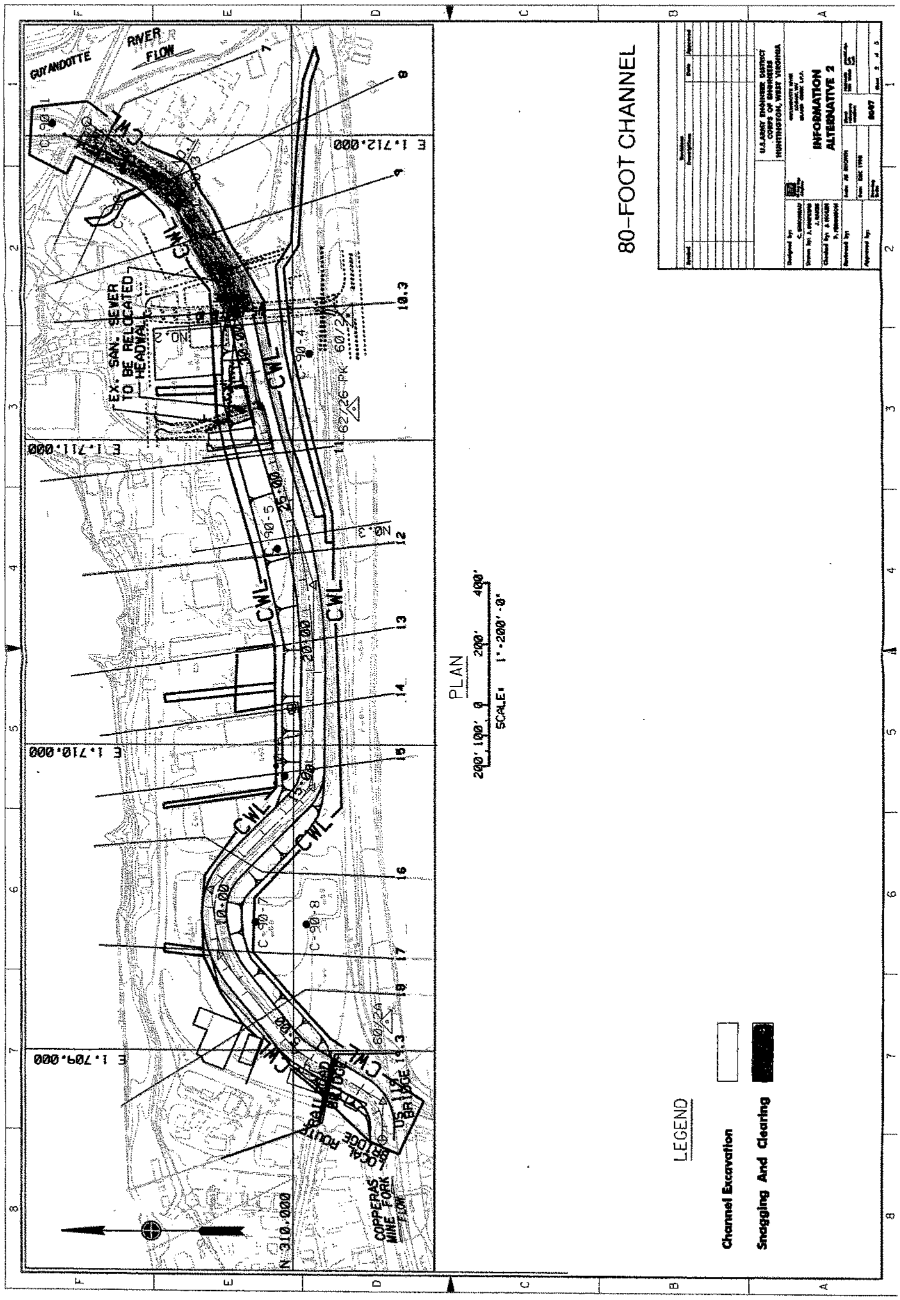
Designed by: C. SIMONEAU
Drawn by: J. SIMPKINS
Checked by: J. NOLEN
P. FERGUSON
Reviewed by:
Approved by:

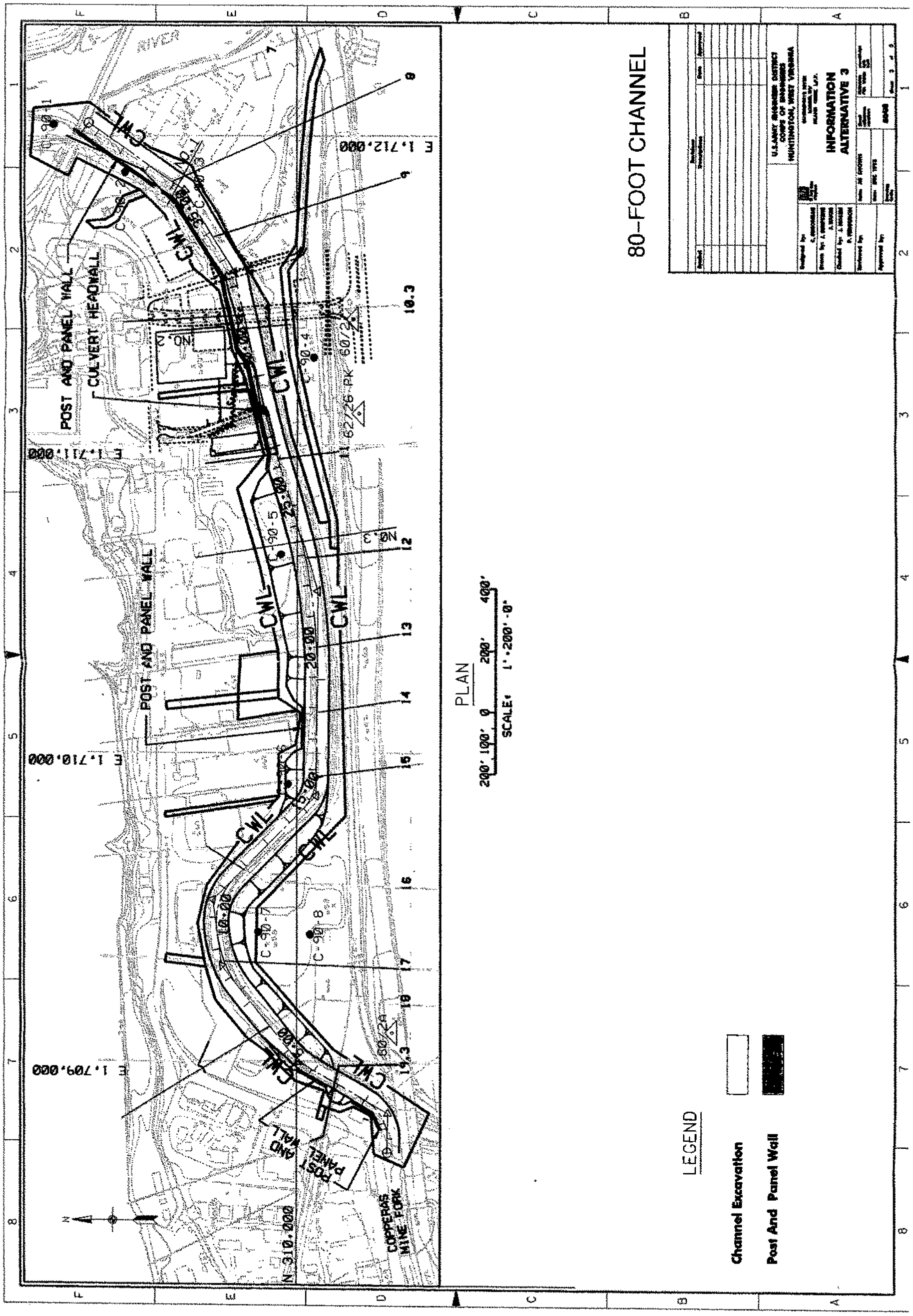
GUYANDOTTE RIVER
LOGAN, WV
ISLAND CREEK ...

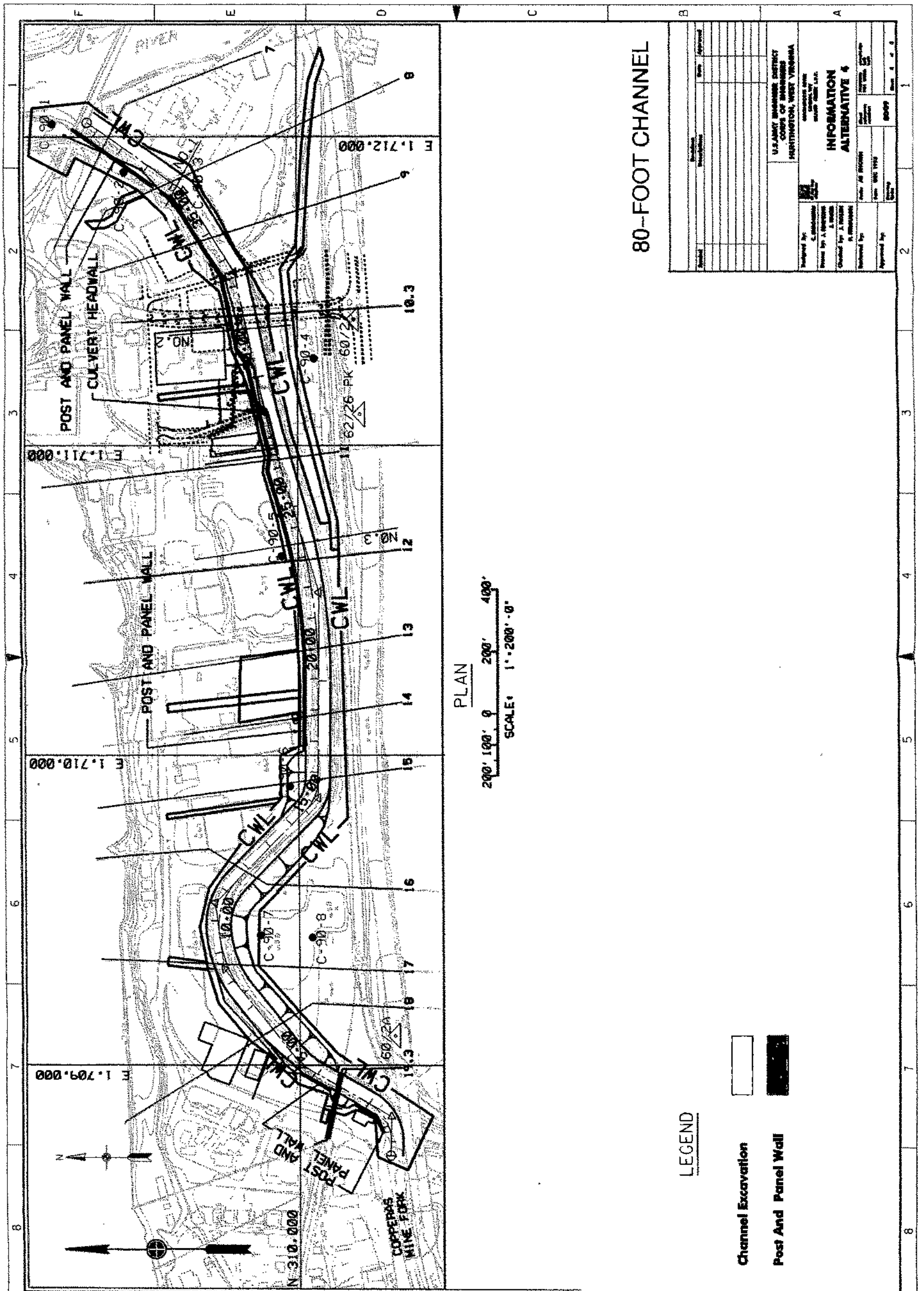
PHOTOGRAPHS
12 THRU 14

Scale: AS SHOWN
Date: DEC. 1992
8005
Sheet 4 of 4

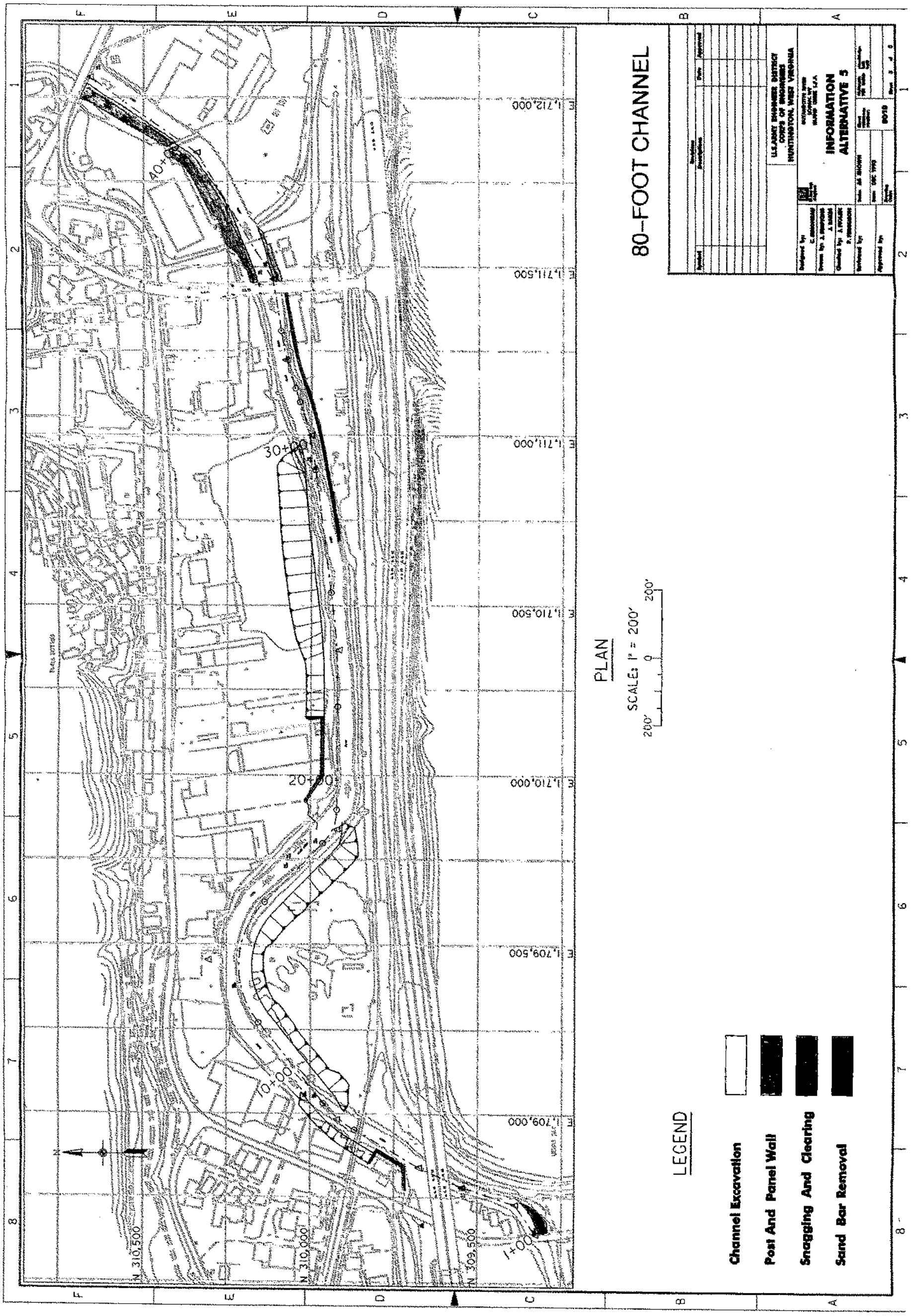

80-FOOT CHANNEL
PLAN
SCALE: 1"=200'-0"
LEGEND
Channel Excavation
Post And Panel Wall
POST AND PANEL WALL
EXIST. SAN. SEWER TO BE RELOCATED
HEADWALL
GUYANDOTTE RIVER FLOW
E 1,712,000
E 1,711,000
E 1,710,000
E 1,709,000
N 310,000
INFORMATION ALTERNATIVE 1

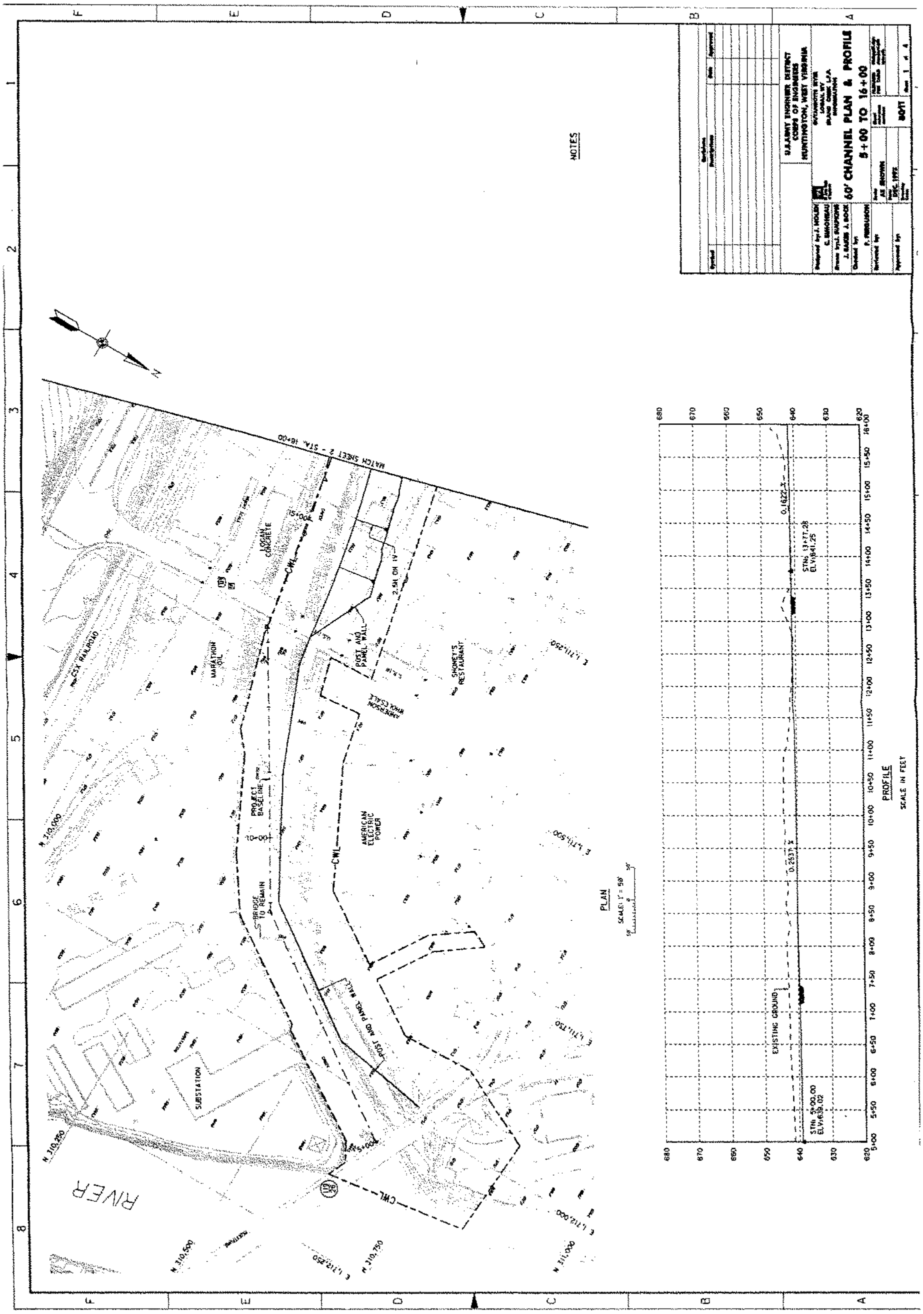

80-FOOT CHANNEL
GUYANDOTTE RIVER FLOW
EX. SAN. SEWER TO BE RELOCATED TO HEADWALL
COPPERAS MINE FORK FLOW
PLAN
SCALE: 1"=200'-0"
LEGEND
Channel Excavation
Snagging And Clearing
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS HUNTINGTON, WEST VIRGINIA
INFORMATION ALTERNATIVE 2

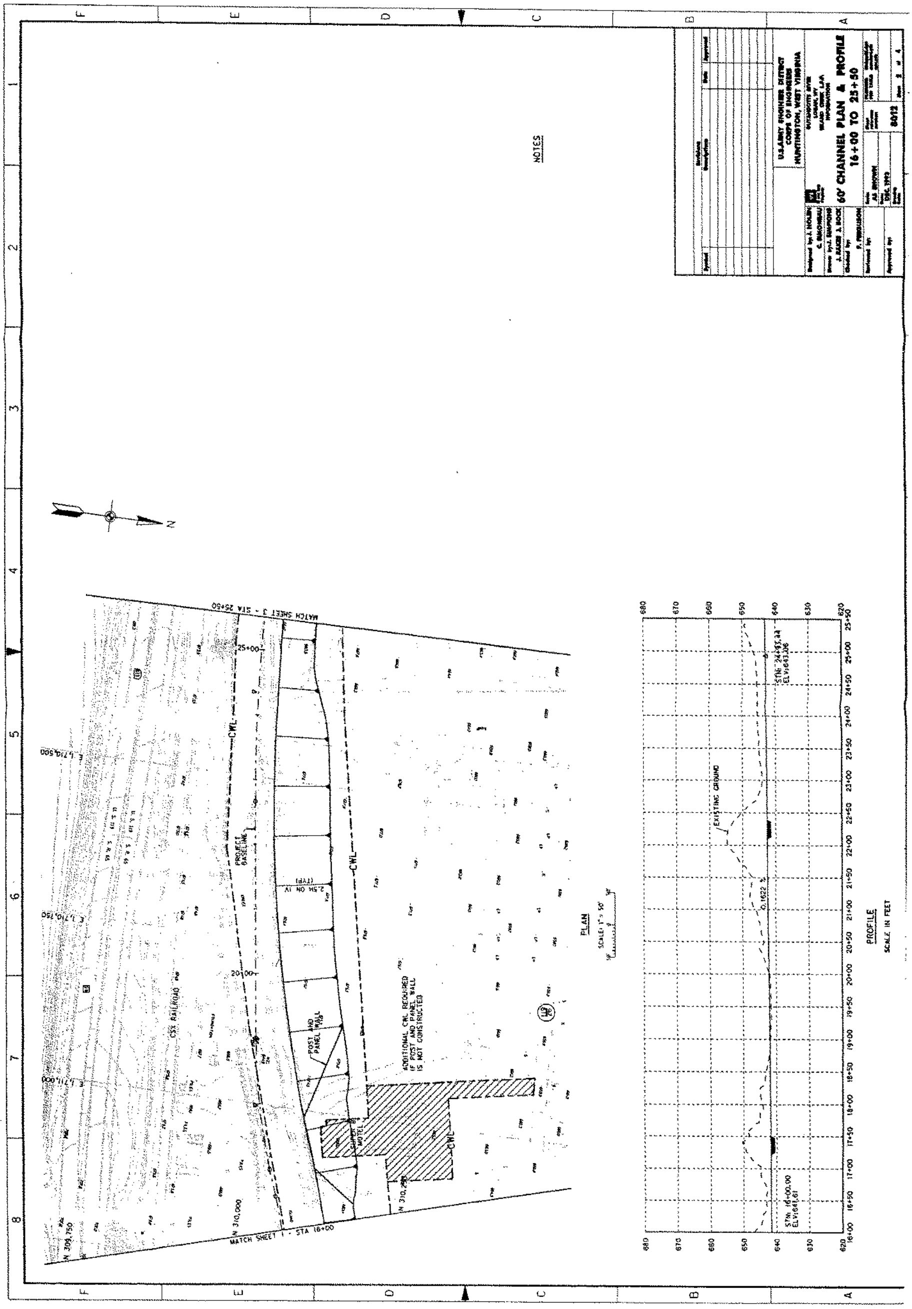

80-FOOT CHANNEL
PLAN
SCALE: 1"=200'-0"
POST AND PANEL WALL
CULVERT HEADWALL
POST AND PANEL WALL
POST AND PANEL WALL
COPPERAS MINE FORK
RIVER
CWL
E 1,712,000
E 1,711,000
E 1,710,000
E 1,709,000
N 310,000
INFORMATION ALTERNATIVE 3
LEGEND
Channel Excavation
Post And Panel Wall

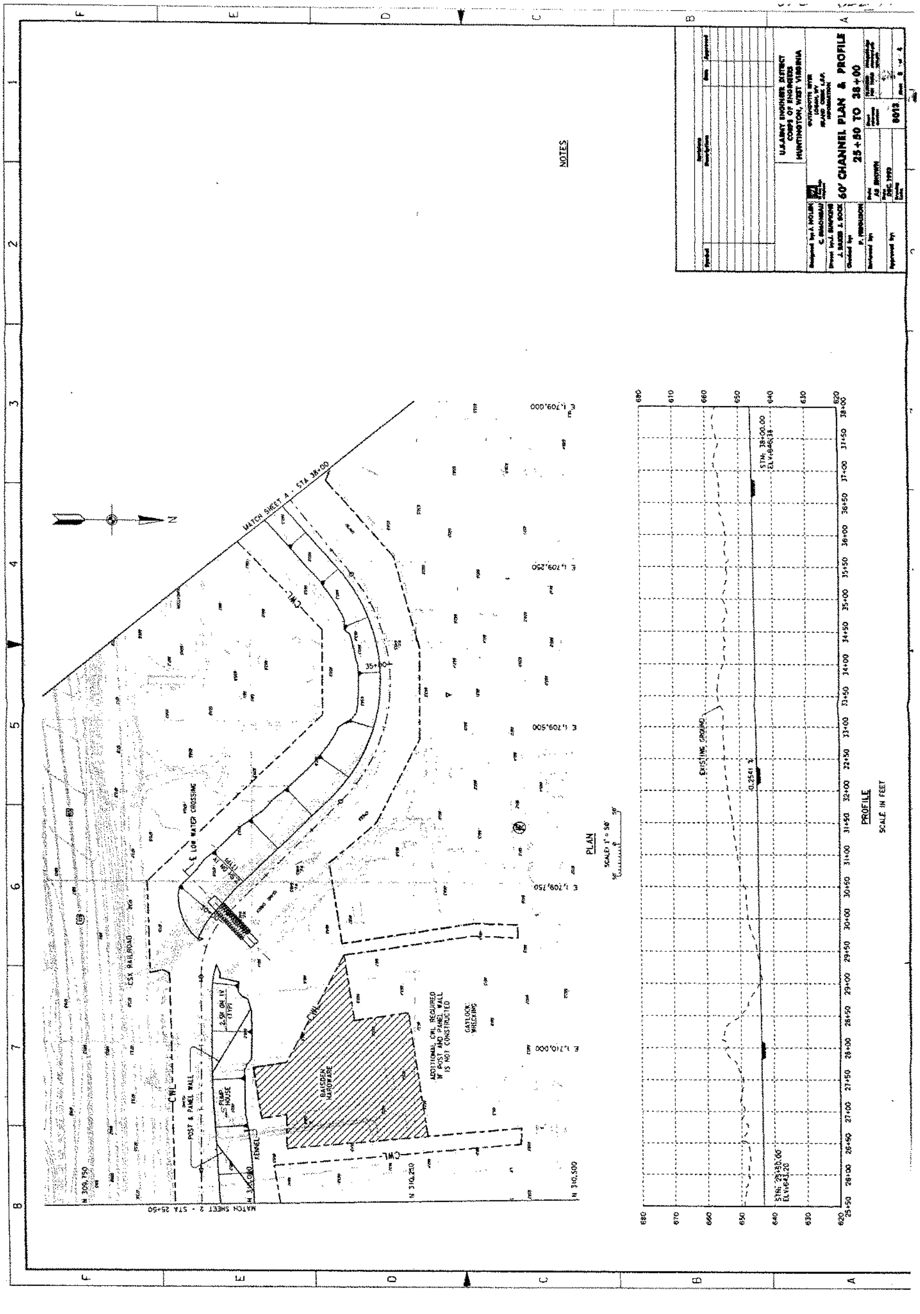


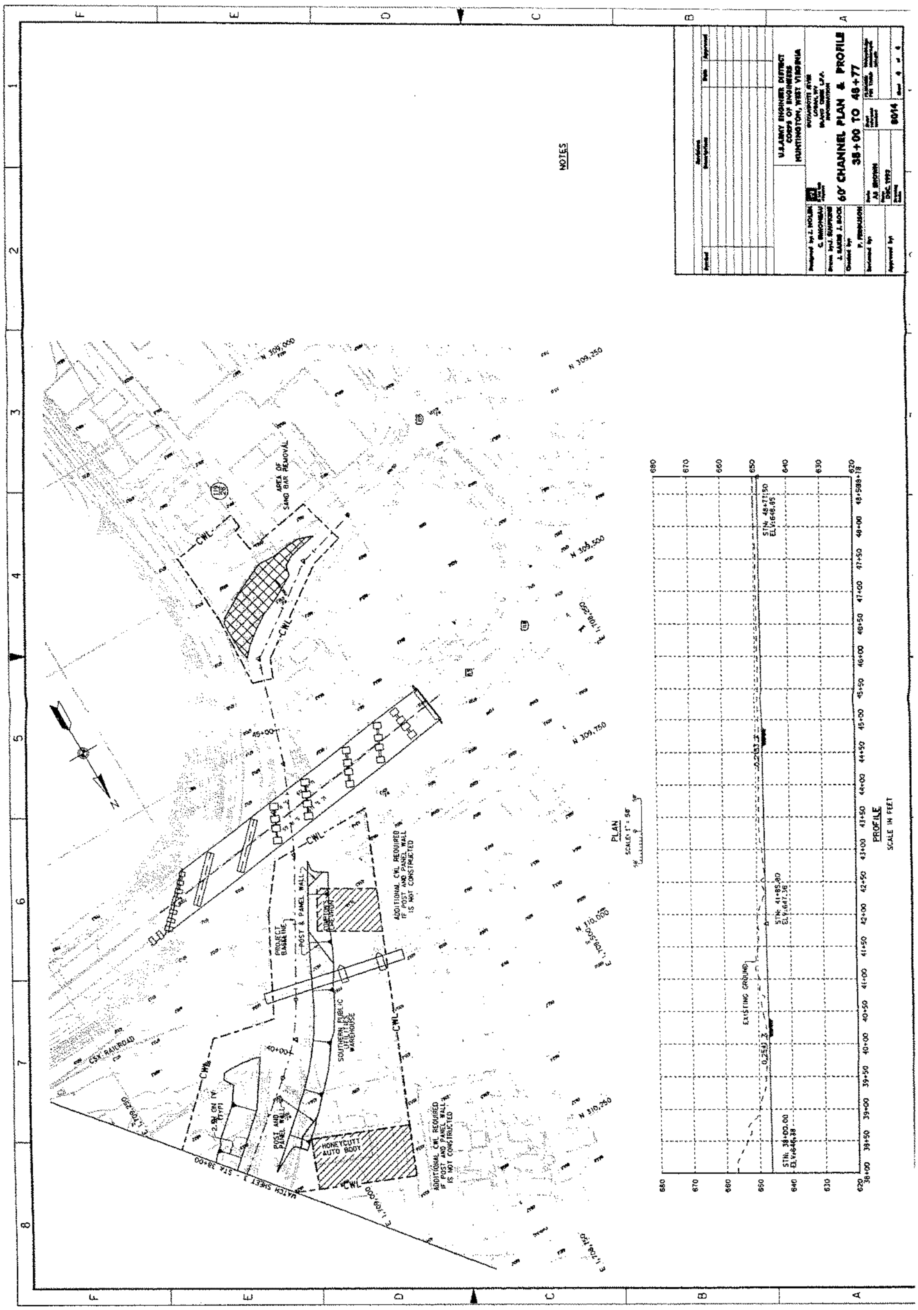
80-FOOT CHANNEL
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
INFORMATION
ALTERNATIVE 4
RIVER
POST AND PANEL WALL
CULVERT HEADWALL
POST AND PANEL WALL
POST AND PANEL WALL
CWL
NO. 2
NO. 3
E 1,712,000
E 1,711,000
E 1,710,000
E 1,709,000
N 310,000
COPPERAS MINE FORK
PLAN
SCALE: 1"=200'-0"
LEGEND
Channel Excavation
Post And Panel Wall

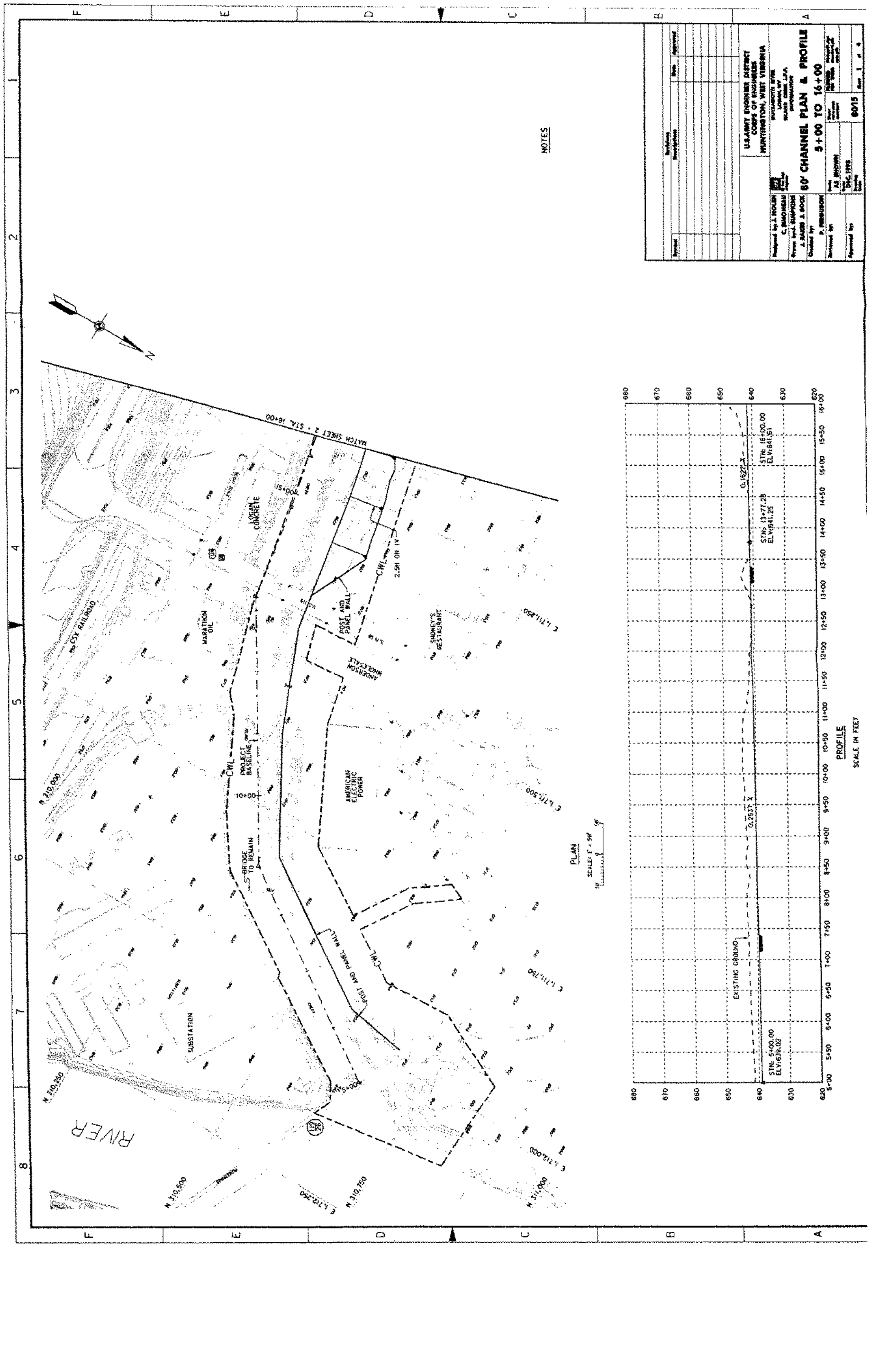

80-FOOT CHANNEL
PLAN
SCALE: 1" = 200'
200' 0 200'
LEGEND
Channel Excavation
Post And Panel Wall
Snagging And Clearing
Sand Bar Removal
INFORMATION
ALTERNATIVE 5
E 1,712,000
E 1,711,500
E 1,711,000
E 1,710,500
E 1,710,000
E 1,709,500
E 1,709,000
N 310,500
N 310,000
N 309,500
40+
30+00
20+00
10+00
1+00

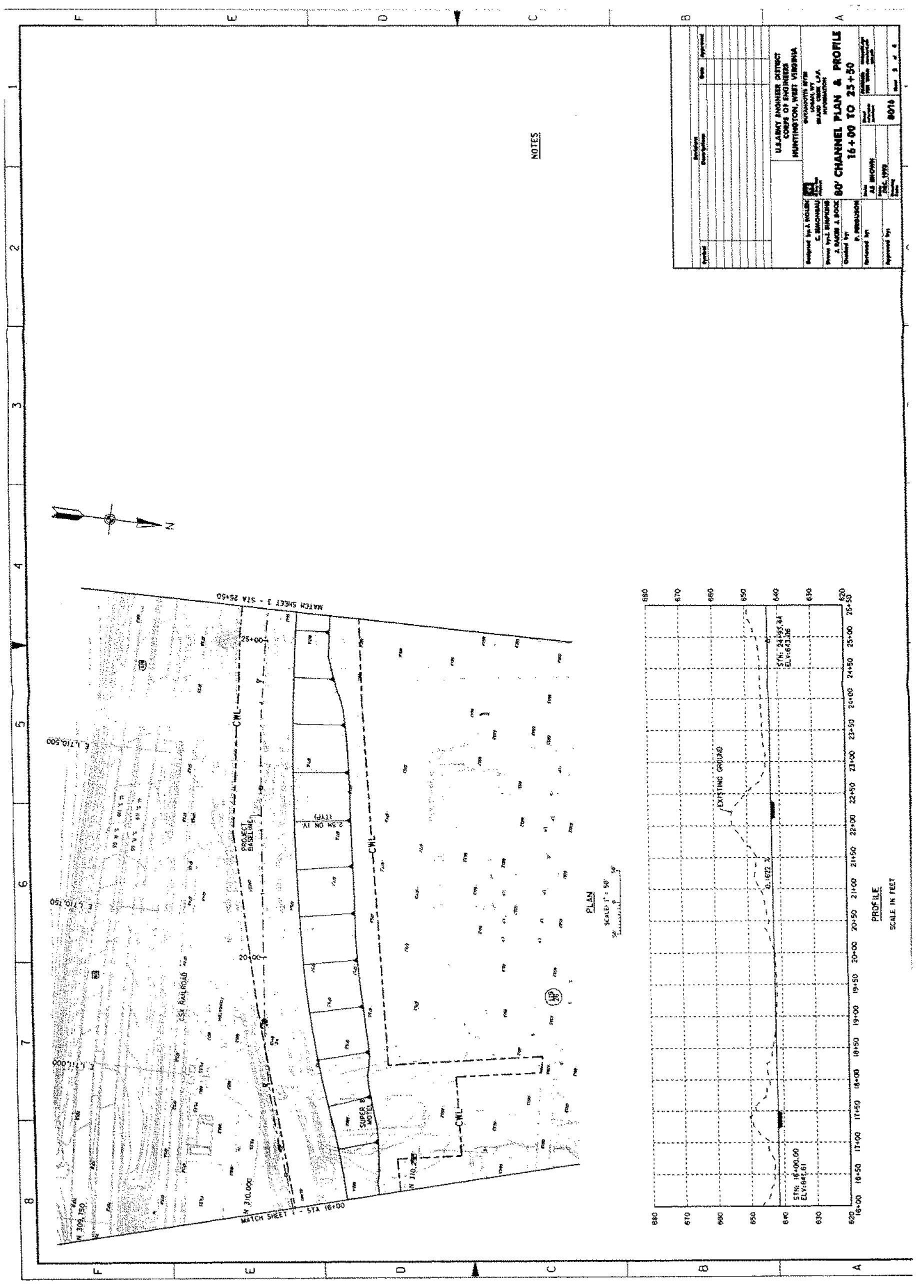

NOTES
U.S.ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
60' CHANNEL PLAN & PROFILE
5+00 TO 16+00
MATCH SHEET 2 - STA. 16+00
CSX RAILROAD
LOGAN CONCRETE
MARATHON OIL
PROJECT BASELINE
BRIDGE TO REMAIN
POST AND PANEL WALL
SHONEY'S RESTAURANT
AMERICAN ELECTRIC POWER
SUBSTATION
RIVER
CWL
PLAN
PROFILE
SCALE IN FEET
EXISTING GROUND

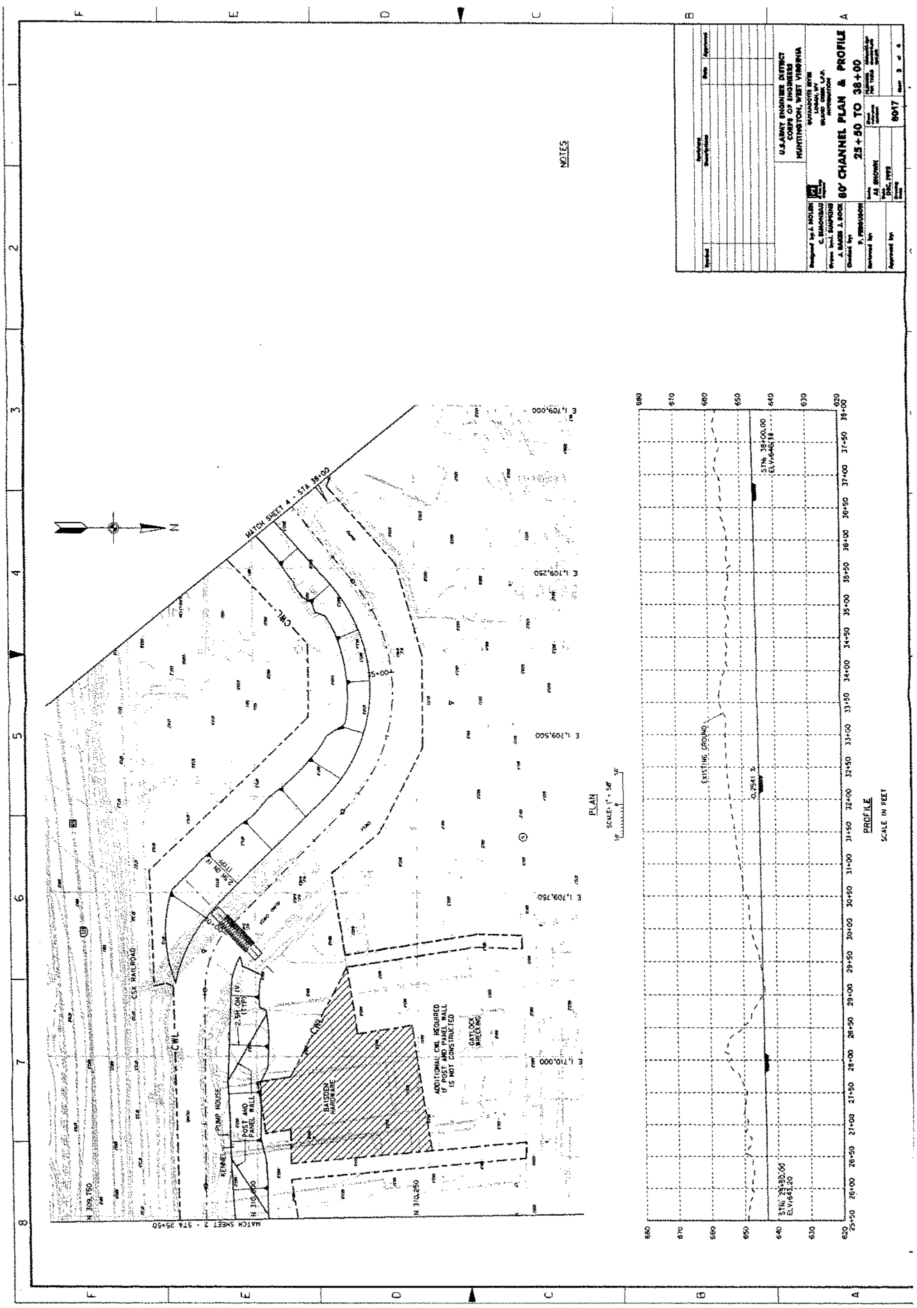

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
60' CHANNEL PLAN & PROFILE
16+00 TO 25+50
NOTES
MATCH SHEET 3 - STA 25+50
MATCH SHEET 1 - STA 16+00
CSX RAILROAD
PROJECT BASELINE
CWL
2.5H ON 1V (TYP)
POST AND PANEL WALL
ADDITIONAL CWL REQUIRED IF POST AND PANEL WALL IS NOT CONSTRUCTED
PLAN
EXISTING GROUND
PROFILE
SCALE IN FEET

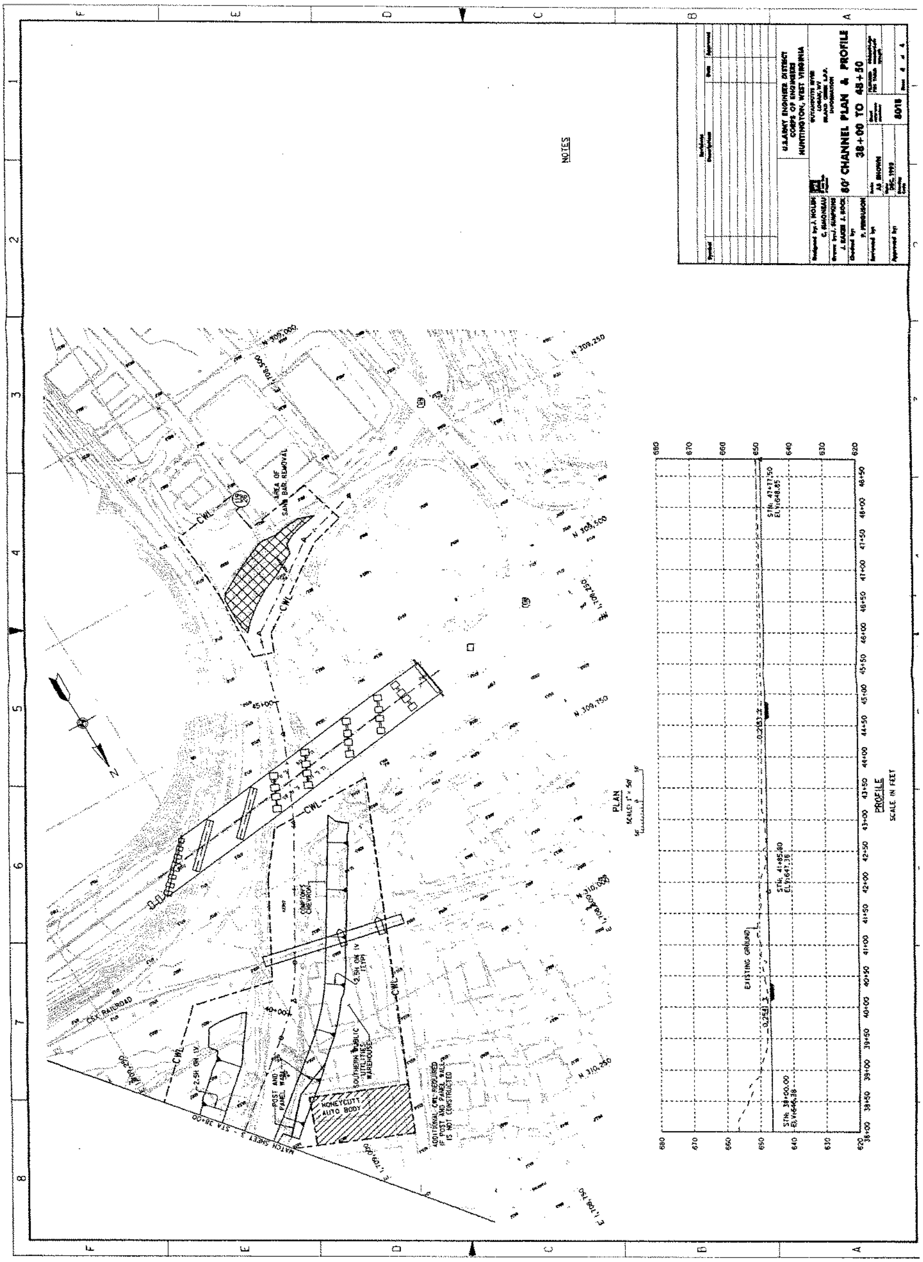

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
60' CHANNEL PLAN & PROFILE
25+50 TO 38+00
NOTES
MATCH SHEET 4 - STA 38+00
MATCH SHEET 2 - STA 25+50
CSX RAILROAD
LOW WATER CROSSING
POST & PANEL WALL
PUMP HOUSE
BALDWIN HARDWARE
ADDITIONAL CWL REQUIRED IF POST AND PANEL WALL IS NOT CONSTRUCTED
CWL
PLAN
PROFILE
SCALE IN FEET
EXISTING GROUND

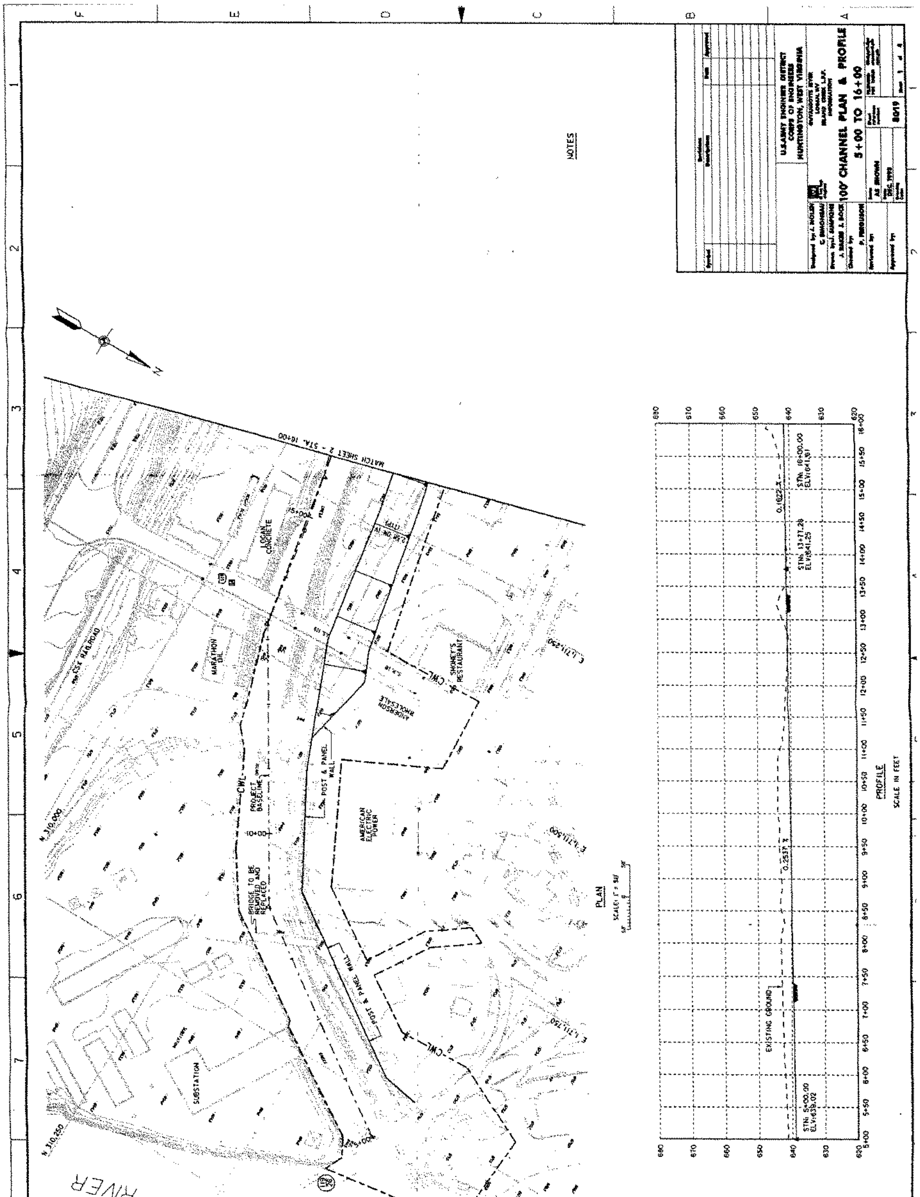

NOTES
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
60' CHANNEL PLAN & PROFILE
38+00 TO 48+77
AREA OF SAND BAR REMOVAL
CSX RAILROAD
SOUTHERN PUBLIC WAREHOUSE
HONEYCUTT AUTO BODY
POST & PANEL WALL
PROJECT BASELINE
ADDITIONAL CWL REQUIRED IF POST AND PANEL WALL IS NOT CONSTRUCTED
PLAN
EXISTING GROUND
PROFILE
SCALE IN FEET

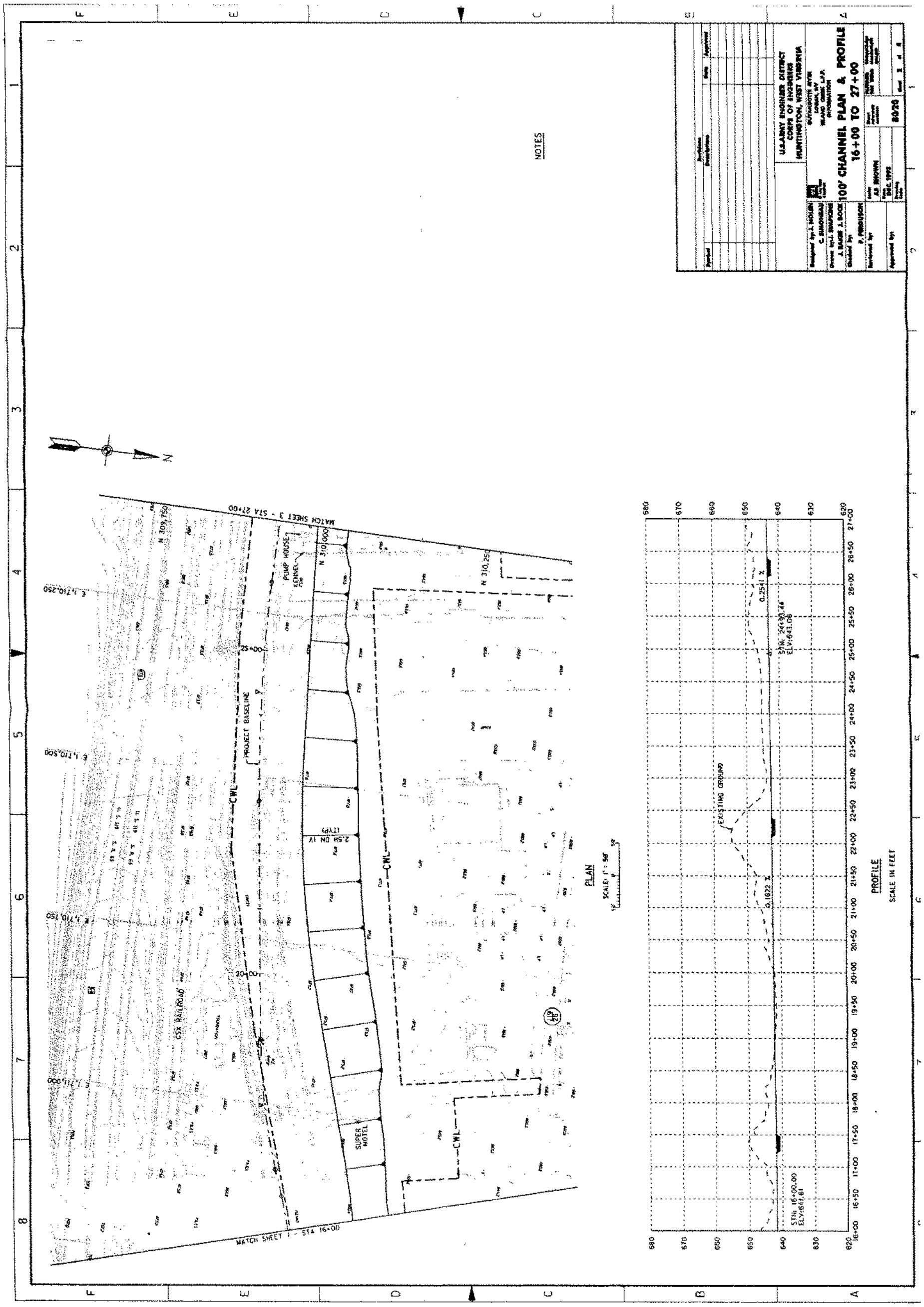

NOTES
U.S.ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
80' CHANNEL PLAN & PROFILE
5+00 TO 16+00
MATCH SHEET 2 - STA. 16+00
CSX RAILROAD
LOGAN CONCRETE
MARATHON OIL
PROJECT BASELINE
CWL
BRIDGE TO REMAIN
SUBSTATION
RIVER
POST AND PANEL WALL
ANDERSON WHOLESALE
SHONEY'S RESTAURANT
AMERICAN ELECTRIC POWER
2.5H ON 1V
PLAN
PROFILE
SCALE IN FEET
EXISTING GROUND

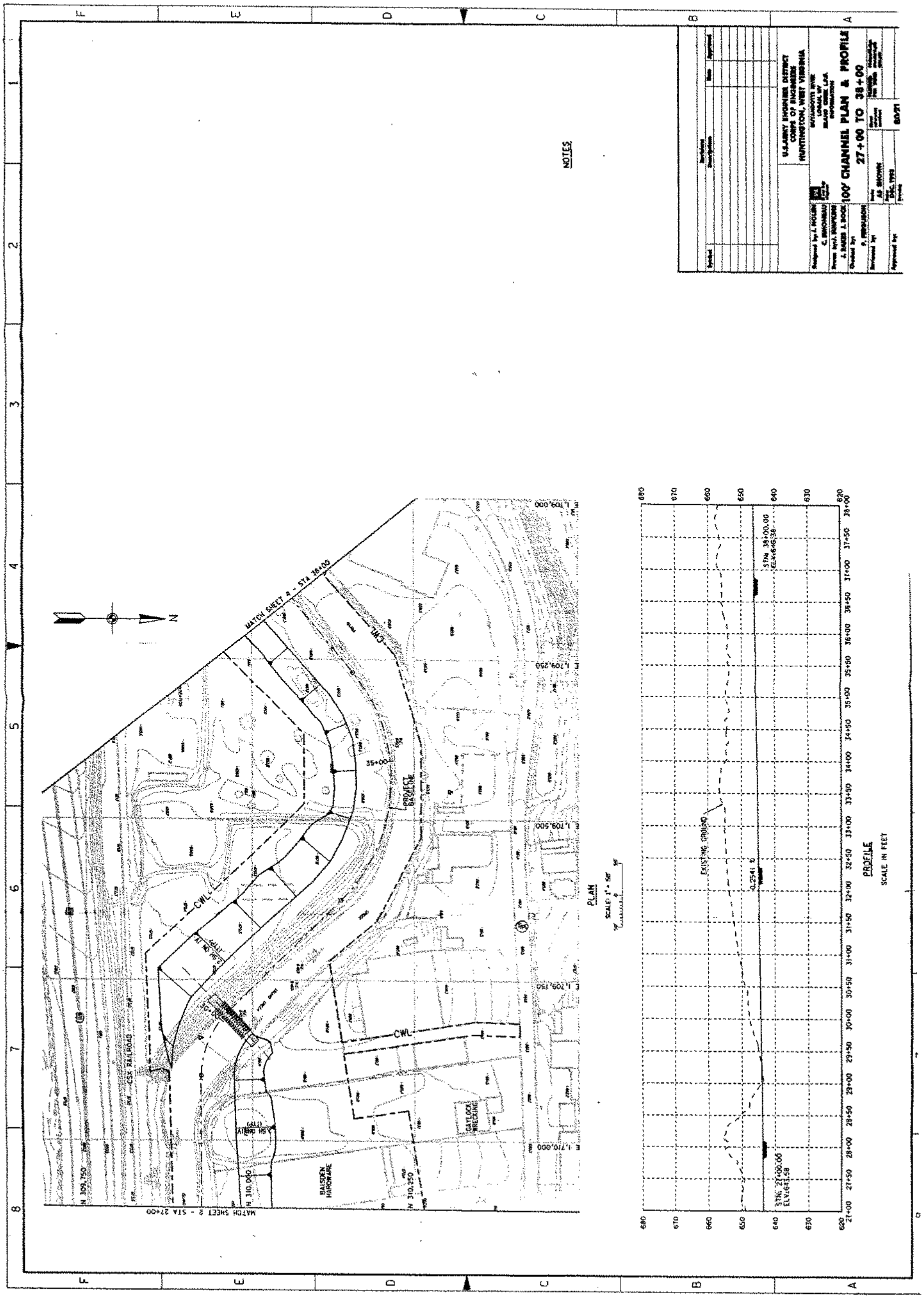

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
80' CHANNEL PLAN & PROFILE
16+00 TO 25+50
NOTES
PLAN
PROFILE
SCALE IN FEET
EXISTING GROUND
MATCH SHEET 1 - STA 16+00
MATCH SHEET 3 - STA 25+50
CSX RAILROAD
SUPER 8 MOTEL
PROJECT BASELINE
CWL


NOTES
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
80' CHANNEL PLAN & PROFILE
25+50 TO 38+00
MATCH SHEET 4 - STA 38+00
MATCH SHEET 2 - STA 25+50
CWL
CSX RAILROAD
PUMP HOUSE
KENNEL
POST AND PANEL WALL
BAISDEN HARDWARE
ADDITIONAL CWL REQUIRED IF POST AND PANEL WALL IS NOT CONSTRUCTED
GAYLOCK WRECKING
PLAN
EXISTING GROUND
PROFILE
SCALE IN FEET

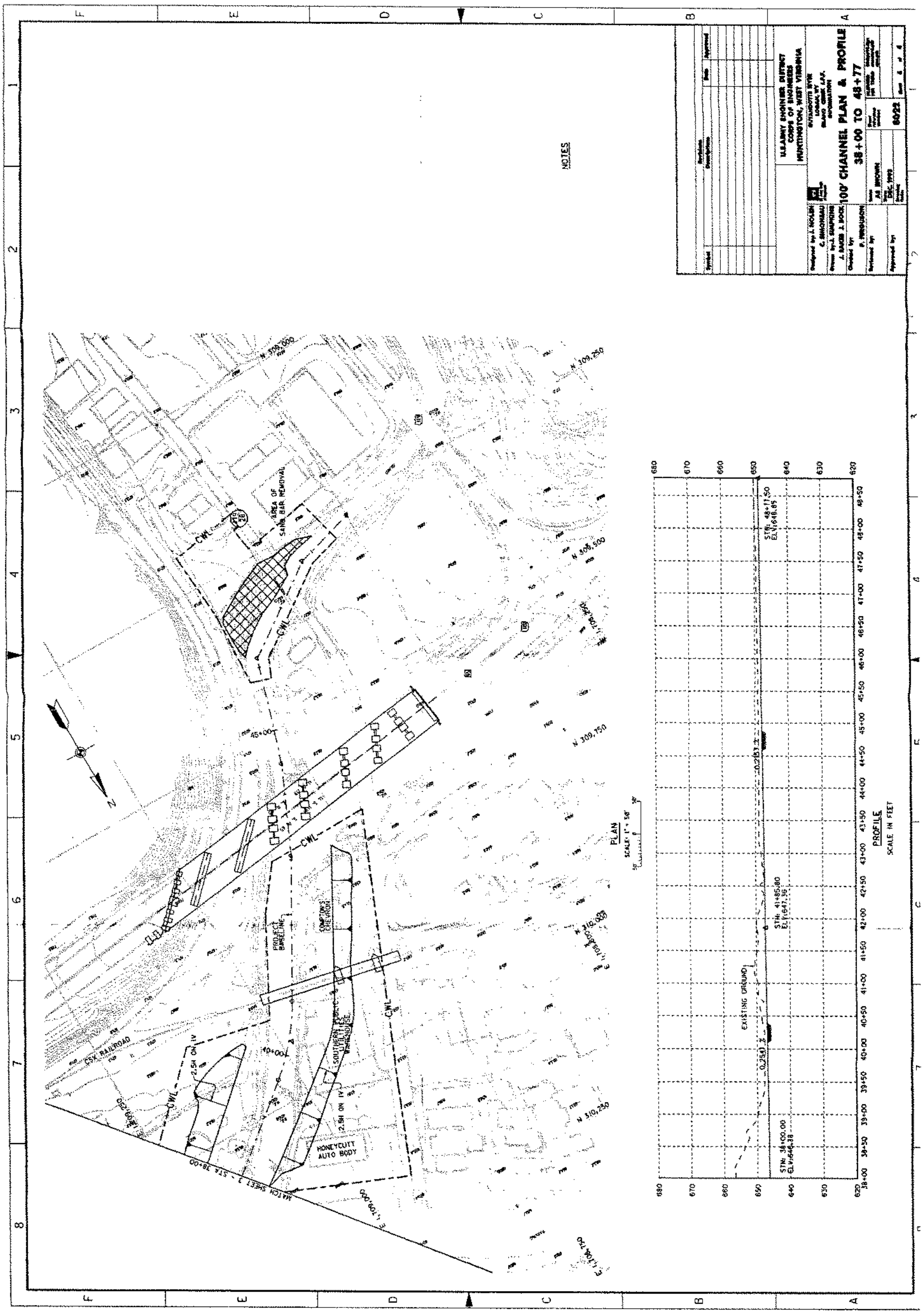

U.S.ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
80' CHANNEL PLAN & PROFILE
38+00 TO 48+50
NOTES
PLAN
PROFILE
SCALE IN FEET
CSX RAILROAD
EXISTING GROUND
AREA OF SAND BAR REMOVAL
COMPTON'S CHEVRON
SOUTHERN PUBLIC UTILITIES WAREHOUSE
HONEYCUTT AUTO BODY
POST AND PANEL WALL
CWL

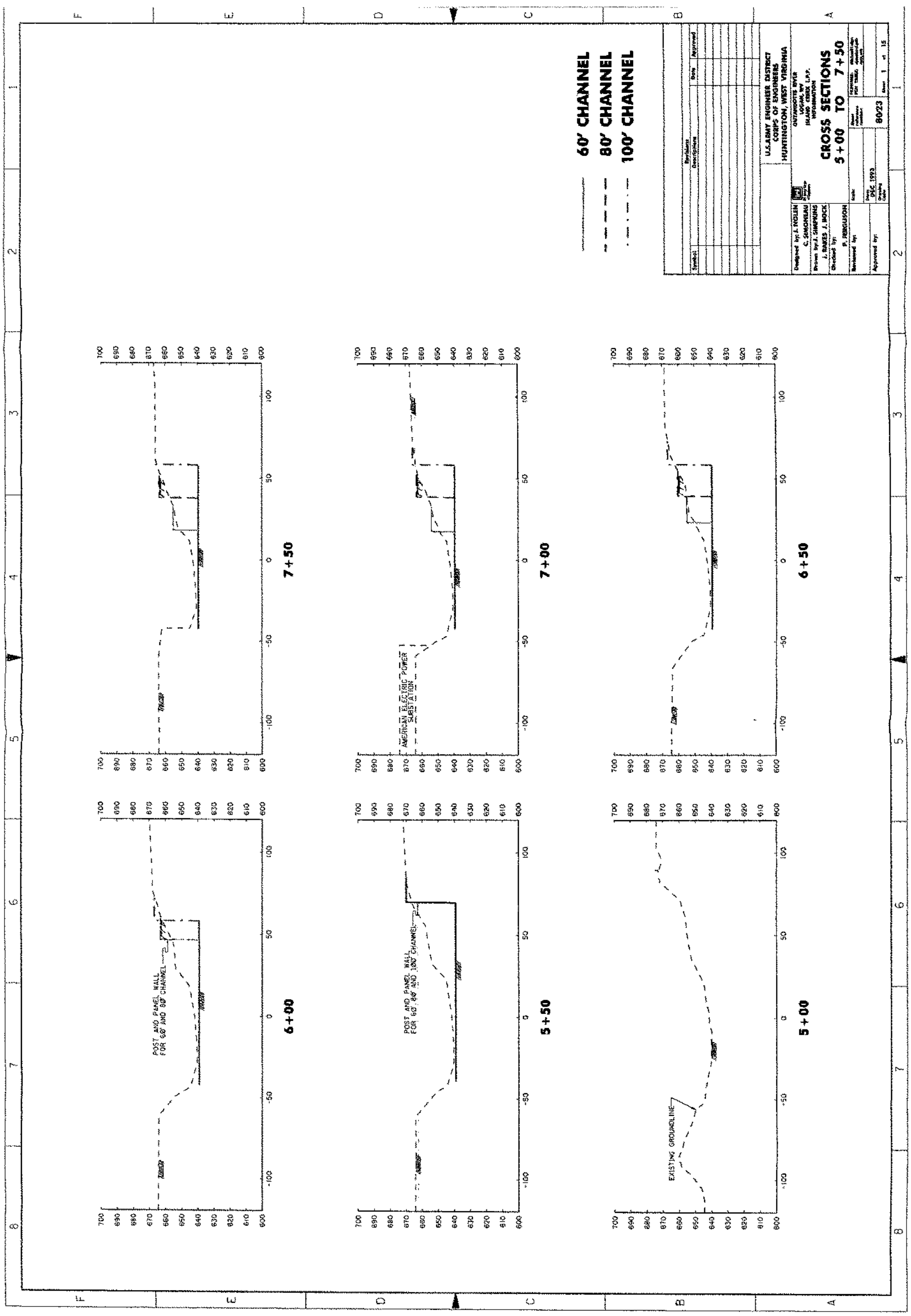

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
100' CHANNEL PLAN & PROFILE
5+00 TO 16+00
NOTES
MATCH SHEET 2 - STA. 16+00
CSX RAILROAD
LOGAN CONCRETE
MARATHON OIL
SHONEY'S RESTAURANT
ANDERSON WHOLESALE
AMERICAN ELECTRIC POWER
POST & PANEL WALL
PROJECT BASELINE
BRIDGE TO BE REMOVED AND REPLACED
SUBSTATION
RIVER
PLAN
PROFILE
SCALE IN FEET
EXISTING GROUND
STN 5+00.00
STN 13+77.28
STN 16+00.00

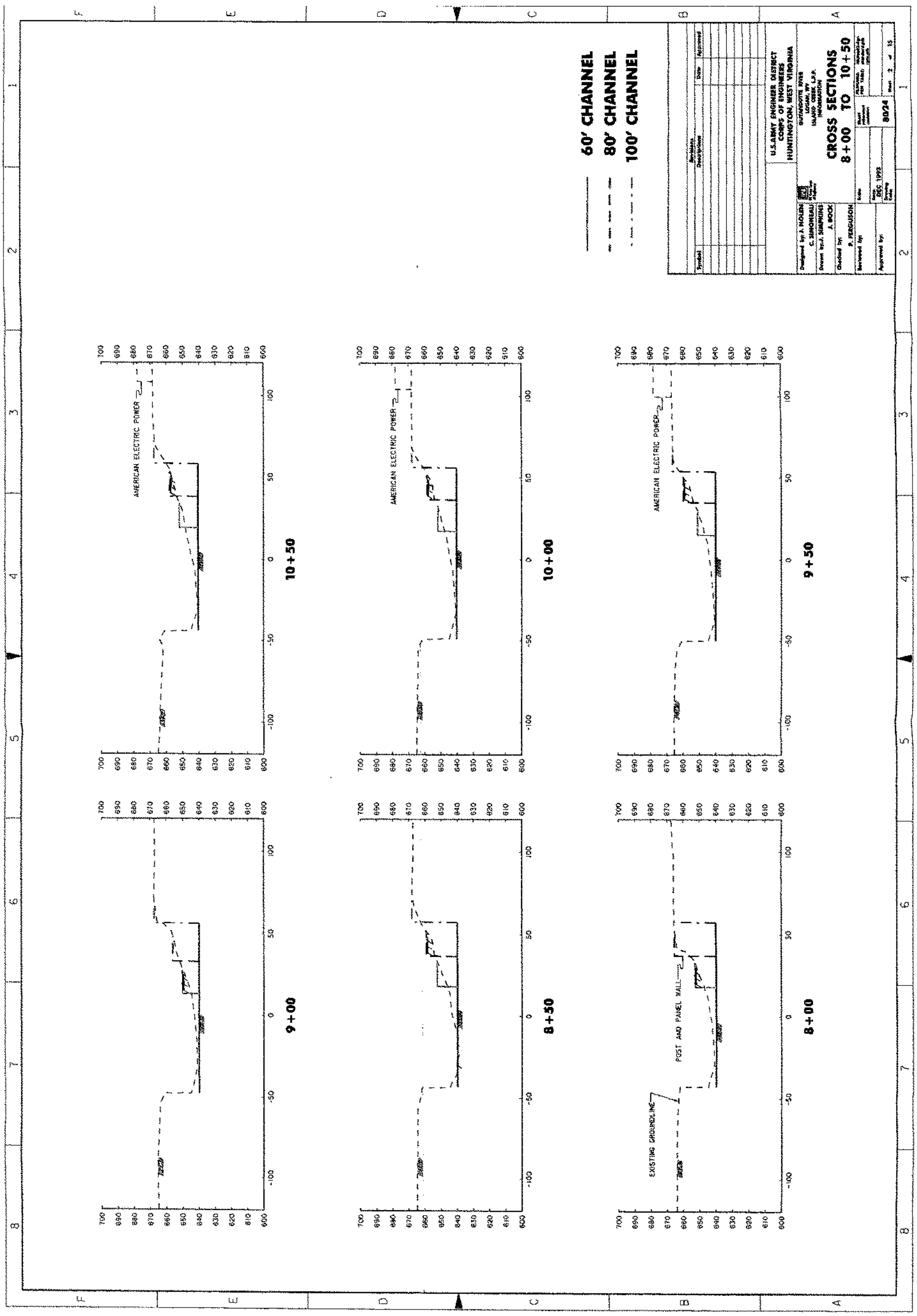

U.S.ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
100' CHANNEL PLAN & PROFILE
16+00 TO 27+00
NOTES
PLAN
PROFILE
SCALE IN FEET
EXISTING GROUND
MATCH SHEET 3 - STA 27+00
MATCH SHEET 1 - STA 16+00
PROJECT BASELINE
CWL
PUMP HOUSE
KENNEL
SUPER MOTEL
CSX RAILROAD
2.5H ON 1V (TYP)
N 310,000
N 310,250
N 309,750
N



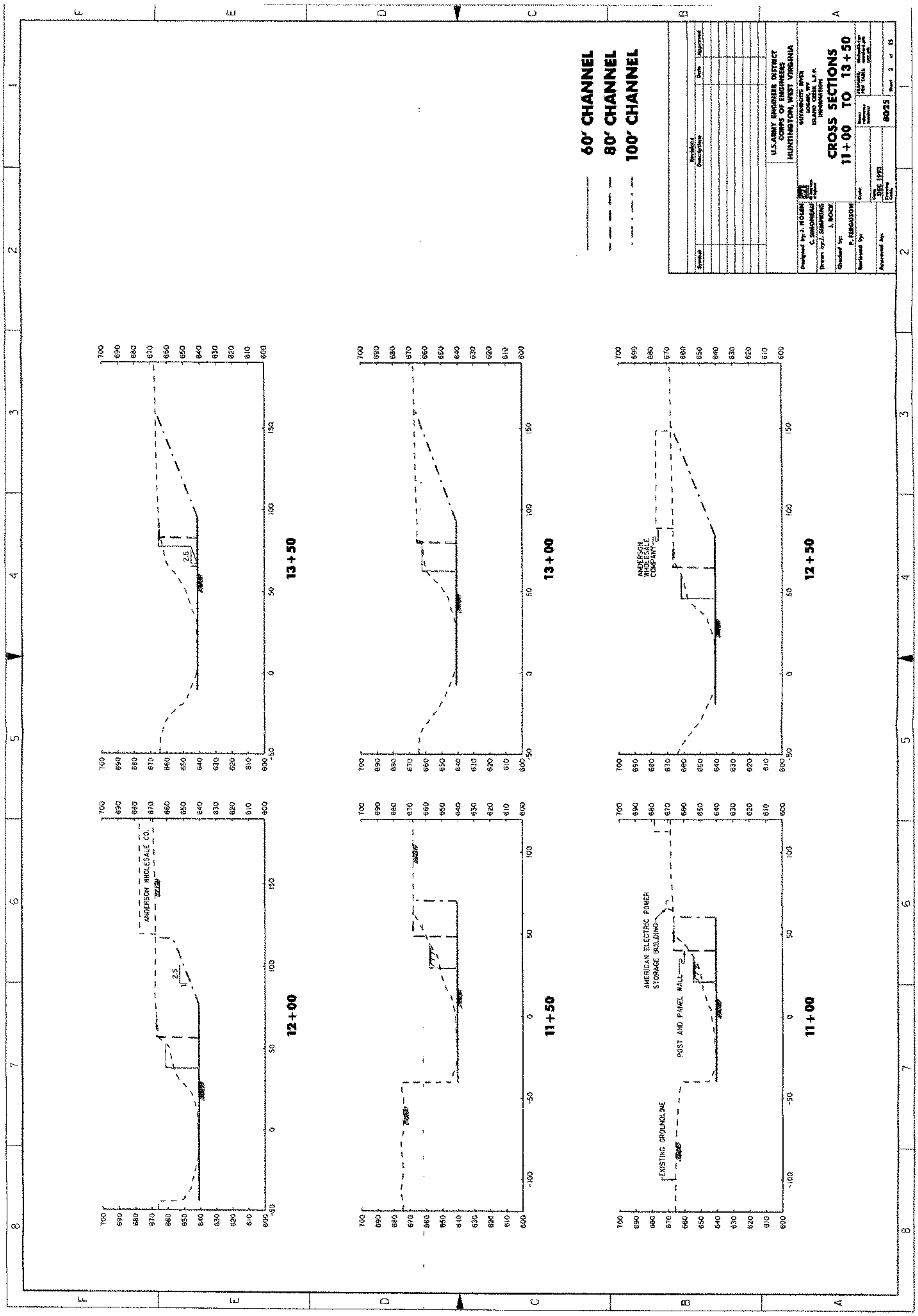
NOTES
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
100' CHANNEL PLAN & PROFILE
27+00 TO 38+00
MATCH SHEET 4 - STA 38+00
MATCH SHEET 2 - STA 27+00
CSX RAILROAD
PROJECT BASELINE
CWL
BAISDEN HARDWARE
PLAN
PROFILE
SCALE IN FEET
EXISTING GROUND

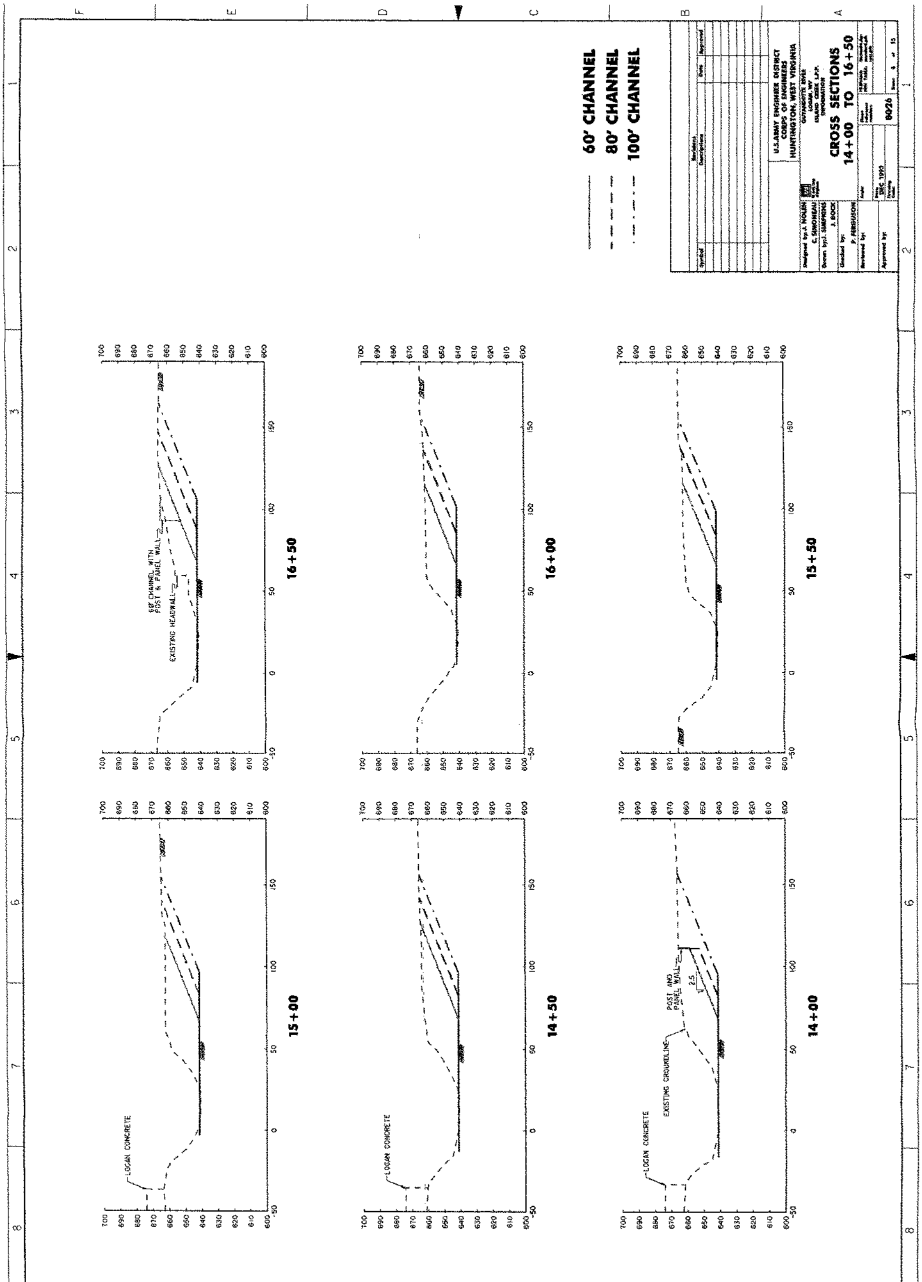

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
100' CHANNEL PLAN & PROFILE
38+00 TO 48+77
6022
NOTES
PLAN
PROFILE
SCALE IN FEET
EXISTING GROUND
CSX RAILROAD
HONEYCUTT AUTO BODY
COMPTON'S CHEVRON
AREA OF SAND BAR REMOVAL
CWL
MATCH SHEET 3 - STA 38+00
STA. 48+11.50
ELV. 648.85
STA. 41+85.80
ELV. 647.36
STA. 38+00.00
ELV. 646.38

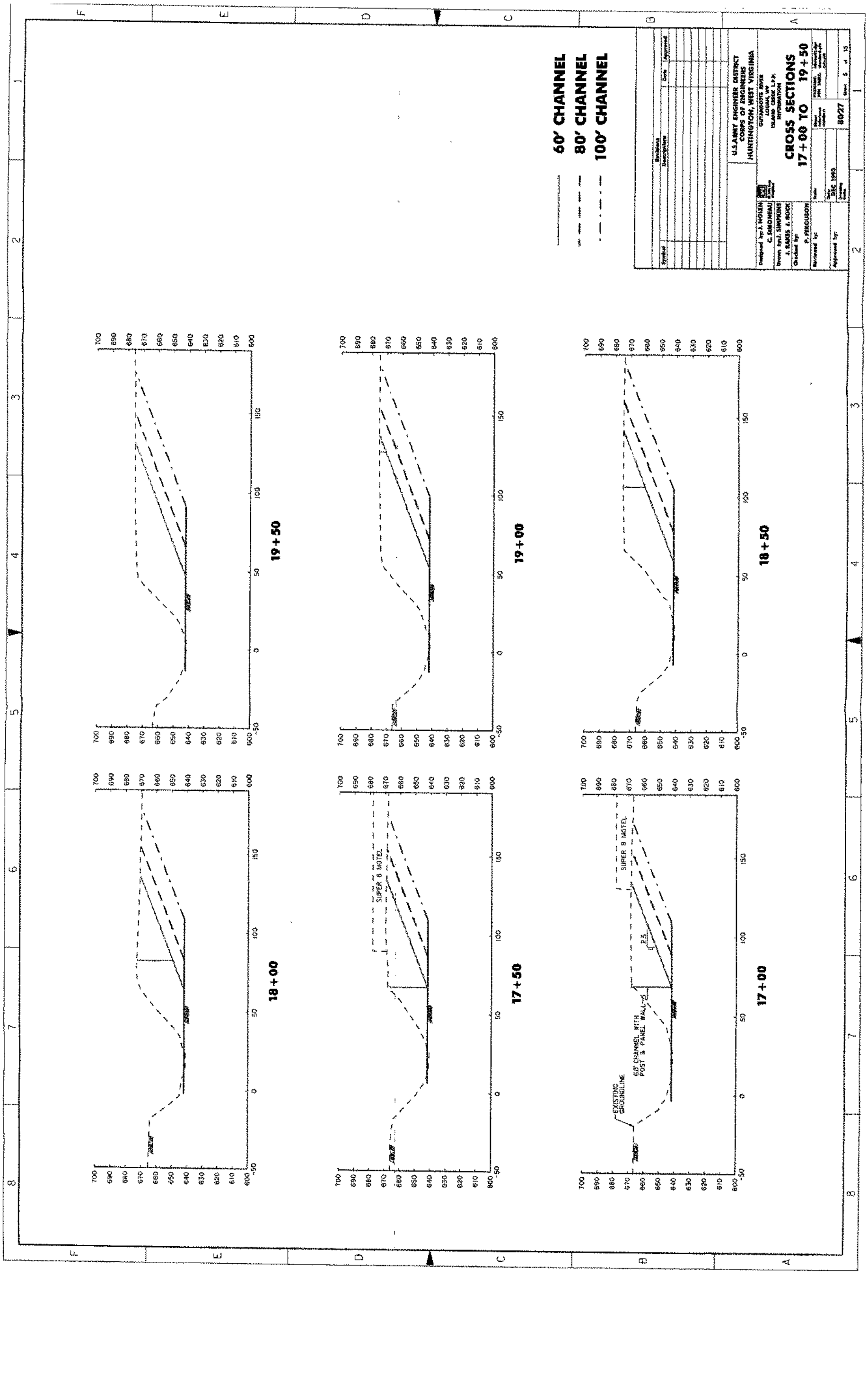

60' CHANNEL
80' CHANNEL
100' CHANNEL
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
CROSS SECTIONS
5+00 TO 7+50
80/23
7+50
7+00
6+50
6+00
5+50
5+00
AMERICAN ELECTRIC POWER SUBSTATION
POST AND PANEL WALL FOR 60' AND 80' CHANNEL
POST AND PANEL WALL FOR 60', 80' AND 100' CHANNEL
EXISTING GROUNDLINE

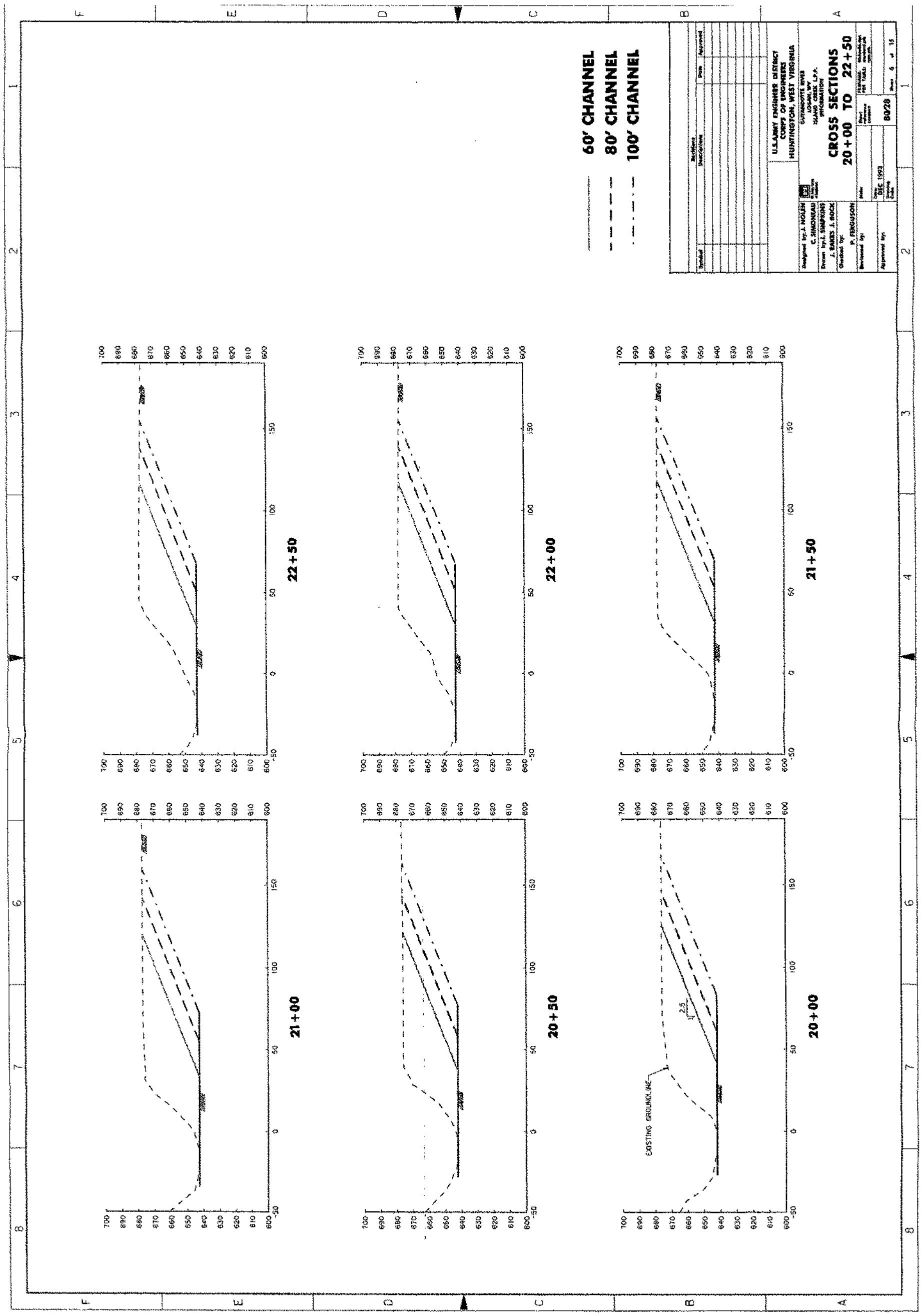


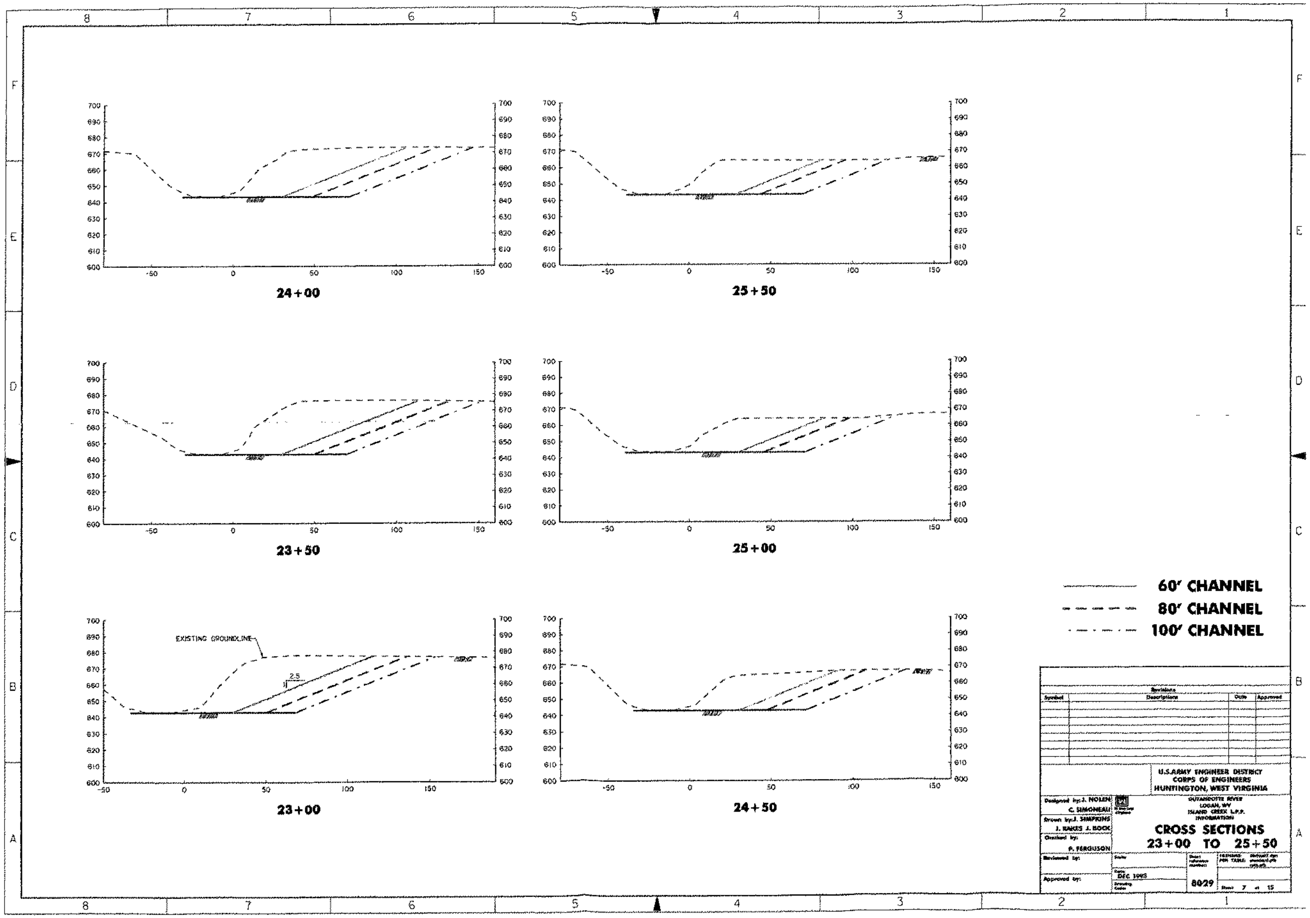
60' CHANNEL
80' CHANNEL
100' CHANNEL
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
CROSS SECTIONS
8+00 TO 10+50
10+50
10+00
9+50
9+00
8+50
8+00
AMERICAN ELECTRIC POWER
POST AND PANEL WALL
EXISTING GROUNDLINE

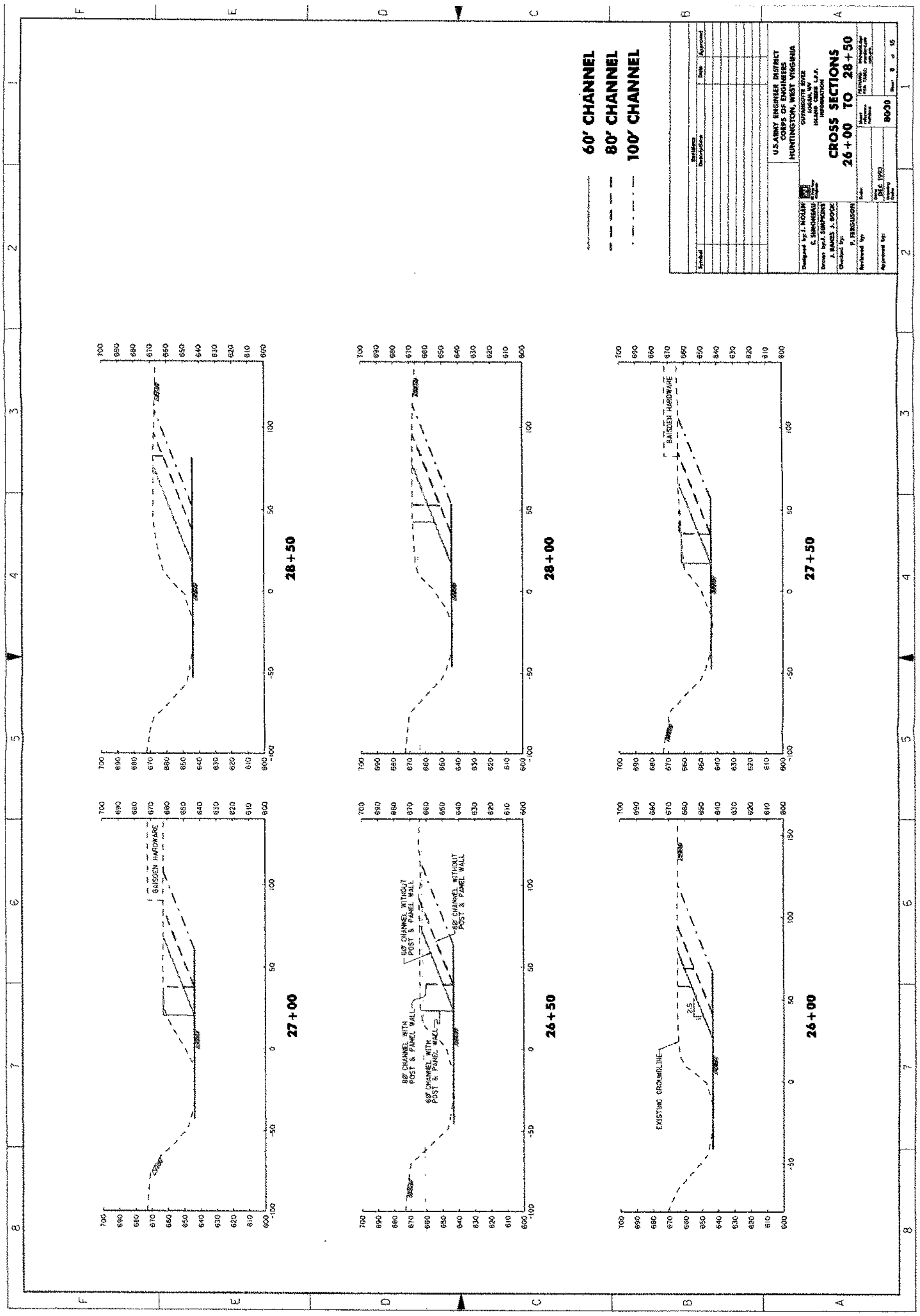

60' CHANNEL
80' CHANNEL
100' CHANNEL
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
CROSS SECTIONS
11+00 TO 13+50
13+50
13+00
12+50
ANDERSON WHOLESALE COMPANY
12+00
ANDERSON WHOLESALE CO.
11+50
11+00
AMERICAN ELECTRIC POWER STORAGE BUILDING
POST AND PANEL WALL
EXISTING GROUNDLINE

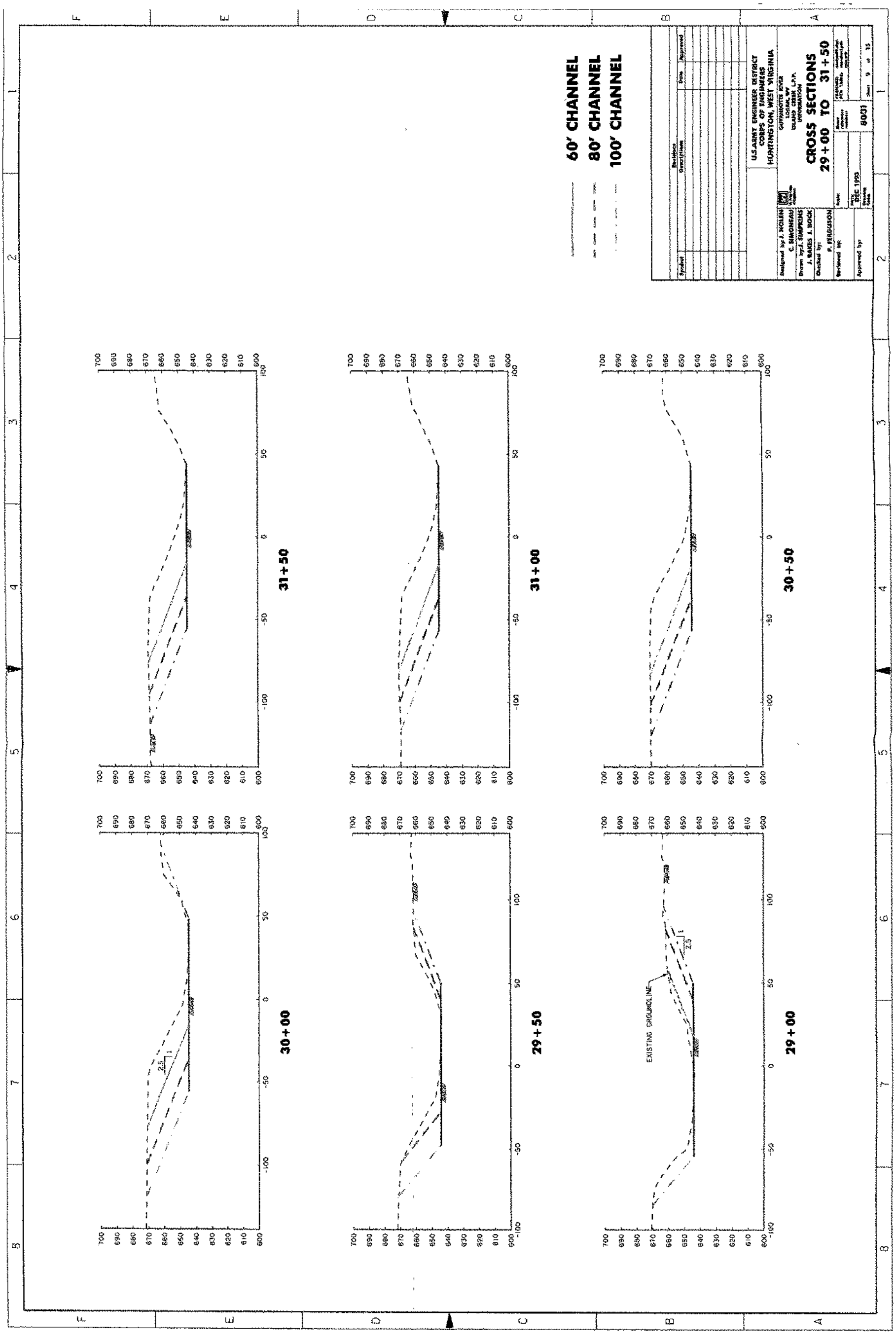

60' CHANNEL
80' CHANNEL
100' CHANNEL
U.S.ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
GUYANDOTTE RIVER
LOGAN, WV
ISLAND CREEK L.P.P.
CROSS SECTIONS
14+00 TO 16+50
Designed by: J. NOLEN
C. SIMONEAU
Drawn by: J. SIMPKINS
J. BOCK
Checked by:
P. FERGUSON
Reviewed by:
Approved by:
Symbol
Description
Date
Approved
DEC 1993
80/26
16+50
16+00
15+50
15+00
14+50
14+00
60' CHANNEL WITH POST & PANEL WALL
EXISTING HEADWALL
LOGAN CONCRETE
EXISTING GROUNDLINE
POST AND PANEL WALL


60' CHANNEL
80' CHANNEL
100' CHANNEL
CROSS SECTIONS
17+00 TO 19+50
19+50
19+00
18+50
18+00
17+50
17+00
SUPER 8 MOTEL
SUPER 8 MOTEL
EXISTING GROUNDLINE
60' CHANNEL WITH POST & PANEL WALL

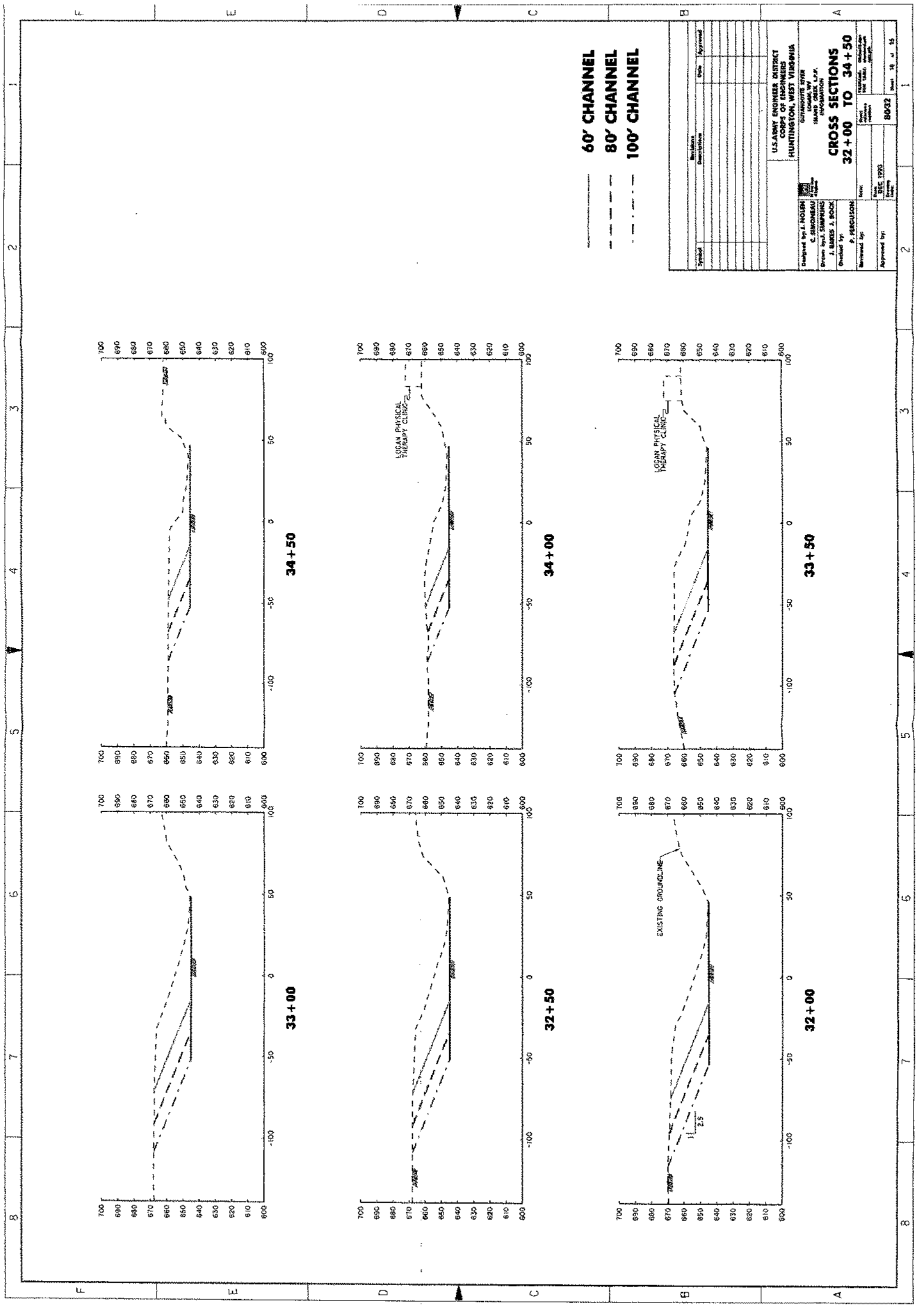

60' CHANNEL
80' CHANNEL
100' CHANNEL
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
CROSS SECTIONS
20+00 TO 22+50
22+50
22+00
21+50
21+00
20+50
20+00
EXISTING GROUNDLINE


24+00
25+50
23+50
25+00
EXISTING GROUNDLINE
23+00
24+50
60' CHANNEL
80' CHANNEL
100' CHANNEL
Revisions
Symbol
Descriptions
Date
Approved
U.S.ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
Designed by: J. NOLEN
C. SIMONEAU
Drawn by: J. SIMPKINS
J. RAKES J. BOCK
Checked by:
P. FERGUSON
Reviewed by:
Approved by:
GUYANDOTTE RIVER
LOGAN, WV
ISLAND CREEK L.P.P.
INFORMATION
CROSS SECTIONS
23+00 TO 25+50
Scale
Date: DEC 1993
Drawing Code
80/29
Sheet 7 of 15

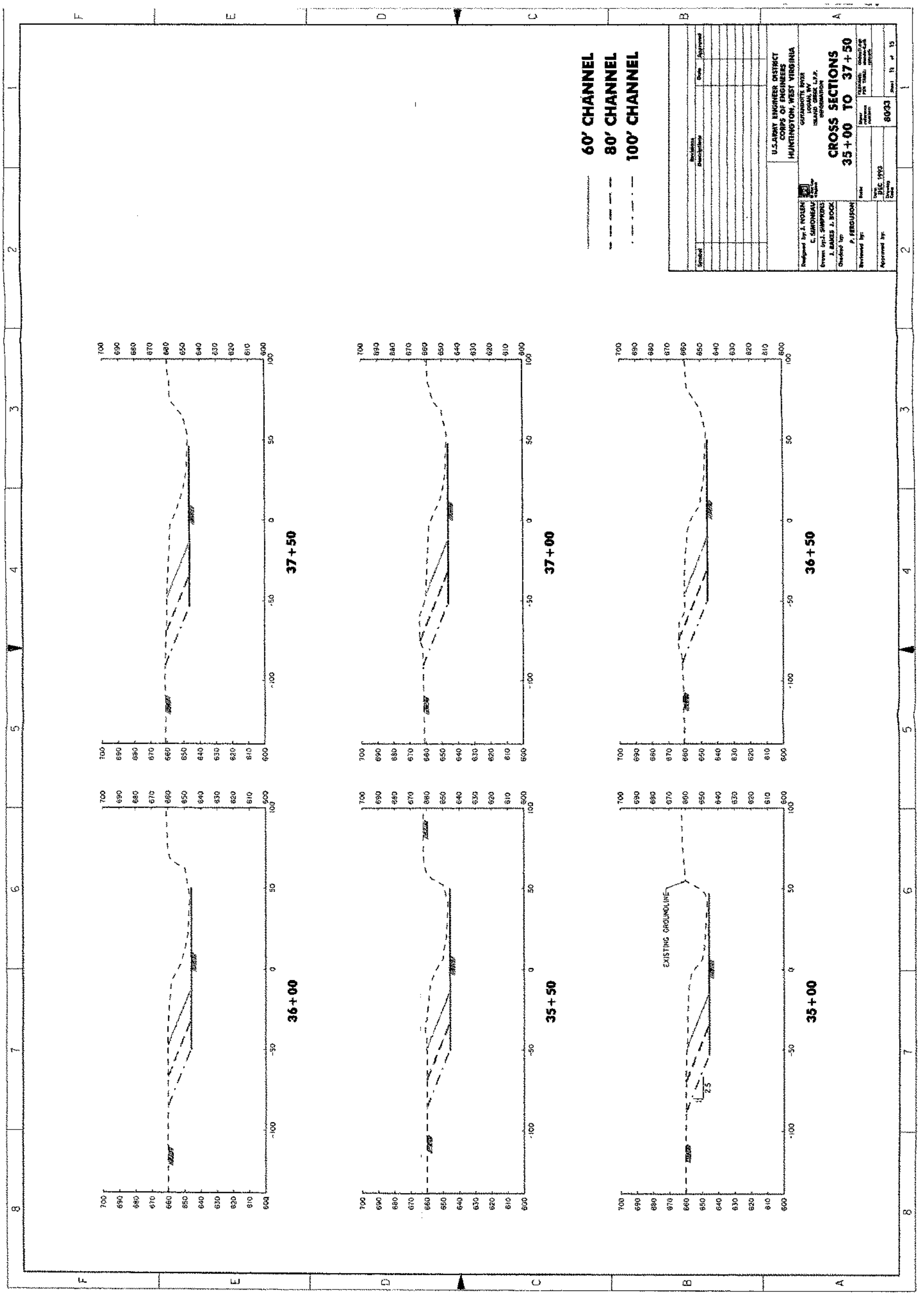

60' CHANNEL
80' CHANNEL
100' CHANNEL
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
CROSS SECTIONS
26+00 TO 28+50
28+50
28+00
27+50
27+00
26+50
26+00
BAISDEN HARDWARE
60' CHANNEL WITHOUT POST & PANEL WALL
80' CHANNEL WITHOUT POST & PANEL WALL
80' CHANNEL WITH POST & PANEL WALL
60' CHANNEL WITH POST & PANEL WALL
EXISTING GROUNDLINE



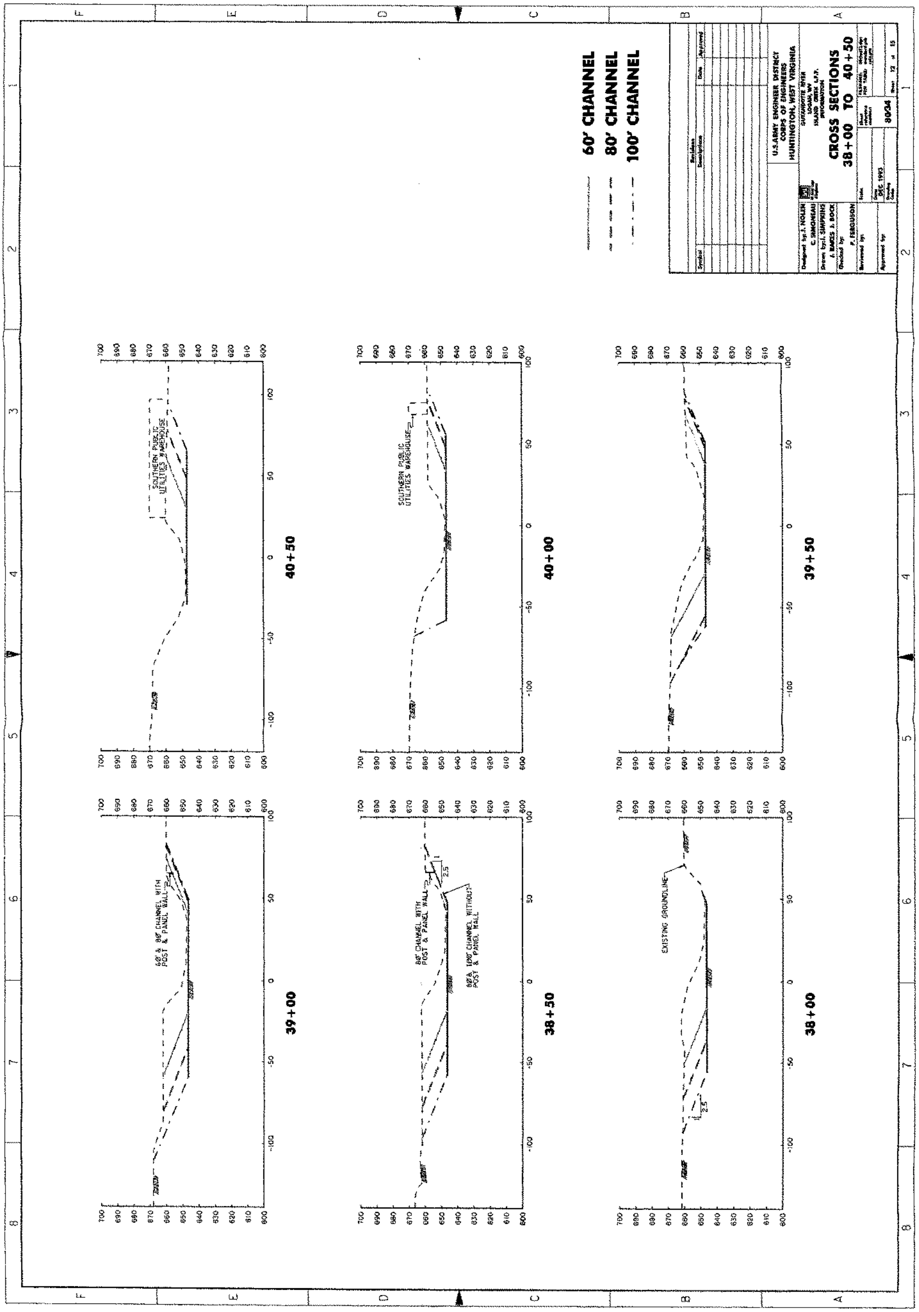
60' CHANNEL
80' CHANNEL
100' CHANNEL
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
CROSS SECTIONS
29+00 TO 31+50
31+50
31+00
30+50
30+00
29+50
29+00
EXISTING GROUNDLINE

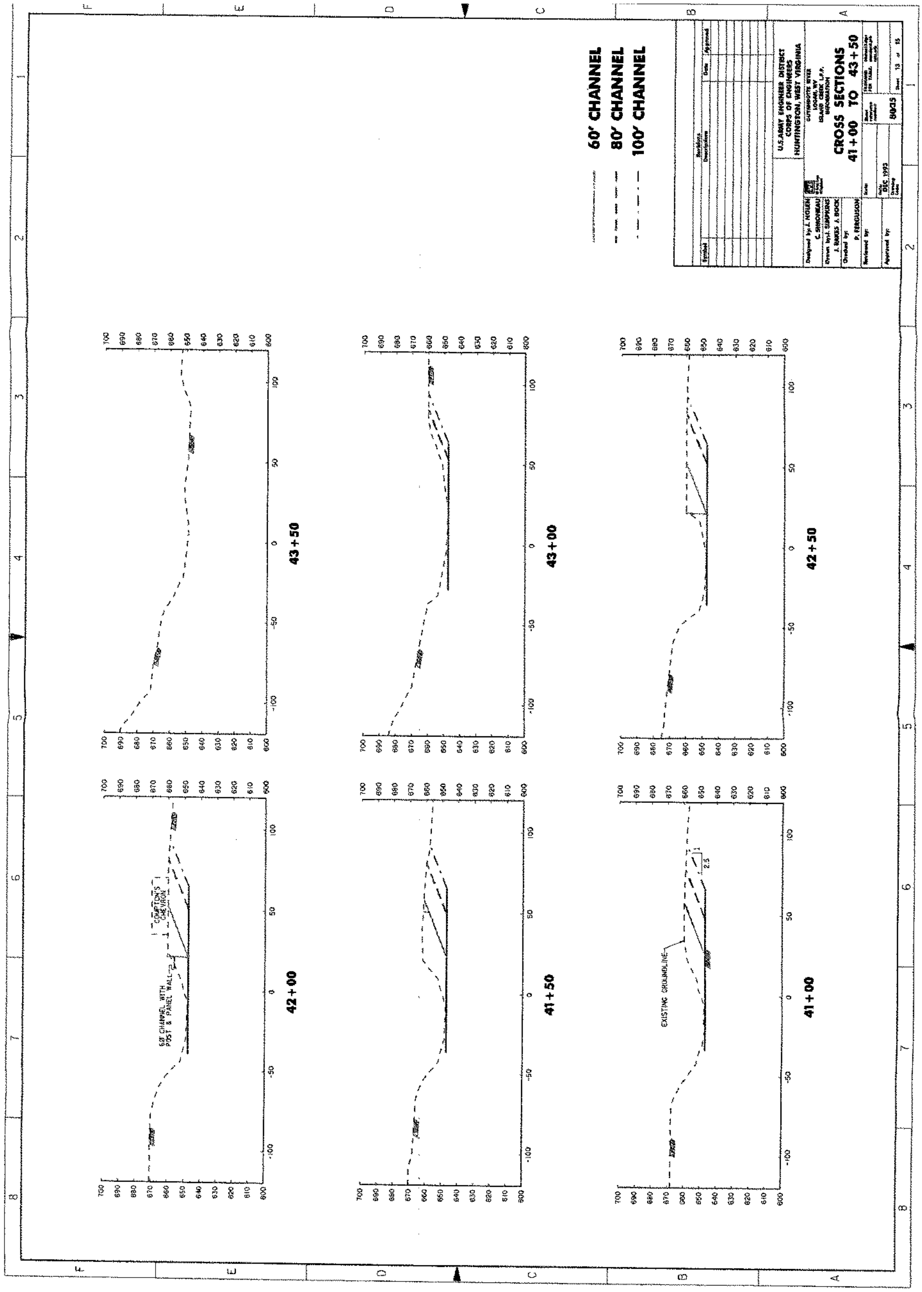


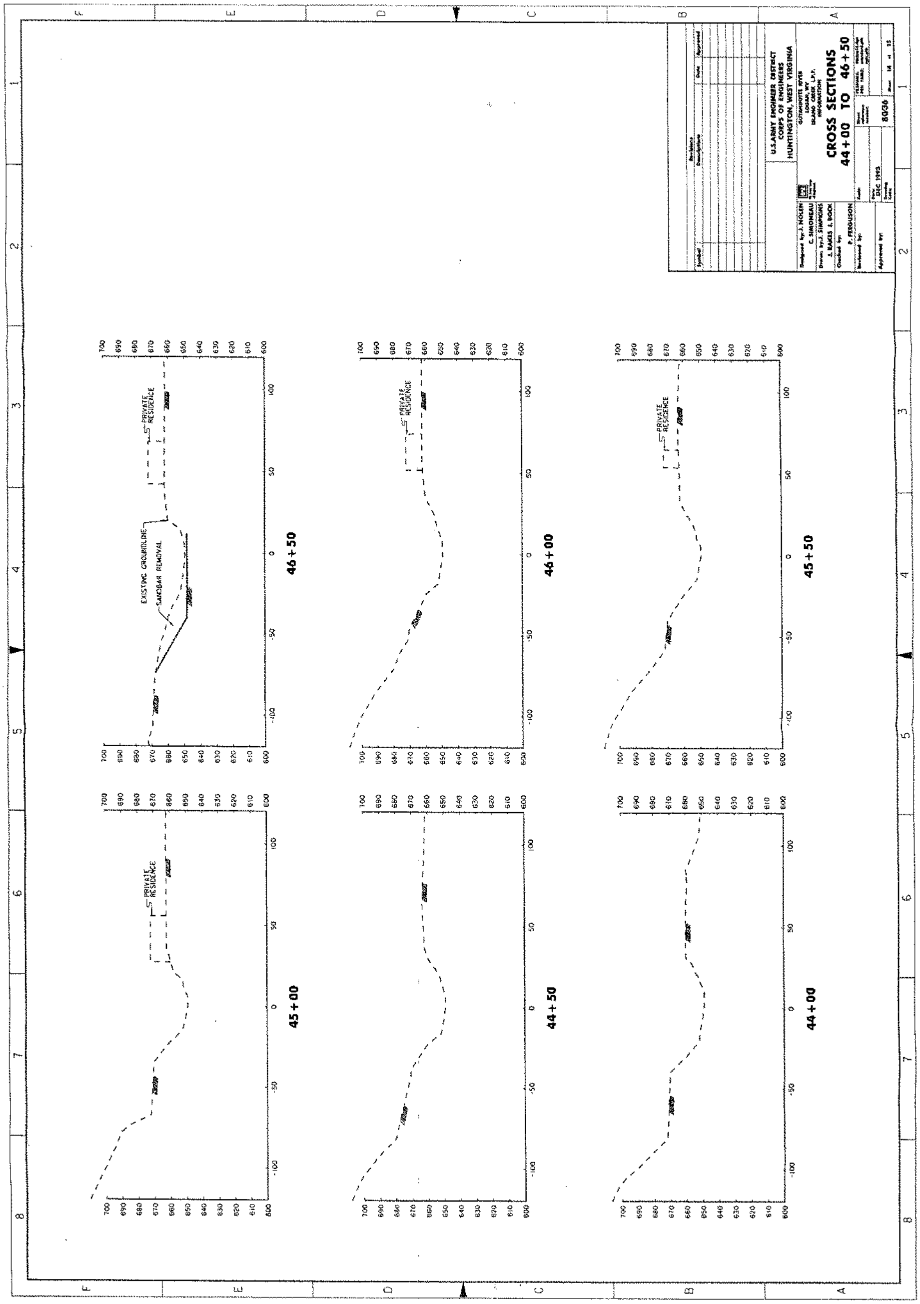
60' CHANNEL
80' CHANNEL
100' CHANNEL
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
CROSS SECTIONS
32+00 TO 34+50
34+50
34+00
33+50
33+00
32+50
32+00
LOGAN PHYSICAL THERAPY CLINIC
EXISTING GROUNDLINE

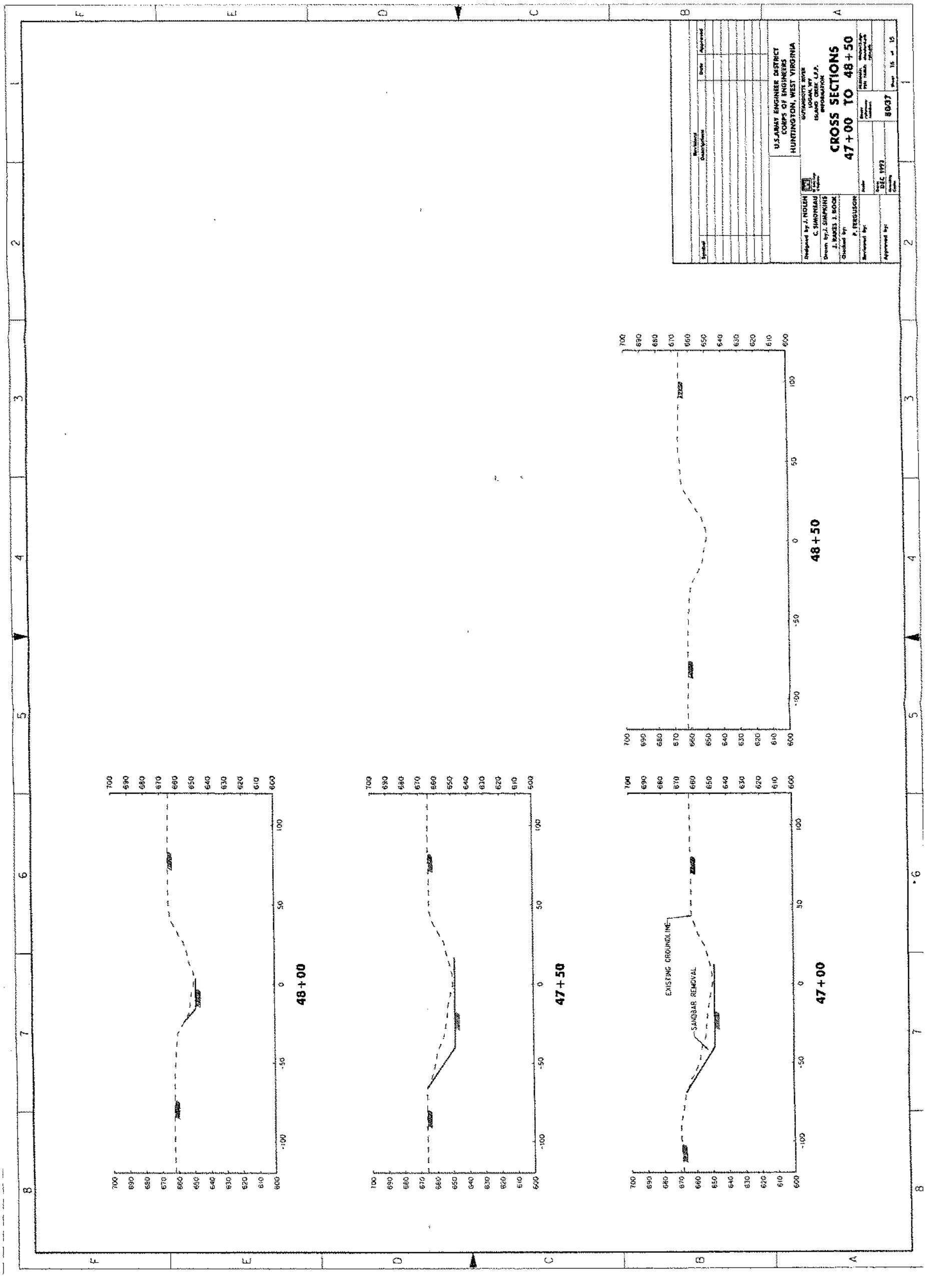


60' CHANNEL
80' CHANNEL
100' CHANNEL
36+00
37+50
35+50
37+00
35+00
36+50
EXISTING GROUNDLINE
2.5
U.S.ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
Designed by: J. NOLEN
C. SIMONEAU
Drawn by: J. SIMPKINS
J. BAKES J. BOCK
Checked by:
P. FERGUSON
Reviewed by:
Approved by:
LOGAN, WV
INFORMATION
CROSS SECTIONS
35+00 TO 37+50
DEC 1993
80/33


60' CHANNEL
80' CHANNEL
100' CHANNEL
39+00
60' & 80' CHANNEL WITH POST & PANEL WALL
40+50
SOUTHERN PUBLIC UTILITIES WAREHOUSE
38+50
80' CHANNEL WITH POST & PANEL WALL
80' & 100' CHANNEL WITHOUT POST & PANEL WALL
40+00
SOUTHERN PUBLIC UTILITIES WAREHOUSE
38+00
EXISTING GROUNDLINE
39+50
U.S.ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
CROSS SECTIONS
38+00 TO 40+50
DEC 1993
80/34


60' CHANNEL
80' CHANNEL
100' CHANNEL
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
CROSS SECTIONS
41+00 TO 43+50
43+50
43+00
42+50
42+00
41+50
41+00
60' CHANNEL WITH POST & PANEL WALL
COMPTON'S CHEVRON
EXISTING GROUNDLINE


U.S.ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
CROSS SECTIONS
44+00 TO 46+50
Designed by: J. NOLEN
C. SIMONEAU
Drawn by: J. SIMPKINS
J. RAKES & BOOK
Checked by:
P. FERGUSON
Reviewed by:
Approved by:
DEC 1993
8036
46+50
EXISTING GROUNDLINE
SANDBAR REMOVAL
PRIVATE RESIDENCE
46+00
45+50
45+00
44+50
44+00


U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
CROSS SECTIONS
47+00 TO 48+50
48+50
48+00
47+50
47+00
EXISTING GROUNDLINE
SANDBAR REMOVAL

ISLAND CREEK

LOCAL PROTECTION PROJECT

ENGINEERING TECHNICAL APPENDIX

TO THE

GENERAL REEVALUATION REPORT

TAB I

STRUCTURAL

Department of the Army
Huntington District, Corps of Engineers
Huntington, West Virginia

TAB I - STRUCTURAL

PAGE:

ISLAND CREEK
LOCAL PROTECTION PROJECT
TAB I
STRUCTURAL NOTES

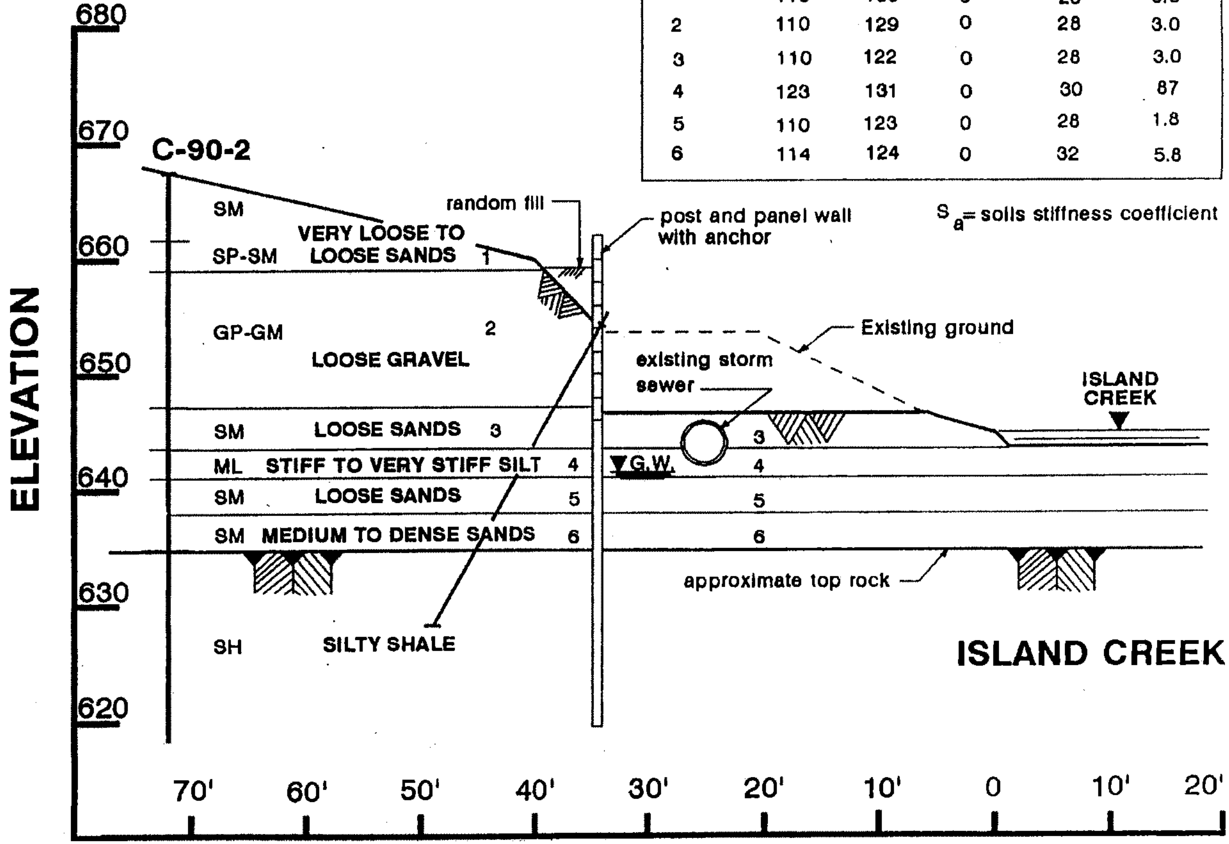
DESIGN

a. **Geotechnical Data.** The structural design calculations of this project were based on assumed geotechnical data. The design of the tieback retaining wall no.1 was based on boring C-90-2, and wall no. 2 was based on field log HTRW 4-9 (See pages A-I-3 and A-I-4). The tieback retaining wall design should be revised according to the latest geotechnical data shown in TAB IV Geotechnical.

b. **Analysis.** The tieback wall was analyzed with the CWALSSI program. CWALSSI is a Finite Element program to analyzed cantilever or anchored sheet pile walls by a soil-structure interaction technique. The output of this program should be verified by an independent analysis.

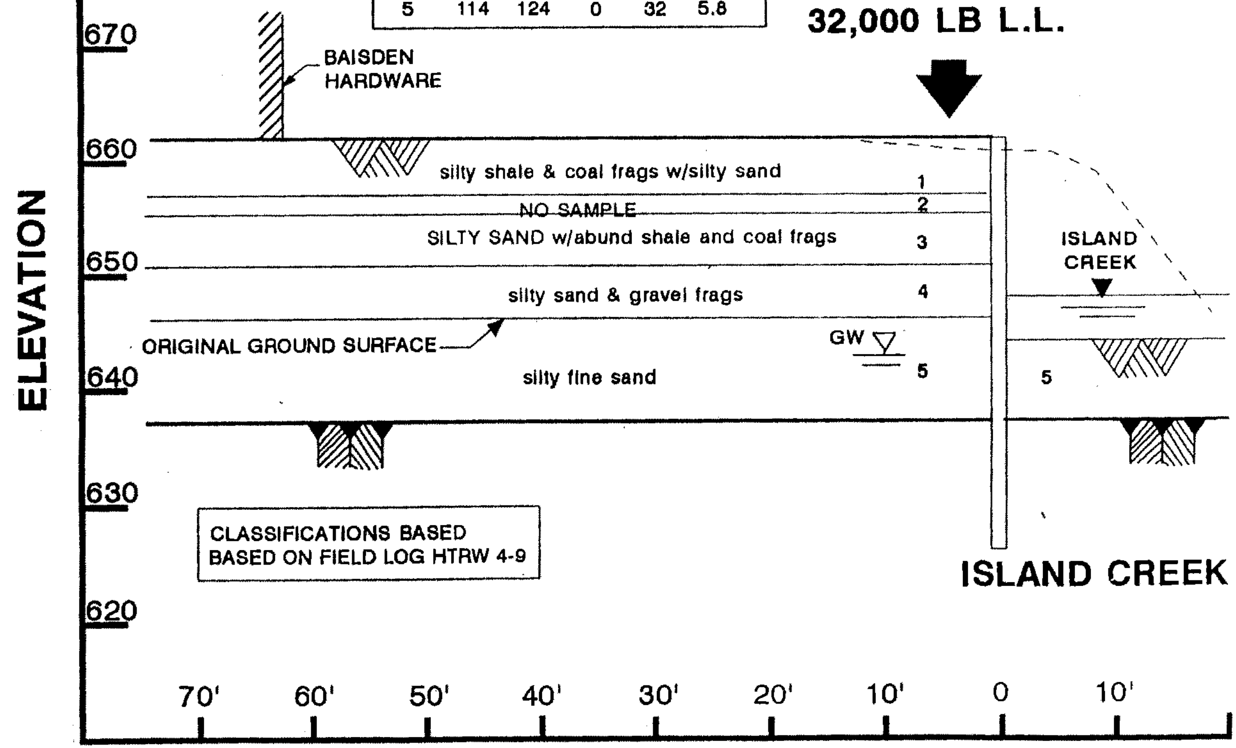
c. **Loading Conditions.** Assumptions made on the loading conditions (See page A-I-5) in regard to drainage were conservative. It was assumed that soil would drain slowly in case of a sudden drop in the water table.

d. **Quantities.** Pages A-I-8 thru A-I-11 show the material quantities per typical wall section used on each wall. The total material quantities per wall are shown on pages A-I-11 thru A-I-12

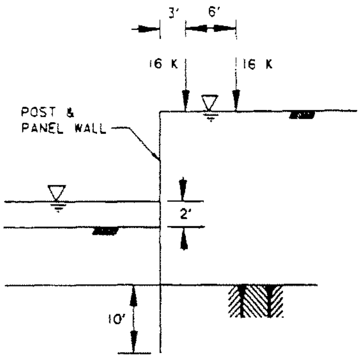


MAT.	γ_m lb/ft³	γ_s lb/ft³	C lbf/ft²	ϕ °	S_a lb/in³
1	110	136	0	28	3.0
2	110	129	0	28	3.0
3	110	122	0	28	3.0
4	123	131	0	30	87
5	110	123	0	28	1.8
6	114	124	0	32	5.8

MAT.	γ_m (lb/ft³)	γ_s (lb/ft³)	C (lb/ft²)	Ø°	S_a (lb/in³)
1	114	129	0	32	5.8
2	110	136	0	28	5.8
3	114	124	0	32	5.8
4	114	124	0	32	5.8
5	114	124	0	32	5.8



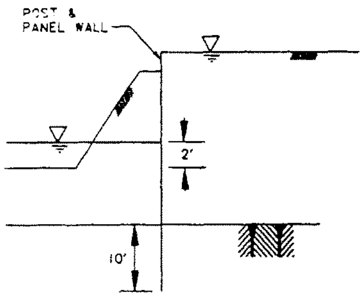
LOADING CASE #1



NOTES

WATER AT THE TOP GROUND SURFACE ON THE RIGHT SIDE AND 2' ABOVE THE CREEK BOTTOM ON THE LEFT SIDE.
WITH ONE OR TWO ANCHORS.
TWO LIVE LOADS OF 16K EACH APPLIED 3' AND 9' FROM THE FACE OF THE WALL.
TOP 4' OF ROCK NEGLECTED DUE TO THE FACT THAT IT IS WEATHERED.

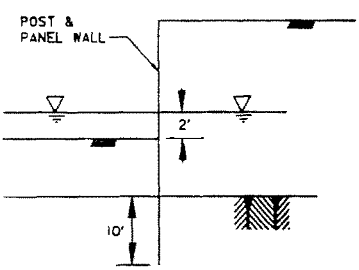
LOADING CASE #2



NOTES

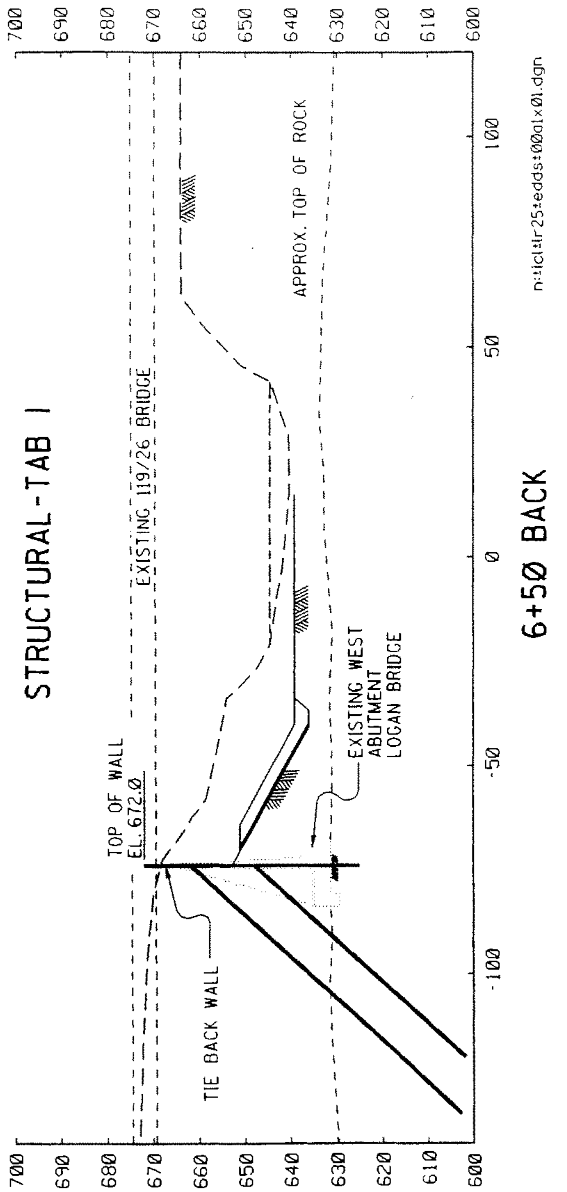
WATER AT THE TOP GROUND SURFACE ON THE RIGHT SIDE AND 2' ABOVE THE CREEK BOTTOM ON THE LEFT SIDE.
NO ANCHORS. SOIL ON LEFT SIDE BEING REMOVED TO INSTALL PANELS AND FIRST ANCHOR.
TOP 4' OF ROCK NEGLECTED DUE TO THE FACT THAT IT IS WEATHERED.

LOADING CASE #3

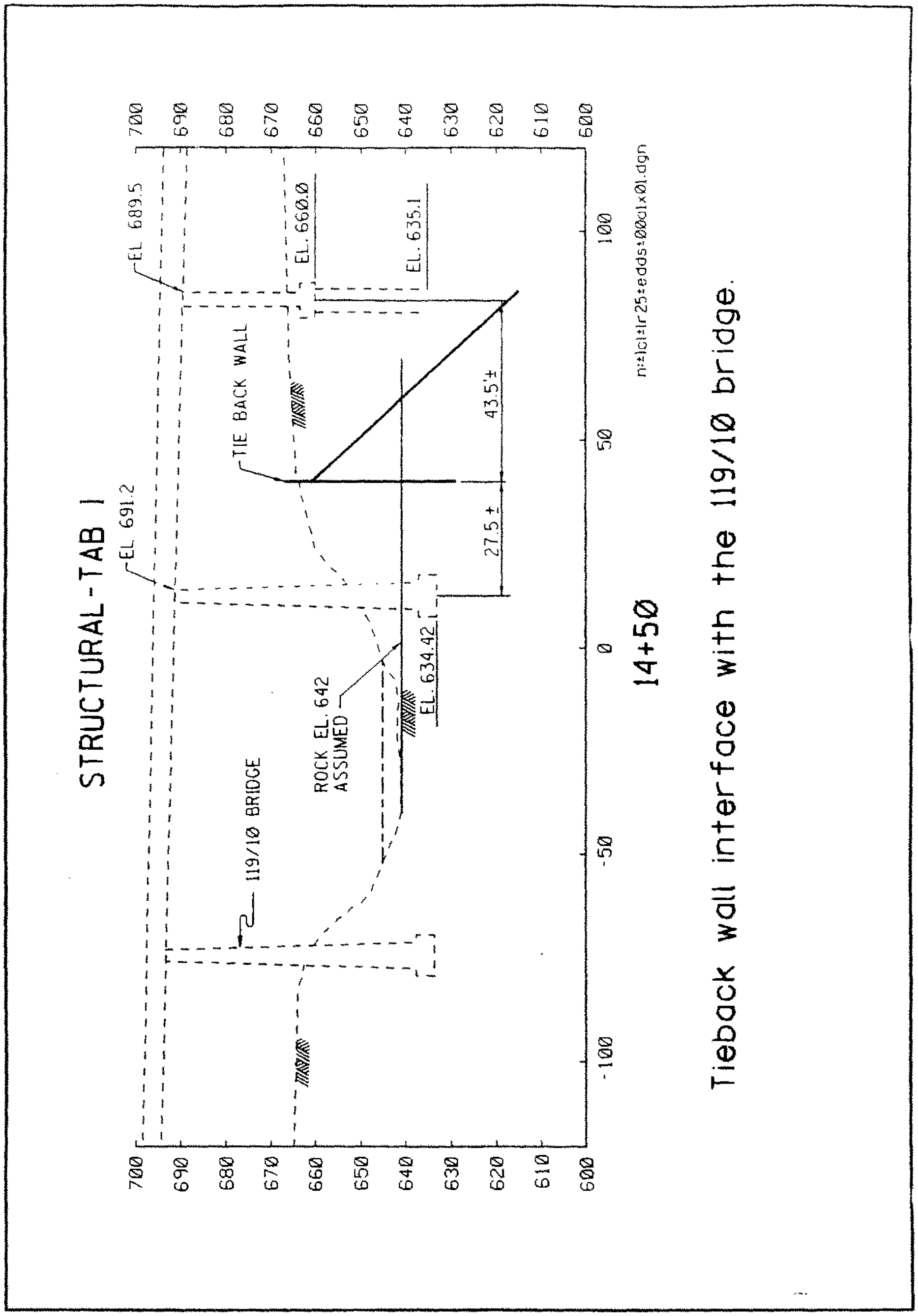


NOTES

WATER AT 2' ABOVE THE CREEK BOTTOM ON BOTH SIDES OF THE WALL.
WITH ONE OR TWO ANCHORS.
TOP 4' OF ROCK NEGLECTED DUE TO THE FACT THAT IT IS WEATHERED.



Tiebackwall interface with the 119/26 bridge.



Tieback wall interface with the 119/10 bridge.

8 OCT 93 PJL
ED-DS

ISLAND CREEK L.P.P., LOGAN, WV
WALL I - QUANTITIES/SECTION

NO.	ITEM	MATERIAL	TOTAL	
	WALL I (APCO BLD.)			
	STA. 0+00 TO 9+9.28			
	*** 32 FT. SECTION ***			
	W14 X 120	A-588	47	LF.
	PILES BORINGS:			
	30" DIA. BORINGS IN ROCK	-	10	LF.
	30" DIA. BORINGS IN OVERBURD	-	37	LF.
	ANCHORS:			
	1 3/8" DIA.	A-722	85	LF.
	1 3/4" DIA.	A-722	57	LF.
	ANCHORS BORINGS:			
	6" DIA. BOR.-1 3/8"-ROCK		40	LF.
	6" DIA. BOR-1 3/8"-OVERBUR.		39.6	LF.
	8" DIA. BOR. FOR 1 3/4"-ROCK	-	35	LF.
	8" DIA. BOR. FOR 1 3/4"-OVERBU	-	17	LF.
	WALES:			
	MC10X22	A-588	68	LF.
	LACING PLATES:			
	.5" X 4" X 7" @ 1.33'	A-588		LB.
	PEDESTAL:			
	W12 X 87	A-588	1.33	LF.
	CONCRETE PANELS:			
	PANEL: 5.33' X 2.0' X 0.67'	fc'3000	17	/SPAN
	FILLET WELD:	-	620	IN./PILE
	*** 26 FT. SECTION ***			
	W14 X 283	A-588	41	LF.
	PILES BORINGS:			
	30" DIA. BORINGS IN ROCK	-	10	LF.
	30" DIA. BORINGS IN OVERBURD	-	31	LF.
	ANCHORS:			
	1 3/4" DIA.	A-722	69	LF.
	ANCHORS BORINGS:			
	8" DIA. BOR. FOR 1 3/4"-ROCK	-	35	LF.
	8" DIA. BOR. FOR 1 3/4"-OVERBU	-	28.3	LF.
	WALES:			
	MC18X42.7	A-588		LF.
	LACING PLATES:			
	.5" X 4" X 7" @ 1.33'	A-588		LB.
	PEDESTAL:			
	W12 X 87	A-588	1.33	LF.
	CONCRETE PANELS:			
	PANEL: 5.33' X 2.0' X 0.67'	fc'3000	14	/SPAN
	FILLET WELD:	-	620	IN./PILE

ISLAND CREEK L.P.P.,LOGAN,WV
WALL I - QUANTITIES/SECTION - CONT.

NO.	ITEM	MATERIAL	TOTAL	
	*** 20 FT. SECTION ***			
	W14 X 283	A-588	35	LF.
	PILES BORINGS:			
	30" DIA. BORINGS IN ROCK	-	10	LF.
	30" DIA. BORINGS IN OVERBURD	-	25	LF.
	ANCHORS:			
	1 3/4" DIA.	A-722	62	LF.
	ANCHORS BORINGS:			
	8" DIA. BOR. FOR 1 3/4"-ROCK	-	34	LF.
	8" DIA. BOR. FOR 1 3/4"-OVERBU	-	22.63	LF.
	WALES:			
	MC18X42.7	A-588		LF.
	LACING PLATES:			
	.5" X 4" X 7" @ 1.33'	A-588		LB.
	PEDESTAL:			
	W12 X 87	A-588	1.33	LF.
	CONCRETE PANELS:			
	PANEL: 5.33' X 2.0' X 0.67'	fc'3000	11	/SPAN
	FILLET WELD:	-	620	IN./PILE
	*** 8 FT. SECTION ***			
	W14X193	A-588	31	LF.
	PILES BORINGS:			
	30" DIA. BORINGS IN ROCK	-	1	LF.
	30" DIA. BORINGS IN OVERBURD	-	30	LF.
	CONCRETE PANELS:			
	PANEL: 5.33' X 2.0' X 0.67'	fc'3000	11	/SPAN

ISLAND CREEK L.P.P.,LOGAN,WV
WALL II- QUANTITIES/SECTION

NO.	ITEM	MATERIAL	TOTAL
	WALL II - BAIDEN HARWARE (STA. 0+0.82 TO 3+66.82)		
	*** 8 FT. SECTION ***		
	W14X193	A-588	31 LF.
	PILES BORINGS:		
	30" DIA. BORINGS IN ROCK	-	1 LF.
	30" DIA. BORINGS IN OVERBURD	-	30 LF.
	CONCRETE PANELS:		
	PANEL: 5.33' X 2.0' X 0.67'	fc'3000	11 /SPAN
	*** 20 FT. SECTION ***		
	W14 X 283	A-588	35 LF.
	PILES BORINGS:		
	30" DIA. BORINGS IN ROCK	-	10 LF.
	30" DIA. BORINGS IN OVERBURD	-	25 LF.
	ANCHORS:		
	1 3/4" DIA.	A-722	62 LF.
	ANCHORS BORINGS:		
	8" DIA. BOR. FOR 1 3/4"-ROCK	-	34 LF.
	8" DIA. BOR. FOR 1 3/4"-OVERBU	-	22.63 LF.
	WALES:		
	MC18X42.7	A-588	LF.
	LACING PLATES:		
	.5" X 4" X 7" @ 1.33'	A-588	LB.
	PEDESTAL:		
	W12 X 87	A-588	1.33 LF.
	CONCRETE PANELS:		
	PANEL: 5.33' X 2.0' X 0.67'	fc'3000	11 /SPAN
	FILLET WELD:	-	620 IN./PILE
	*** 26 FT. SECTION ***		
	W14 X 283	A-588	41 LF.
	PILES BORINGS:		
	30" DIA. BORINGS IN ROCK	-	10 LF.
	30" DIA. BORINGS IN OVERBURD	-	31 LF.
	ANCHORS:		
	1 3/4" DIA.	A-722	69 LF.
	ANCHORS BORINGS:		
	8" DIA. BOR. FOR 1 3/4"-ROCK	-	35 LF.
	8" DIA. BOR. FOR 1 3/4"-OVERBU	-	28.3 LF.
	WALES:		
	MC18X42.7	A-588	LF.
	LACING PLATES:		
	.5" X 4" X 7" @ 1.33'	A-588	LB.
	PEDESTAL:		
	W12 X 87	A-588	1.33 LF.
	CONCRETE PANELS:		
	PANEL: 5.33' X 2.0' X 0.67'	fc'3000	14 /SPAN
	FILLET WELD:	-	620 IN./PILE

30 SEP 93 PJL
ED-DS

ISLAND CREEK L.P.P.,LOGAN,WV
WALL I - TOTAL QUANTITIES

NO.	ITEM	MATERIAL	TOTAL	
	PILES:			
8	W14X120	A-588	322	LF.
25	W14X193	A-588	854	LF.
112	W14X283	A-588	4515	LF.
	PILES BORINGS:			
145	30" DIA. BORINGS IN ROCK	-	1487	LF.
145	30" DIA. BORINGS IN OVERBURD	-	4245	LF.
	ANCHORS:			
	1 3/8" DIA.	A-722	680	LF.
	1 3/4" DIA.	A-722	9845	LF.
	ANCHORS BORINGS:			
	6" DIA. BOR. FOR 1 3/8" ANCHOR			
8	8 BORINGS:OVERBURDEN	-	317	LF.
8	8 BORINGS: ROCK	-	320	LF.
	8" DIA. BOR. FOR 1 3/4" ANCHORS			
146	146 BORINGS:OVERBURDEN	-	3876	LF.
146	146 BORINGS:ROCK		4841	LF.
	WALES:			
	MC10X22	A-588	68	LF.
	MC18X42.7	A-588	1687	LF.
	LACING PLATES:			
	.5" X 4" X 7" @ 1.33'	A-588	6400	LB.
	PEDESTAL:			
	W12 X 87	A-588	204	LF.
	CONCRETE PANELS:			
1806	AREA COVERED:21396. SF.	fc'3000	766	TONS
	FILLET WELD:	-	3848	FT.

II

30 SEP 93

PJL
ED-DS

ISLAND CREEK,WV
WALL II - TOTAL QUANTITIES

NO.	ITEM	MATERIAL	TOTAL	
	PILES:			
35	W14X193	A-588	1278	LF.
28	W14X283	A-588	1085	LF.
	PILES BORINGS:			
63	30" DIA. BORINGS IN ROCK	-	549	LF.
63	30" DIA. BORINGS IN OVERBURD	-	1843	LF.
	ANCHORS:			
45	1 3/4" DIA.	A-722	2957	LF.
	ANCHORS BORINGS:			
	6" DIA. BOR. FOR 1 3/4" ANCHOR			
8	8 BORINGS:OVERBURDEN	-	265	LF.
8	8 BORINGS: ROCK	-	374	LF.
	8" DIA. BOR. FOR 1 3/4" ANCHORS			
37	37 BORINGS:OVERBURDEN	-	919	LF.
37	37 BORINGS:ROCK		1183	LF.
	WALES:			
	MC18X42.7	A-588	528	LF.
	LACING PLATES:			
	.5" X 4" X 7" @ 1.33'	A-588	1584	LB.
	PEDESTAL:			
	W12 X 87	A-588	54	LF.
	CONCRETE PANELS:			
523	AREA TO BE COVERED: 6298 SF.	fc'3000	273.1	TONS
	FILLET WELD:	-	101.2	FT.

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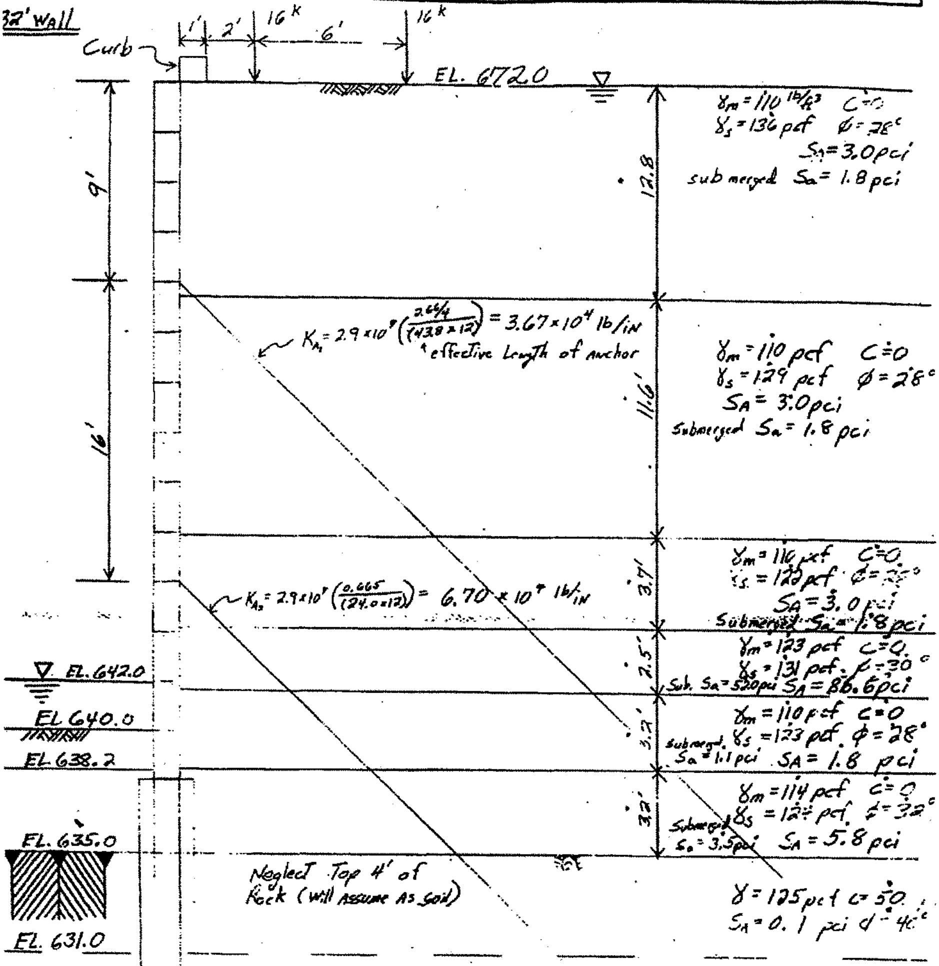


* Geotechnical info based on 6+50 Boring C-90-2
See Appendix A - Geotechnical Information.

*Use Williams, MCP II Anchors
$F_u = 150$ ksi, $F_y = 127.7$ ksi

$1\frac{3}{8}"\phi$, $A = 1.58$ □"

$1\frac{3}{4}"\phi$, $A = 2.66$ □"

$E = 2.9 \times 10^7$ psi

US Army Corps of Engineers Ohio River Division	Subject Island Creek, WV, LPP Post & Panel Wall	Page / Of Pages Computed by DAK Date 8-29-93 Checked by Date

32' Wall

The 32' wall is used at the beginning of the wall by the U.S. 119/26 Bridge. The soil profile was obtained from boring C-90-2.

Summary of Results (Two Anchors : 1 3/8" ϕ Top, 1 3/4" ϕ Bottom, 150 KSI Bar 9' & 25' From Top.)

Condition	Bending Moment	Deflection	Anchor Force Top	Anchor Force Bottom
L.C. #1	9.802×10^{4} lb-ft	0.39"	24,375 lbs	59,330 lbs
L.C #2	1.217×10^{5} lb-ft	3.85"	—	—
L.C. #3	5.432×10^{4} lb-ft	0.22"	13,391 lbs	33,040 lbs

Determine Post Size

$$S_{req'd} = \frac{m}{f_b} = \frac{9.802\times10^{4}(4)(12)}{18000} = 261.39\ in^3$$ Use W14 x 233

$S_{prov} = 375\ in^3$

$$\text{check L.C. \#4} \rightarrow f_b = \frac{1.217\times10^{5}(4)(12)}{375} = 15.58^k < 0.73F_y = 26.3^k \text{ ok}$$

Maximum Anchor Force / 4' of wall

Top Anchor → $24{,}375\times4 = 97.50^k < 142.2^k$ ok

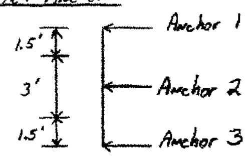
Bottom Anchor → $59{,}330\times4 = 237.32^k < 240.0^k$ ok

Allowable Working Load of 60% Ultimate see. Williams, CAT. No. 49 page 2

Rigid Anchor Forces

Anchor	L.C. #1	L.C. #2	L.C. #3
1	70.72^k	62.86^k	38.96^k
2	-39.05^k	-56.32^k	-22.54^k
3	11.16^k	11.50^k	5.91^k
Total	42.83^k	18.04^k	22.33^k

Effective Area For each Anchor



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32' Wall (con't)

Bearing Pressure Assume 2' ϕ hole For Posts

Anchor 1 → $P/A = \frac{70.72(4)}{24 \times 18} = 655$ psi < 3000 Psi ok

Anchor 2 → $\frac{56.32(4)}{24 \times 36} = 261$ psi < 3000 Psi ok

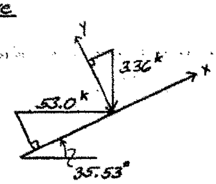
Anchor 3 → $\frac{11.50(4)}{24 \times 18} = 106$ psi < 3,000 psi ok

Shear on Failure Plane

Use the highest Sum of the Rigid Anchor Forces (L.C. #1) in the program "CSLIDE" to determine Failure plane and resultant Force on Failure wedge.

Area of Failure Plane = 2 × 10.324 = 20.65 ft² = 2973.6 in²

Load on plane

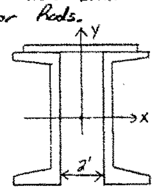


X-dir = $-3.36 \sin 35.53 + 53.0 \cos 35.53 = 41.18^k$

$f_v = \frac{V}{A} = \frac{41.18}{2973.6} = 13.8$ psi < 50 psi ok

Wales

Two channels will be used back to back with a 2" space between them for the anchor Rods.



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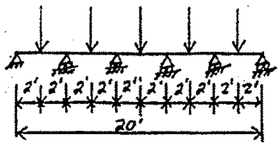
32' Wall (con'T)

Top wales 97.50^k each
Bottom Wales 237.32^k each



Determine Size of Channels

Assume wales will be installed in 20' sections ∴ 5 spans of 4'/section

From AISC Manual, 9th ed page 2-312

$M_{MAX} = 0.171\ PL$ and $V_{MAX} = 0.66\ P$

Top Wales

$P_{MAX} = 97.50\ (1.17) = 114.08^k$

$M_{MAX} = 0.171\ (114.08)(4) = 78.03^{k\text{-}ft}$

$V_{MAX} = 0.66\ (114.08) = 75.29^k$

$S_{reqd} = \dfrac{78.03 \times 12}{20} = 46.82\ in^3$

Since 2 channels $S_{reqd}/channel = \dfrac{46.82}{2} = 23.4\ in^3$

Try MC 10 × 28.5 $S_{prov} = 25.3\ in^3$

check Shear

$V_{chan} = \dfrac{75.29}{2} \doteq 37.6^k$

$f_v = \dfrac{37.6}{10\ (0.425)} = 8.85\ ksi < 12.0\ ksi$ ok

Check Test Load

$P = 114.08 \times 1.33 = 151.73^k$

$f_v \times 1.33 = 11.78\ ksi < 12.0\ ksi$ ok

$f_b = \dfrac{.171\ (151.73)(4)(12)/2}{36.1} = 17.25\ ksi < \sigma_{All} = 0.73\ F_y = 26.$

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32' Wall (Con'T)

Check Bearing on webs of wales

Web yielding (AISC Spec. Sect. K1.3, 9th ed Manual)

@ Interior Load (per 1 channel) $t_w = 0.425''$ $N = 9''$ $K = 1.25''$ Load $= 114.08^k/2 = 57.04^k$

$$57.04 = (0.425)(9+5(1.25))\,f_y$$

$$f_y = 8.80 \text{ ksi} < 0.55 F_y = 19.8 \text{ ksi} \quad \text{ok}$$

@ End Load

$$0.34(57.04) = (0.425)(7.95+2.5(1.25))\,f_y$$

$$f_y = 4.12 \text{ ksi} < 19.8 \text{ ksi} \quad \text{ok}$$

Check @ Test Load

Load $= 57.04 \times 1.33 = 75.86^k$

@ Interior Load

$$(75.86) = (0.425)(9+5(1.25))\,f_y$$

$$f_y = 11.70 \text{ ksi} < 0.73 F_y = 26.3 \text{ ksi} \quad \text{ok}$$

@ End Load

$$0.34(75.86) = (0.425)(7.95+2.5(1.25))\,f_y$$

$$f_y = 5.48 \text{ ksi} < 26.3 \text{ ksi} \quad \text{ok}$$

Web Crippling (AISC Spec. Sect. K1.4, 9th ed. Manual)

@ Interior Loads

$$57.04 \le 67.5(0.425)^2\left[1 + 3\left(\tfrac{9}{10}\right)\left(\tfrac{0.425}{0.575}\right)^{1.5}\right]\sqrt{f_y\left(\tfrac{0.575}{0.425}\right)}$$

$$f_y = 2.19 \text{ ksi} < 0.50 F_y = 18 \text{ ksi} \quad \text{ok}$$

@ End Loads

$$19.39 \le 34.0(0.425)^2\left[1 + 3\left(\tfrac{7.95}{10}\right)\left(\tfrac{0.425}{0.575}\right)^{1.5}\right]\sqrt{f_y\left(\tfrac{0.575}{0.425}\right)}$$

$$f_y = 1.16 \text{ ksi} < 18.0 \text{ ksi} \quad \text{ok}$$

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32' Wall (Con'T)

check @ Test Load

@ Interior Load

$$75.86 \le 67.5(0.425)^2\left[1+3\left(\frac{9.0}{10}\right)\left(\frac{0.425}{0.575}\right)^{1.5}\right]\sqrt{f_y\left(\frac{0.575}{0.425}\right)}$$

$$f_y = 3.88 \text{ ksi} < 0.60 F_y = 21.6 \text{ ksi} \quad \text{ok}$$

@ End Load

$$0.34(75.86) \le 34(0.425)^2\left[1+3\left(\frac{7.95}{10}\right)\left(\frac{0.425}{0.575}\right)^{1.5}\right]\sqrt{f_y(.575/.425)}$$

$$f_y = 2.06 \text{ ksi} < 21.6 \text{ ksi} \quad \text{ok}$$

Determine Size of Plate Washer

Assume ½ of anchor load is distributed by mT and Direct Bearing through washer To webs of wales; Remainder Distributed by means of flexure in plate"

$$m = \frac{PL}{4} = \frac{114.08(3)}{\underset{50\%}{(2)}4} = 42.78 \text{ ''-k}$$

$$S_{Req'd} = \frac{42.78}{18} = 2.37 \text{ in}^3 \qquad S_{prov.} = \frac{(9-3)\times 1.625^2}{6} = 2.64 \text{ in}^3$$

check bending Stress @ Test Load

$$m = \frac{151.73(3)}{(2)(4)} = 56.90 \text{ ''-k}$$

$$f_b = \frac{56.90}{2.64} = 21.55 \text{ ksi} < 0.73 F_y = 26.3 \text{ ksi} \quad \text{ok}$$

Use 9" × 1.625" Plate washer

Bottom Wales

$$P_{max} = 237.32(1.17) = 277.66^k$$

$$M_{max} = 0.171(277.66)(4) = 189.92^{ft-k}$$

$$V_{max} = \frac{277.66}{2} = 138.83^k$$

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32' Wall (Con'T)

$$S_{Req'd} = \frac{189.92 \times 12}{20} = 114.0 \text{ in}^3$$

Since 2 channels $S_{Req'd}/\text{channel} = \frac{114.0}{2} = 57.0 \text{ in}^3$

Try MC 18 × 51.9 $S_{prov} = 69.7 \text{ in}^3/\text{channel}$

check shear

$$V_{chan} = \frac{138.83}{2} = 69.42^k$$

$$f_v = \frac{69.42}{18(0.60)} = 6.43 \text{ ksi} < 12.0 \text{ ksi} \quad ok$$

check Test Load

$$P = 277.66 \times 1.33 = 369.29^k$$

$$f_v \times 1.33 = 11.40 \text{ ksi} < 12.0 \text{ ksi} \quad ok$$

$$f_b = \frac{0.171(369.29)(4)(12)/2}{69.7} = 21.74 \text{ ksi} < 26.3 \text{ ksi} \quad ok$$

check Bearing on webs of wales

Web yielding (AISC Spec Sect K1.3, 9th ed Manual)

@ Interior Load (per 1 channel) $t_w = 0.60''$ $N = 9''$ $k = 1.375''$ Load $= \frac{277.66}{2} = 138.83^k$

$$138.83 = (0.60)(9 + 5(1.375)) f_y$$

$$f_y = 14.58 \text{ ksi} < 0.55 F_y = 19.6 \text{ ksi} \quad ok$$

@ End Load

$$0.34(138.83) = (0.60)(7.95 + 2.5(1.375)) f_y$$

$$f_y = 6.91 \text{ ksi} < 19.6 \text{ ksi} \quad ok$$

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32' Wall (Con't)

Check @ Test Load

$$Load = 138.83 \times 1.33 = 184.64^{k}$$

@ Interior Load

$$184.64 = (0.60)(9 + 5(1.375))\, f_y$$

$$f_y = 19.38 \text{ ksi} < 0.73 F_y = 26.3 \text{ ksi} \quad \text{ok}$$

@ End Load

$$0.34(184.64) = (0.60)(7.95 + 2.5(1.375))\, f_y$$

$$f_y = 9.19 \text{ ksi} < 26.3 \text{ ksi} \quad \text{ok}$$

Web Crippling (AISC Spec Sect. K1.4, 9th ed. Manual)

@ Interior Load

$$138.83 \le 67.5(0.60)^2\left[1 + 3\left(\frac{9}{18}\right)\left(\frac{0.60}{0.625}\right)^{1.5}\right]\sqrt{f_y\,\frac{0.625}{0.60}}$$

$$f_y = 5.39 \text{ ksi} < 0.50 F_y = 18.0 \text{ ksi} \quad \text{ok}$$

@ End Load

$$0.34(138.83) \le 34(0.60)^2\left[1 + 3\left(\frac{7.95}{18}\right)\left(\frac{0.60}{0.625}\right)^{1.5}\right]\sqrt{f_y\left(\frac{0.625}{0.60}\right)}$$

$$f_y = 2.83 \text{ ksi} < 18.0 \text{ ksi} \quad \text{ok}$$

Check @ Test Load

@ Interior Load

$$184.64 \le 67.5(0.60)^2\left[1 + 3\left(\frac{9}{18}\right)\left(\frac{0.60}{0.625}\right)^{1.5}\right]\sqrt{f_y\left(\frac{.625}{0.60}\right)}$$

$$f_y = 9.54 \text{ ksi} < 0.60 F_y = 21.6 \text{ ksi} \quad \text{ok}$$

@ End Load

$$0.34(184.64) \le 34.0(0.60)^2\left[1 + 3\left(\frac{7.95}{18}\right)\left(\frac{0.60}{0.625}\right)^{1.5}\right]\sqrt{f_y\,(.625/0.60)}$$

$$f_y = 5.00 \text{ ksi} < 21.6 \text{ ksi} \quad \text{ok}$$

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32' Wall (Con'T)

Determine Size of Plate Washer

"Assume ½ of the Anchor Load is distributed by nut And Direct Bearing Through washer To webs of wales; Remainder Distributed by means of flexure in plate"

$$m = \frac{PL}{4} = \frac{277.66\,(3)}{2\,(4)} = 104.12''\text{-}k$$

$$S_{Req'd} = \frac{104.12}{18} = 5.78 \text{ in}^3$$

$$S_{prov} = \frac{(9-3) \times 2.50^2}{6} = 6.25 \text{ in}^3$$

Check bending Stress @ Test Load

$$m = \frac{369.29\,(3)}{2\,(4)} = 138.48''\text{-}k$$

$$f_b = \frac{138.48}{6.25} = 22.16 \text{ ksi} < 0.73 F_y = 26.3 \text{ ksi} \quad ok$$

Use 9" x 2½" Plate Washers

Check bearing @ 2nd Reaction From end of wales (max reaction)

Web yielding

$$P_{max} = 1.2 \times 138.83 = 166.60^k$$

Working Load

$$166.60 = (0.60)(9 + 5(1.375)) f_y$$

$$f_y = 17.49 \text{ ksi} < 0.55 F_y = 19.6 \text{ ksi} \quad ok$$

Test Load

$$P_{max} = 1.2 \times 184.64 = 221.57$$

$$221.57 = (0.60)(9 + 5(1.375)) f_y$$

$$f_y = 23.26 \text{ ksi} < 0.73 F_y = 26.3 \text{ ksi} \quad ok$$

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32' Wall (con't)

Web Crippling

Working Load

$$166.60 \le 67.5\,(0.6)^2\left[1+3\left(\tfrac{9}{18}\right)\left(\tfrac{0.60}{0.625}\right)^{1.5}\right]\sqrt{f_y\left(\tfrac{0.625}{0.60}\right)}$$

$f_y = 7.76$ ksi $< 0.50\,F_y = 18$ ksi ok

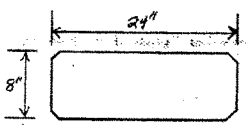
Test Load

$$221.57 = 67.5\,(0.6)^2\left[1+3\left(\tfrac{9}{18}\right)\left(\tfrac{0.60}{0.625}\right)^{1.5}\right]\sqrt{f_y\left(\tfrac{0.625}{0.60}\right)}$$

$f_y = 13.73$ ksi $< 0.60\,F_y = 21.6$ ksi ok

Determine Panel Size

Max Horizontal Pressure is 4357.44 psf @ EL 642 L.C. #2



$d = 8 - 1.5 = 6.5''$
$f'_c = 3000$ psi
$f_y = 60^k$
$L = 3'\text{-}3''$

Load Factors
L.L = 1.7
Hydr. = 1.3

$$\frac{4357.44}{1000} \times 2 = 8.71\ ^k/_{ft}$$

$$m = \frac{8.71 \times 3.25^2}{8} = 11.50\ \text{ft-k}$$

$$M_u = 1.3 \times 1.7 \times 11.50 = 25.42^{\text{ft-k}}$$

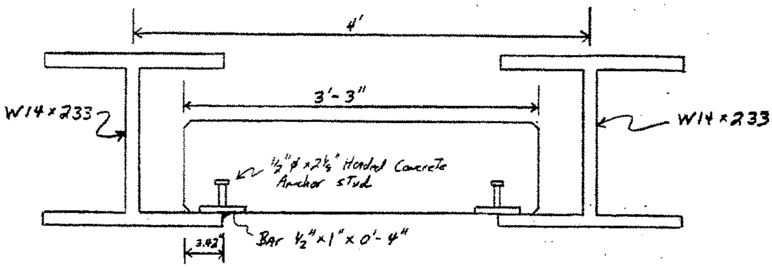
$$R_u = \frac{25.42 \times 12}{0.9\,(24)(6.5)^2} = 0.334\ \text{ksi}$$

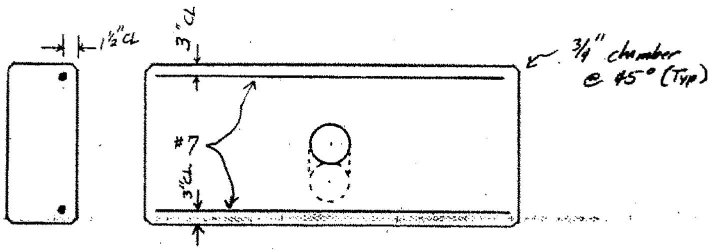
$$\rho = \frac{1}{23.53}\left(1 - \sqrt{1 - \frac{(23.53)(2)(0.334)}{60}}\right) = 0.0060$$

$$A_s = 0.0060\,(24)(6.5) = 0.94\ ^{\square''}/_{2'}$$

Min Temp & shrinkage $= 0.0028\,(24)(8) = 0.54\ ^{\square''}/_{2'}$

32' Wall (Con'T)





$As_{prov} = 2(0.60) = 1.20^{\square''}/_{2'} > 0.94^{\square''}/_{2'}$ ok

Anchorage

Top Anchor

Assume pull out Resistance of Rock/Grout is 30psi. Use a hole for 1⅜"φ Anchors.

Rock/Grout surface Area = $\pi(6)(12) = 226.19$ in²/L.F.

Resistance = 30 (226.19) = 6785.7 K/L.F of anchor

embedment Length = 151.73 / 6.79 = 22.35' use 23'-0"

Test Load

Bottom Anchor

Assume 6"φ hole for 1¾" Anchors

32' Wall (Con't)

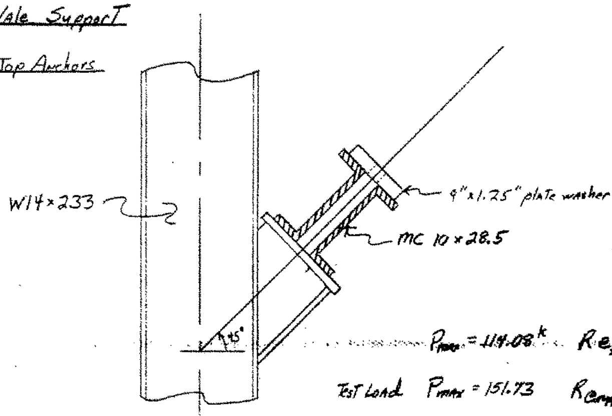
Rock / Grout Surface Area $= \pi(6)(12) = 226.19$ in²/L.F. (8, 301.6)

Resistance $= 30(226.19) = 6.79$ K/L.F. of anchor (9.048)

embedment Length $= 369.29 / 6.79 = 54.39'$ use 55'-0"
↑ Test Load (40.8' USE 41')

Wale Support

Top Anchors



$P_{max} = 114.08^k$ $Re_{support} = 1.2 \times P = 136.90$

Test Load $P_{max} = 151.73$ $R_{Comp} = 1.2 \times P = 182.08^k$

Area of Support $= \frac{136.90}{21.6} = 6.34$ in²

Try WT 10.5×73.5 $A = 21.6$ in² $S = 23.7$ in³ $R_y = 3.08$ in

Bending Moment $= 136.90\left(\frac{11.03}{2} - 2.39\right) = 427.81$ k-in

$f_b = 427.81/23.7 = 18.05$ ksi < 21.6 ksi ok

check axial $f_A = \frac{136.90}{21.6} = 6.34$ ksi < 20.78 ksi ok Assume $L = 2'$, $K = 2.1$
↑ from Table C-C2 AISC 9th ed

check @ Test Load

$M = 182.08\left(\frac{11.03}{2} - 2.39\right) = 569.00$ k-in

$f_b = 569.00/23.7 = 24.01$ ksi < 26.3 ksi ok

check axial $f_A = \frac{182.08}{21.6} = 8.43$ ksi < 20.78 ksi ok

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32' Wall (Con't)

Wale Support Bottom Anchors

$P_{MAX} = 277.66^k$ $R_{e\,supp.} = 1.2 \times P = 333.19^k$

Test Load $P_{MAX} = 369.29^k$ $R_{e\,supp.} = 1.2 \times P = 443.15^k$

Area of Support $= \frac{333.19}{21.6} = 15.43 \text{ in}^2$

Try W 12 x 87 $A = 25.6 \text{ in}^2$ $S = 118 \text{ in}^3$ $R_x = 5.38 \text{ in}$

Check Axial Load

$f_A = \frac{333.19}{25.6} = 13.02 \text{ ksi} < 20.78 \text{ ksi}$ ok Assume $L = 2'$, $K = 2.1$ ← From Table C-C2-1, AIS. 9th ed.

Test Load $f_A = \frac{443.15}{25.6} = 17.31 \text{ ksi} < 20.78 \text{ ksi}$ ok

Welds W12 x 87 To W14 x 233

Available ⇒ $L_w = (4 b_f - 2T_w) + (2d - 4T_f) = 69.29''$ ← conservative since the 45° angle is not accounted for.

Assume 5/16" Weld

Allowable Load = 5/16 (0.707)(70)(0.3) = 4.64 k/in

Required Length

$V = 443.15 \times \cos 45 = 313.35^k$

$\frac{313.35}{4.64} = 67.53'' < 69.29''$ ok

WT 10.5 x 73.5 To W14 x 233

Available $L_w = (2b_f - T_w) + (2d - 2T_f) = 44.06''$

Assume 5/16" weld

Allowable weld Load = 4.64 k/in

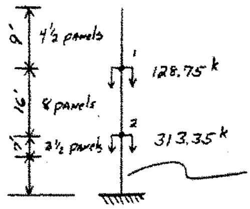
$V = 182.08 \times \cos 45 = 128.75^k$

Req'd Length $= \frac{128.75}{4.64} = 27.75'' < 44.06''$ ok

US Army Corps of Engineers Ohio River Division	Subject Island Creek, WV, LPP Post & Panel Wall	Page 13 Of Pages Computed by DAK Date 9-13-93 Checked by Date

32' Wall (Con'T)

Axial Load on Posts



W14×233 $A = 68.5\ in^2$ $r = 6.63\ in$ $S = 375\ in^3$

Concrete Panels

$8/12 \times 2 \times 4 \times .15 = 0.8^k$ each panel

W_t of panels @ joint 1 = $4.5 \times 0.8 = 3.6^k$

W_t of panels @ joint 2 = $8 \times 0.8 = 6.4^k$

W_t of panels below joint 2 = $3.5 \times 0.8 = 2.8^k$

Will Assume $K = 2.1$ $L = 16'$

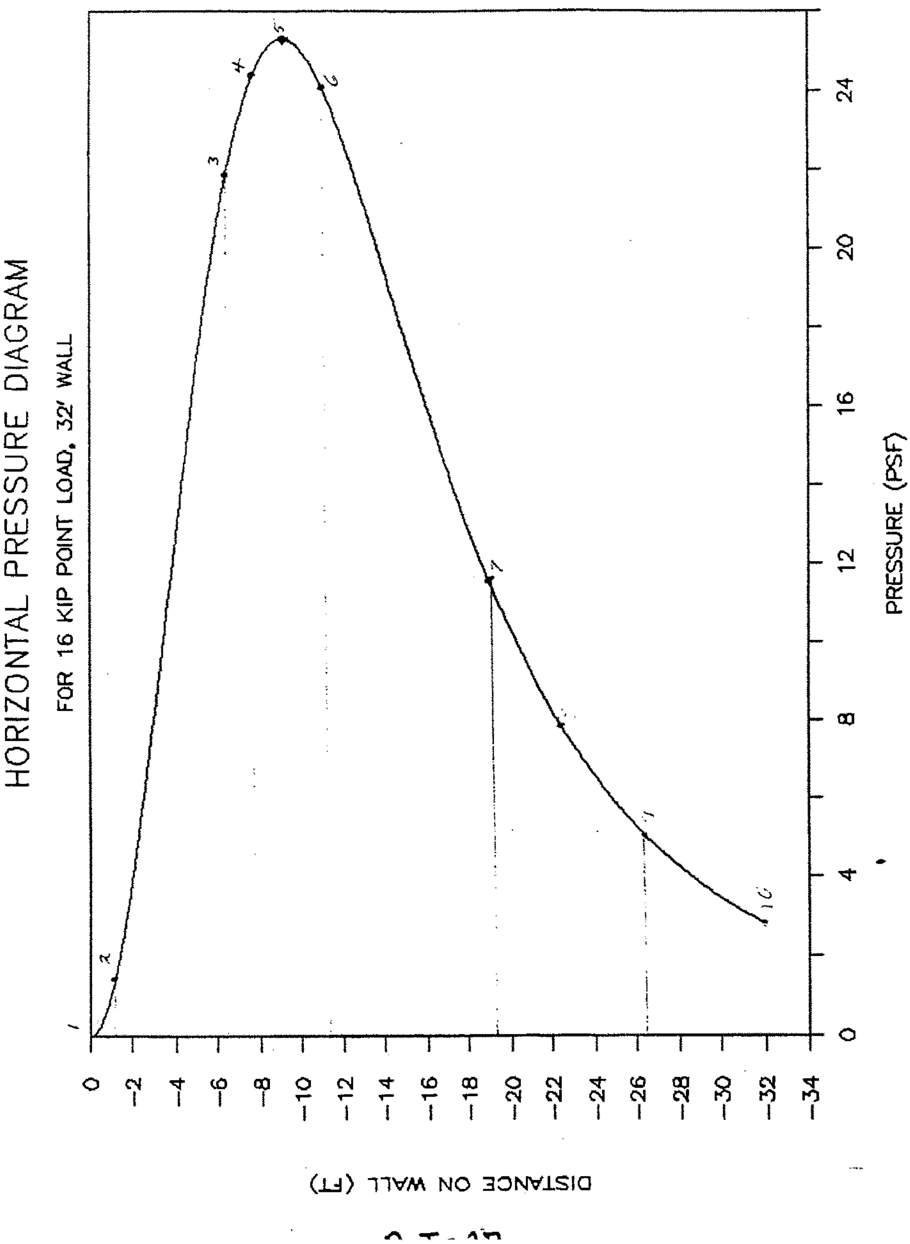
$$Kl/r = \frac{2.1 \times 16 \times 12}{6.63} = 60.81$$

From Table C-36, AISC 9th ed

$$F_a = 17.33\ ksi$$

$$f_a = (128.75 + 313.35 + 3.6 + 6.4 + 2.8)/68.5 = 6.64\ ksi < 17.33\ \underline{\underline{ok}}$$

RD Form 427


HORIZONTAL PRESSURE DIAGRAM
FOR 16 KIP POINT LOAD, 32' WALL
PRESSURE (PSF)
DISTANCE ON WALL (FT)

DISTANCE	PT	PR	PL
0.00	0.00	0.00	0.00
-0.10	13.60	7.35	0.00
-0.20	27.20	14.70	0.00
-0.30	40.80	22.05	0.00
-0.40	54.40	29.40	0.00
-0.50	68.00	36.75	0.00
-0.60	81.60	44.10	0.00
-0.70	95.20	51.45	0.00
-0.80	108.80	58.80	0.00
-0.90	122.40	66.15	0.00
-1.00	136.00	73.50	0.00
-1.10	149.60	80.85	0.00
-1.20	163.20	88.20	0.00
-1.30	176.80	95.55	0.00
-1.40	190.40	102.90	0.00
-1.50	204.00	110.25	0.00
-1.60	217.60	117.60	0.00
-1.70	231.20	124.95	0.00
-1.80	244.80	132.30	0.00
-1.90	258.40	139.65	0.00
-2.00	272.00	147.00	0.00
-2.10	285.60	154.35	0.00
-2.20	299.20	161.70	0.00
-2.30	312.80	169.05	0.00
-2.40	326.40	176.40	0.00
-2.50	340.00	183.75	0.00
-2.60	353.60	191.10	0.00
-2.70	367.20	198.45	0.00
-2.80	380.80	205.80	0.00
-2.90	394.40	213.15	0.00
-3.00	408.00	220.50	0.00
-3.10	421.60	227.85	0.00
-3.20	435.20	235.20	0.00
-3.30	448.80	242.55	0.00
-3.40	462.40	249.90	0.00
-3.50	476.00	257.25	0.00
-3.60	489.60	264.60	0.00
-3.70	503.20	271.95	0.00
-3.80	516.80	279.30	0.00

DISTANCE ON WALL (FT)	PRESSURE (PSF)	DISTANCE ON WALL (FT)	PRESSURE (PSF)	DISTANCE ON WALL (FT)	PRESSURE (PSF)
0.00	0.00	-5.60	19.34	-11.20	23.77
-0.10	0.01	-5.70	19.70	-11.30	23.64
-0.20	0.04	-5.80	20.04	-11.40	23.51
-0.30	0.09	-5.90	20.37	-11.50	23.37
-0.40	0.17	-6.00	20.69	-11.60	23.23
-0.50	0.26	-6.10	21.01	-11.70	23.09
-0.60	0.37	-6.20	21.31	-11.80	22.94
-0.70	0.51	-6.30	21.60	-11.90	22.80
-0.80	0.66	-6.40	21.87	-12.00	22.64
-0.90	0.83	-6.50	22.14	-12.10	22.49
-1.00	1.02	-6.60	22.40	-12.20	22.34
-1.10	1.23	-6.70	22.65	-12.30	22.18
-1.20	1.46	-6.80	22.88	-12.40	22.02
-1.30	1.71	-6.90	23.10	-12.50	21.86
-1.40	1.97	-7.00	23.31	-12.60	21.69
-1.50	2.25	-7.10	23.51	-12.70	21.53
-1.60	2.55	-7.20	23.70	-12.80	21.36
-1.70	2.86	-7.30	23.88	-12.90	21.19
-1.80	3.19	-7.40	24.05	-13.00	21.03
-1.90	3.53	-7.50	24.20	-13.10	20.86
-2.00	3.88	-7.60	24.35	-13.20	20.69
-2.10	4.25	-7.70	24.48	-13.30	20.51
-2.20	4.63	-7.80	24.61	-13.40	20.34
-2.30	5.02	-7.90	24.72	-13.50	20.17
-2.40	5.42	-8.00	24.82	-13.60	20.00
-2.50	5.83	-8.10	24.92	-13.70	19.82
-2.60	6.25	-8.20	25.00	-13.80	19.65
-2.70	6.67	-8.30	25.07	-13.90	19.47
-2.80	7.11	-8.40	25.13	-14.00	19.30
-2.90	7.55	-8.50	25.19	-14.10	19.12
-3.00	8.00	-8.60	25.23	-14.20	18.95
-3.10	8.45	-8.70	25.27	-14.30	18.77
-3.20	8.90	-8.80	25.29	-14.40	18.60
-3.30	9.36	-8.90	25.31	-14.50	18.42
-3.40	9.83	-9.00	25.32	-14.60	18.25
-3.50	10.29	-9.10	25.32	-14.70	18.08
-3.60	10.76	-9.20	25.31	-14.80	17.90
-3.70	11.22	-9.30	25.29	-14.90	17.73
-3.80	11.69	-9.40	25.27	-15.00	17.56
-3.90	12.16	-9.50	25.24	-15.10	17.38
-4.00	12.62	-9.60	25.20	-15.20	17.21
-4.10	13.08	-9.70	25.15	-15.30	17.04
-4.20	13.54	-9.80	25.10	-15.40	16.87
-4.30	13.99	-9.90	25.04	-15.50	16.70
-4.40	14.44	-10.00	24.98	-15.60	16.53
-4.50	14.89	-10.10	24.91	-15.70	16.37
-4.60	15.33	-10.20	24.83	-15.80	16.20
-4.70	15.77	-10.30	24.75	-15.90	16.03
-4.80	16.19	-10.40	24.66	-16.00	15.87
-4.90	16.62	-10.50	24.56	-16.10	15.71
-5.00	17.03	-10.60	24.46	-16.20	15.54
-5.10	17.44	-10.70	24.36	-16.30	15.38
-5.20	17.84	-10.80	24.25	-16.40	15.22
-5.30	18.23	-10.90	24.14	-16.50	15.06
-5.40	18.61	-11.00	24.02	-16.60	14.90
-5.50	18.98	-11.10	23.90	-16.70	14.74

DISTANCE ON WALL (FT)	PRESSURE (PSF)	DISTANCE ON WALL (FT)	PRESSURE (PSF)	DISTANCE ON WALL (FT)	PRESSURE (PSF)
-16.80	14.59	-22.40	7.81	-28.00	4.22
-16.90	14.43	-22.50	7.72	-28.10	4.18
-17.00	14.28	-22.60	7.63	-28.20	4.14
-17.10	14.12	-22.70	7.55	-28.30	4.09
-17.20	13.97	-22.80	7.46	-28.40	4.05
-17.30	13.82	-22.90	7.38	-28.50	4.01
-17.40	13.67	-23.00	7.30	-28.60	3.96
-17.50	13.52	-23.10	7.22	-28.70	3.92
-17.60	13.38	-23.20	7.13	-28.80	3.88
-17.70	13.23	-23.30	7.06	-28.90	3.84
-17.80	13.09	-23.40	6.98	-29.00	3.80
-17.90	12.94	-23.50	6.90	-29.10	3.76
-18.00	12.80	-23.60	6.82	-29.20	3.72
-18.10	12.66	-23.70	6.75	-29.30	3.69
-18.20	12.52	-23.80	6.67	-29.40	3.65
-18.30	12.38	-23.90	6.60	-29.50	3.61
-18.40	12.25	-24.00	6.53	-29.60	3.57
-18.50	12.11	-24.10	6.45	-29.70	3.54
-18.60	11.98	-24.20	6.38	-29.80	3.50
-18.70	11.85	-24.30	6.31	-29.90	3.46
-18.80	11.71	-24.40	6.24	-30.00	3.43
-18.90	11.58	-24.50	6.17	-30.10	3.39
-19.00	11.46	-24.60	6.10	-30.20	3.36
-19.10	11.33	-24.70	6.04	-30.30	3.33
-19.20	11.20	-24.80	5.97	-30.40	3.29
-19.30	11.08	-24.90	5.91	-30.50	3.26
-19.40	10.95	-25.00	5.84	-30.60	3.23
-19.50	10.83	-25.10	5.78	-30.70	3.19
-19.60	10.71	-25.20	5.71	-30.80	3.16
-19.70	10.59	-25.30	5.65	-30.90	3.13
-19.80	10.47	-25.40	5.59	-31.00	3.10
-19.90	10.35	-25.50	5.53	-31.10	3.07
-20.00	10.24	-25.60	5.47	-31.20	3.04
-20.10	10.12	-25.70	5.41	-31.30	3.01
-20.20	10.01	-25.80	5.35	-31.40	2.98
-20.30	9.90	-25.90	5.29	-31.50	2.95
-20.40	9.78	-26.00	5.24	-31.60	2.92
-20.50	9.67	-26.10	5.18	-31.70	2.89
-20.60	9.57	-26.20	5.12	-31.80	2.86
-20.70	9.46	-26.30	5.07	-31.90	2.83
-20.80	9.35	-26.40	5.01	-32.00	2.80
-20.90	9.25	-26.50	4.96		
-21.00	9.14	-26.60	4.91		
-21.10	9.04	-26.70	4.85		
-21.20	8.94	-26.80	4.80		
-21.30	8.84	-26.90	4.75		
-21.40	8.74	-27.00	4.70		
-21.50	8.64	-27.10	4.65		
-21.60	8.54	-27.20	4.60		
-21.70	8.45	-27.30	4.55		
-21.80	8.35	-27.40	4.50		
-21.90	8.26	-27.50	4.45		
-22.00	8.17	-27.60	4.41		
-22.10	8.07	-27.70	4.36		
-22.20	7.98	-27.80	4.31		
-22.30	7.89	-27.90	4.27		

```
10010   TITL   ISLAND    CREEK,    WV,  LPP
10020   TITL   POST   AND   PANEL    WALL
10030   TITL   32'  WALL,    L.C.   #1
10040   STRU    4          .15000           625.00          1.00000
10050               .00            625.00
10060               .00            672.00
10070              2.00            672.00
10080              2.00            625.00
10090   SOLT    1    1           40.00           7.200           .1250           631.00
10100           -50.00           631.00
10110   SORT    1    1           40.00           7.200           .1250           631.00
10120            50.00           631.00
10230   SOST           40.00            7.20000
10240   METH    1
10250   WATR          620.00            620.00           .06250              0.
10260   EQAC          .06700            .10000
10270   FACT              .50              1.50          1.0000
10280   HOLO    2         85.66
10290   END
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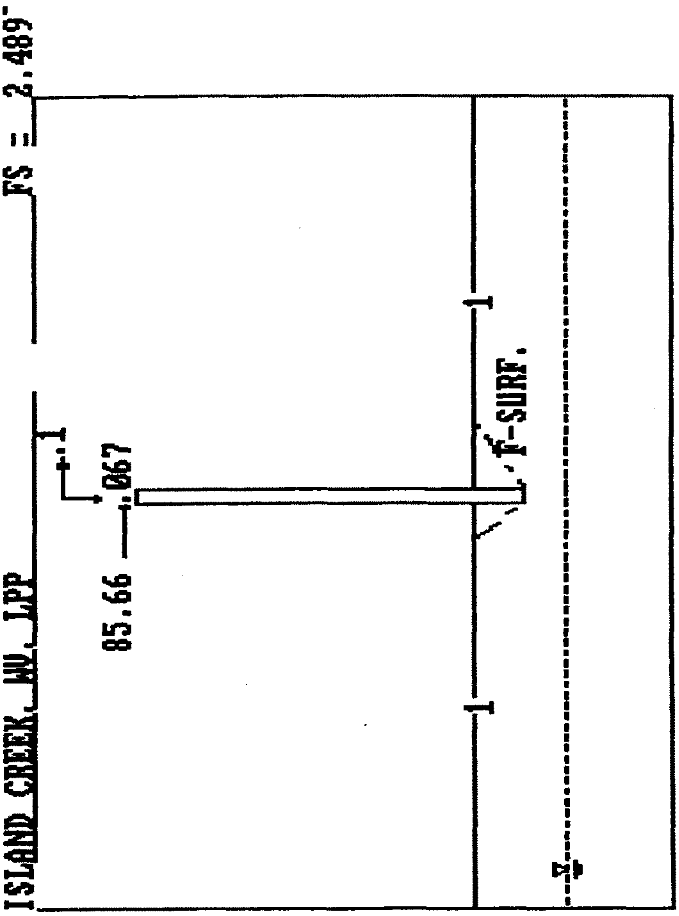
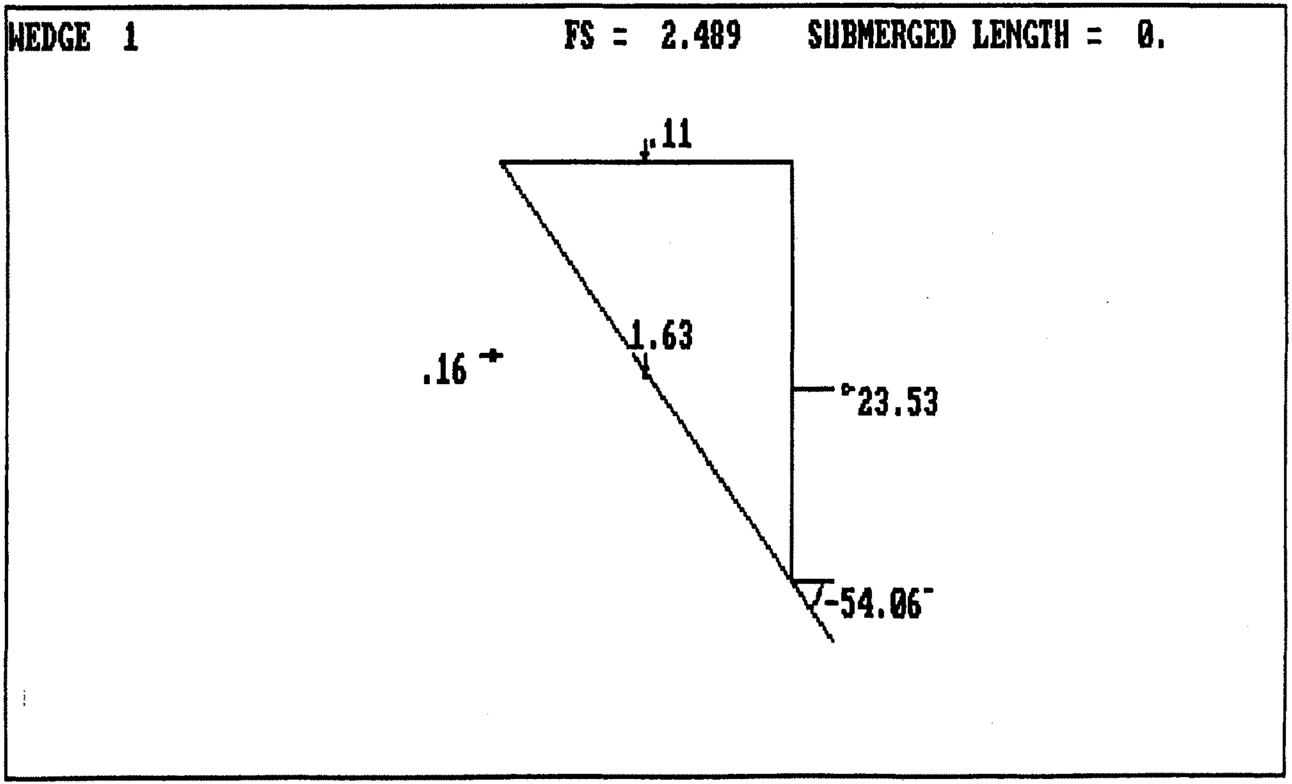
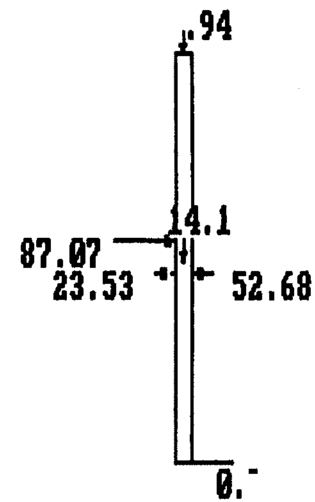

ISLAND CREEK WV LPP
FS = 2.489
85.66
.067
F-SURF.
1
1
1

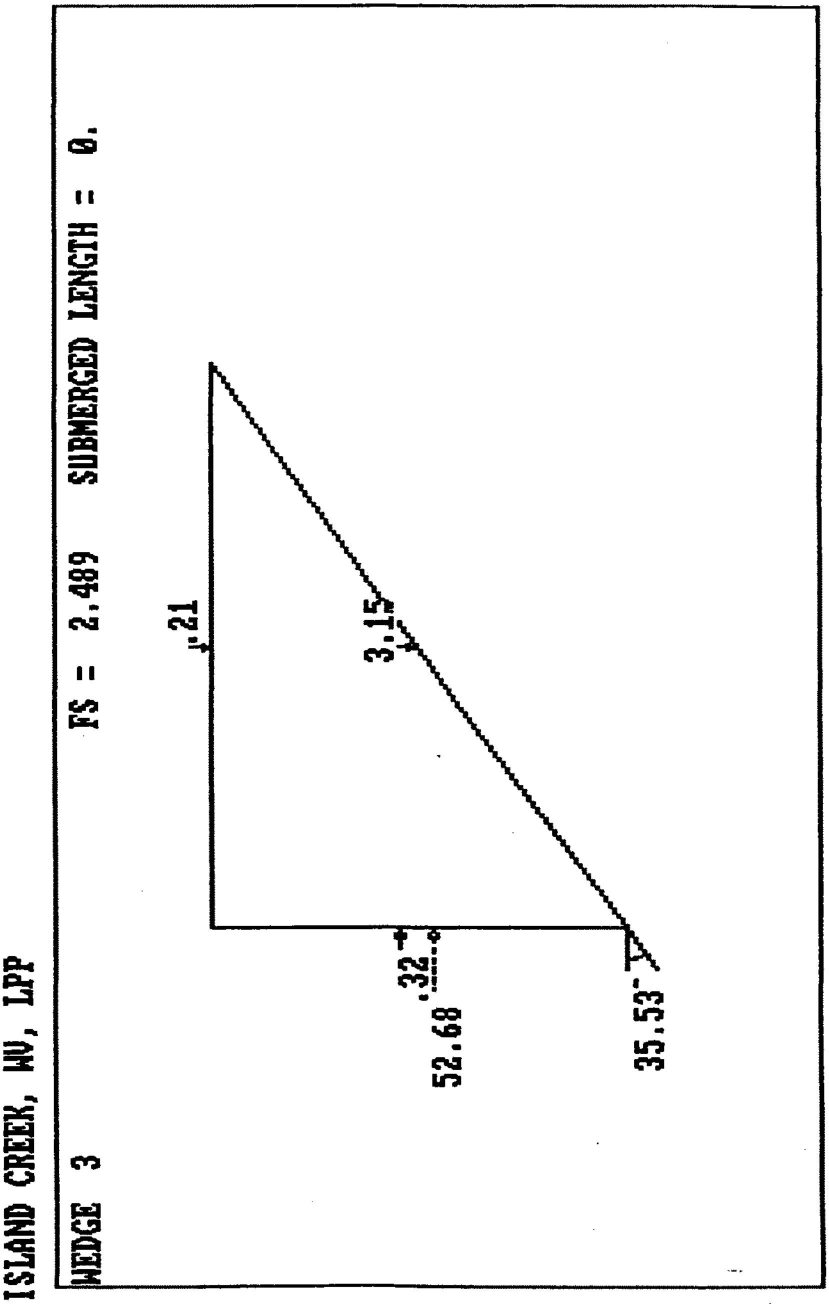
ISLAND CREEK, WV, LPP



ISLAND CREEK, WV, LPP

STRUCTURAL WEDGE FS = 2.489 SUBMERGED LENGTH = 0.




ISLAND CREEK, WV, LPP
WEDGE 3
FS = 2.489
SUBMERGED LENGTH = 0.
.21
3.15
.32
52.68
35.53

PROGRAM CSLIDE - ECHOPRINT

DATE: 11-01-93 TIME: 15:09:30

ISLAND CREEK, WV, LPP
POST AND PANEL WALL
32' WALL, L.C. #1

SINGLE FAILURE PLANE ANALYSIS

HYDROSTATIC WATER FORCE COMPUTED FOR WEDGES

NO OF CORNERS IN STRUCTURE ----------	4
DENSITY OF CONCRETE -----------------	.1500(KCF)
DENSITY OF WATER --------------------	.0625(KCF)
WATER LEVEL LEFT SIDE ---------------	620.00(FT)
WATER LEVEL RIGHT SIDE --------------	620.00(FT)
NO. OF SOIL LAYERS LEFT SIDE --------	1
NO. OF SOIL LAYERS RIGHT SIDE -------	1

ELEV. OF WEDGE-STRUCTURE INTERSECTION
ON ACTIVE SIDE OF STRUCTURE ---------625.000(FT)

STRUCTURE INFORMATION

POINT	X-COORD	Y-COORD
1	.00	625.00
2	.00	672.00
3	2.00	672.00
4	2.00	625.00

LEFTSIDE SOIL DATA

LAYER NO.	FRICTION ANGLE (DEG)	COHESION (KSF)	UNIT WEIGHT (KCF)	ELEV AT STRUCTURE (FT)
1	40.00	7.2000	.125	631.00

LAYER NO	POINT NO. 1 X-COORD	POINT NO. 1 Y-COORD
1	-50.00	631.00

SOIL DATA BELOW STRUCTURE

FRICTION ANGLE --------- 40.00
COHESION --------------- 7.2000

RIGHTSIDE SOIL DATA

LAYER NO.	FRICTION ANGLE (DEG)	COHESION (KSF)	UNIT WEIGHT (KCF)	ELEV AT STRUCTURE (FT)
1	40.00	7.2000	.125	631.00

LAYER NO	POINT NO. 1 X-COORD	Y-COORD
1	50.00	631.00

SEISMIC ACCELERATIONS

VERTICAL --------- .067
HORIZONTAL ------- .100

HORIZONTAL LOADS

WEDGE NO	LOAD
2	85.660

PROGRAM CSLIDE - FINAL RESULTS

DATE: 11-01-93 TIME: 15:09:46

ISLAND CREEK, WV, LPP
POST AND PANEL WALL
32' WALL, L.C. #1

SINGLE FAILURE PLANE ANALYSIS

HYDROSTATIC WATER FORCE COMPUTED FOR WEDGES

WEDGE NUMBER	HORIZONTAL LOADS LEFT SIDE (KIPS)	HORIZONTAL LOADS RIGHT SIDE (KIPS)	VERTICAL LOAD (KIPS)
1	.163	.000	.109
2	87.070	.000	.945
3	.315	.000	.211

WATER PRESSURES ON WEDGES

LEFTSIDE WEDGES

WEDGE NO.	TOP PRESSURE (KSF)	BOTTOM PRESSURE (KSF)
1	.000	.000

STRUCTURAL WEDGE

X-COORD. (FT)	PRESSURE (KSF)
.00	.000
2.00	.000

RIGHTSIDE WEDGES

WEDGE NO.	TOP PRESSURE (KSF)	BOTTOM PRESSURE (KSF)
3	.000	.000

WEDGE NUMBER	FAILURE ANGLE (DEG)	TOTAL LENGTH (FT)	WEIGHT OF WEDGE (KIPS)	SUBMERGED LENGTH (FT)	UPLIFT FORCE (KIPS)
1	-54.056	7.411	1.631	.000	.000
2	.000	2.000	14.100	.000	.000
3	35.533	10.324	3.151	.000	.000

WEDGE NUMBER	NET FORCE ON WEDGE (KIPS)
1	23.531
2	-76.212
3	52.681

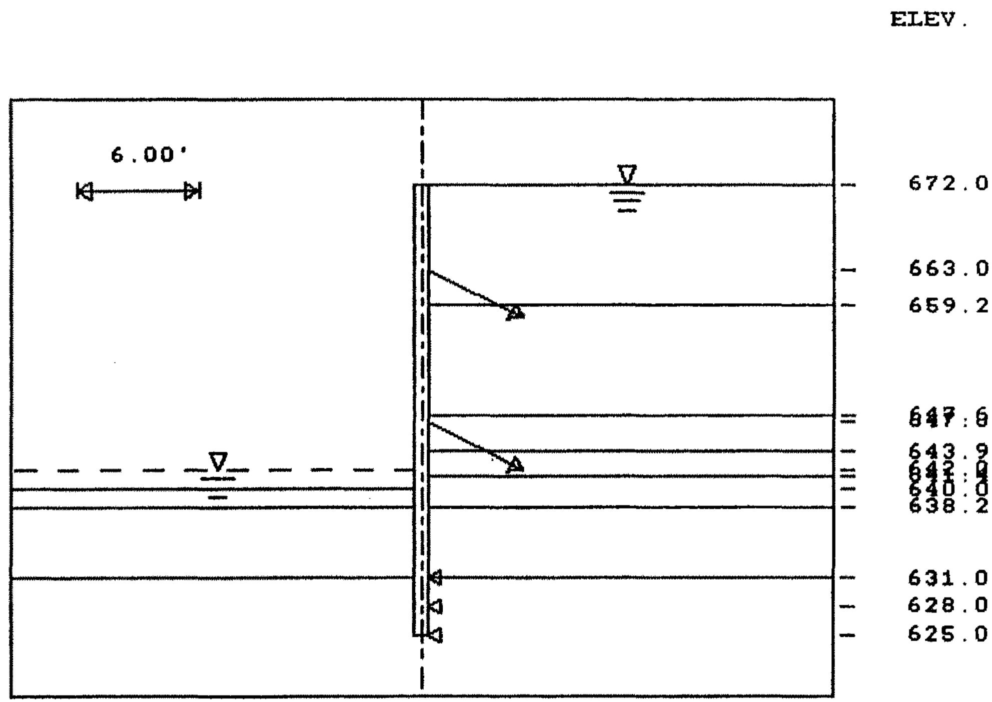
SUM OF FORCES ON SYSTEM ---- .000

FACTOR OF SAFETY ----------- 2.489

```
1000   'ISLAND   CREEK   LPP,   LOGAN,   WV
1010   'POST   AND   PANEL   WALL
1020   'WALL   HEIGHT   =  32',   W14   X  233
1030   'TWO   ANCHORS,    4'  C  TO  C  SPACING,    L.C.   1
1040   WALL      672.00       2.900E+07       7.53E+02       17.13E+00
1050   WALL      625.00
1060   ANCHOR        663.00    F   5.93E+04      3.55E+04      3.55E+04       2.11E+04       1.000E+00
1062   ANCHOR        647.00    F  10.00E+04      6.0E+04       6.0E+04        7.10E+04       1.000E+00
1065   ANCHOR        631.00    R  10.00E+04      0.00          0.00           0.00           0.00
1066   ANCHOR        628.00    R  10.00E+04      0.00          0.00           0.00           0.00
1067   ANCHOR        625.00    R  10.00E+04      0.00          0.00           0.00           0.00
1070   SURFACE    RIGHTSIDE         1
1080          .00      672.00
1090   SURFACE      LEFTSIDE        1
1100          .00      640.00
1110   SOIL   RIGHTSIDE      STRENGTH        7
1120     136.00     110.00    28.0       .00     .0       .00       1.8       1.8     659.20      0.00
1130     129.00     110.00    28.0       .00     .0       .00       1.8       1.8     647.60      0.00
1135     122.00     110.00    28.0       .00     .0       .00       1.8       1.8     643.90      0.00
1136     131.00     123.00    30.0       .00     .0       .00      52.0      52.0     641.40      0.00
1137     123.00     110.00    28.0       .00     .0       .00       1.1       1.1     638.20      0.00
1138     124.00     114.00    32.0       .00     .0       .00       3.5       3.5     631.00      0.00
1139     125.00     125.00    40.0     50.00     .0       .00       0.1       0.1
1140   SOIL    LEFTSIDE      STRENGTH        3
1150     123.00     110.00    28.0       .00     .0       .00       1.1       1.1     638.20      0.00
1155     124.00     114.00    32.0       .00     .0       .00       3.5       3.5     631.00      0.00
1160     125.00     125.00    40.0     50.00     .0       .00       0.1       0.1
1170   WATER   ELEVATIONS        62.50    672.00     642.00
1180   H  D  10  672   0  670.9   2.46   665.8   42.62   664.2   49.22   663.0   50.64
1181   660.6   47.02   652.8   22.40   649.5   15.44   645.5   9.92   640.0   5.60
1190   FINISH
```

'ISLAND CREEK LPP, LOGAN, WV

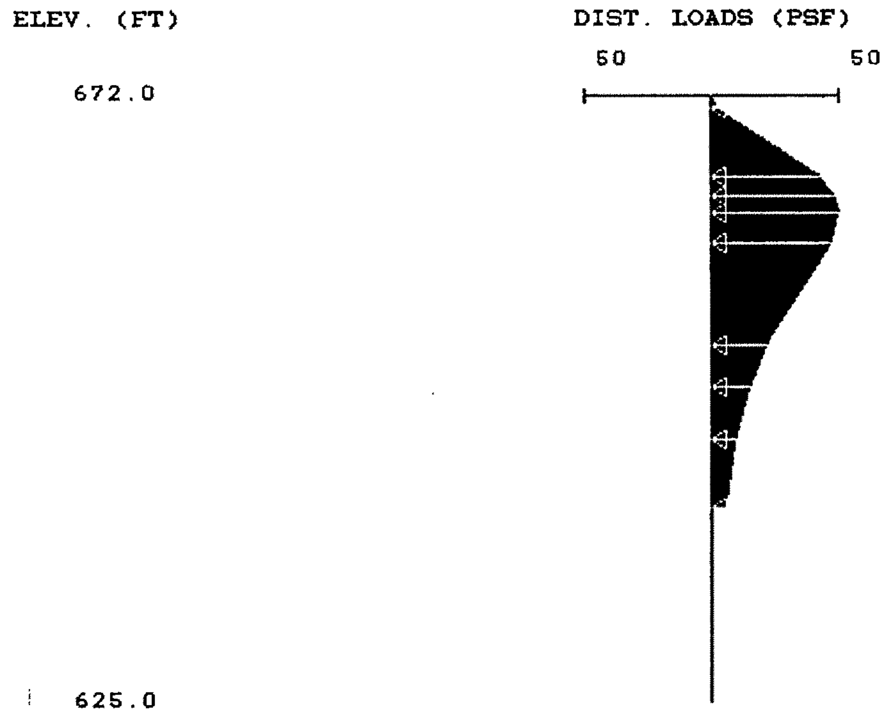
'POST AND PANEL WALL



***** INPUT GEOMETRY *****

DATE: 30-AUG-1993 TIME: 16.41.23

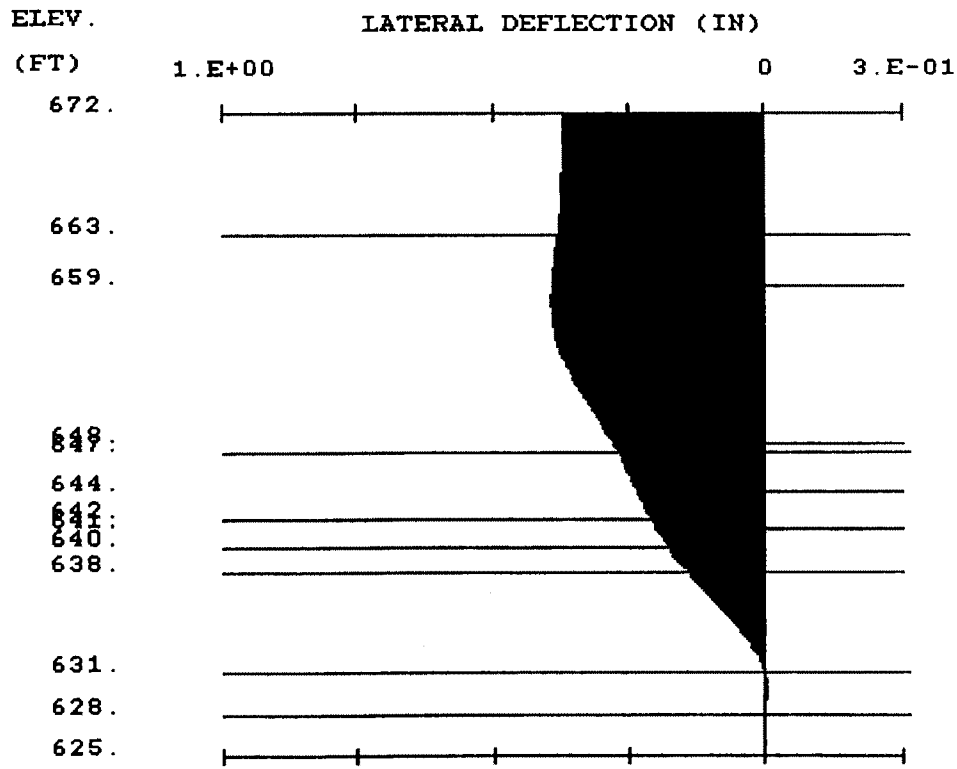
'ISLAND CREEK LPP, LOGAN, WV
'POST AND PANEL WALL



***** INPUT HORIZONTAL LOADS *****
DATE: 30-AUG-1993 TIME: 16.42.23

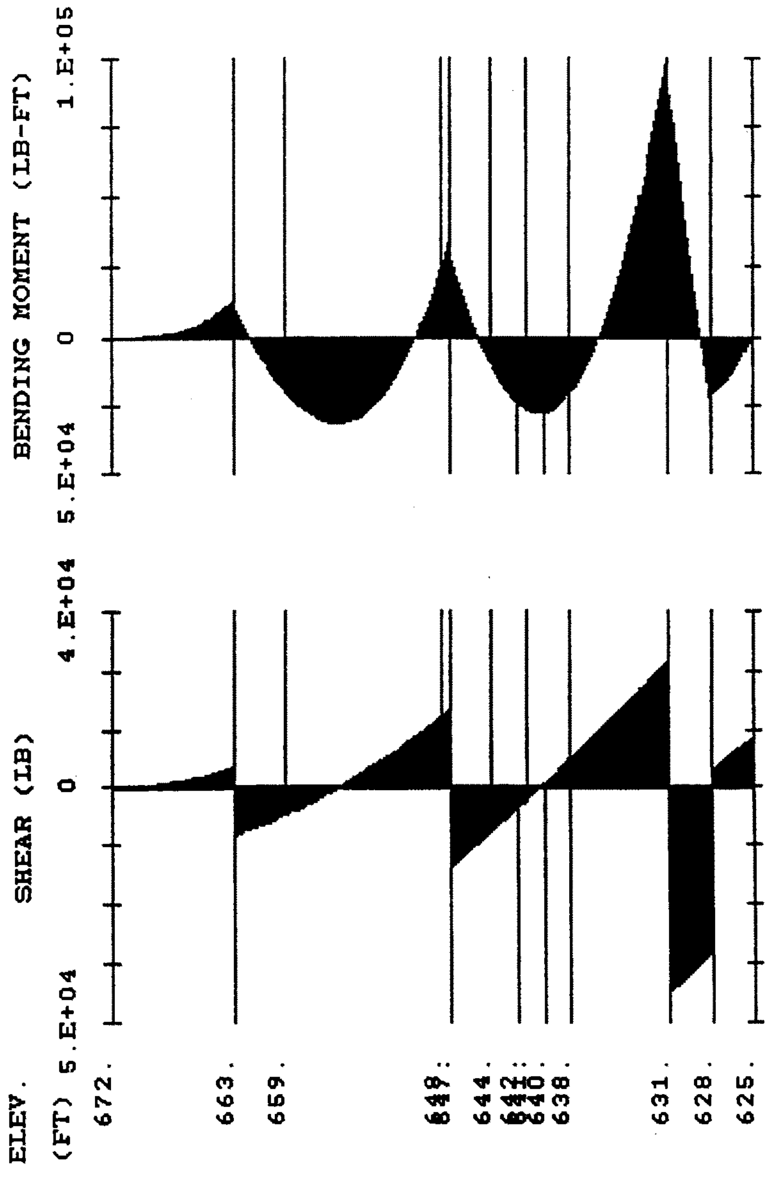
A-I-42

'ISLAND CREEK LPP, LOGAN, WV
'POST AND PANEL WALL

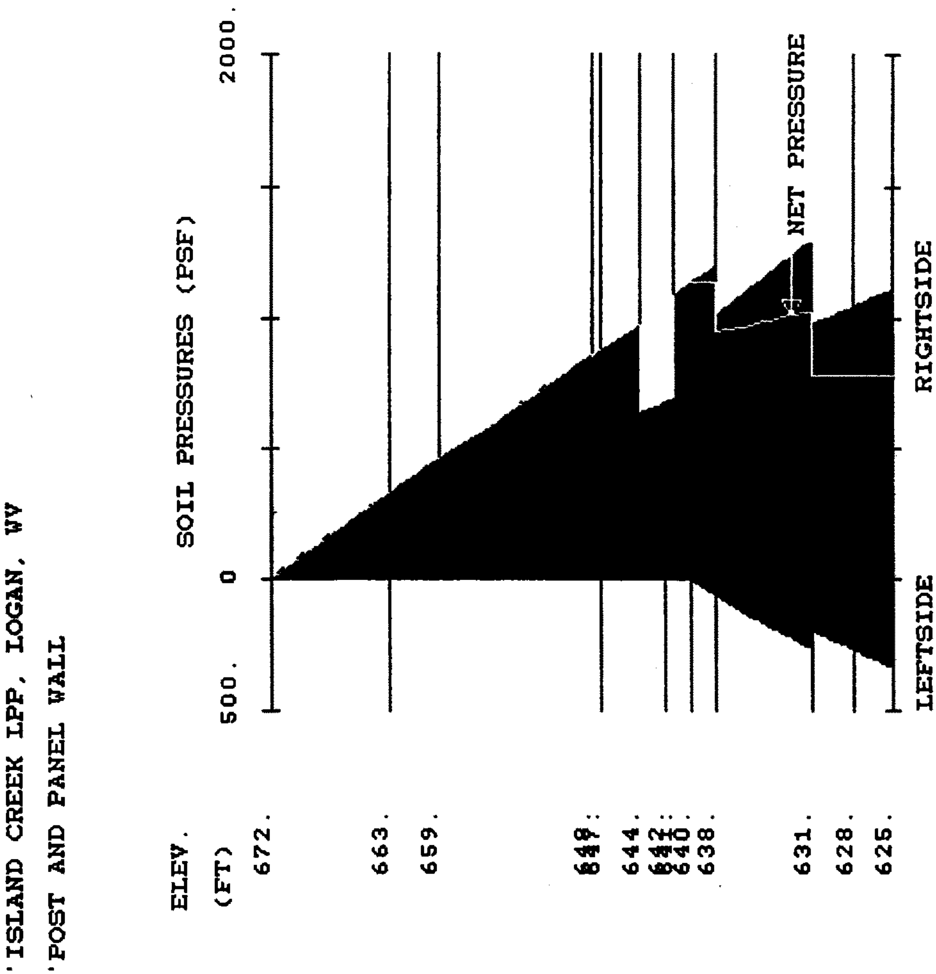


'ISLAND CREEK LPP, LOGAN, WV

'POST AND PANEL WALL



A-I-44


'ISLAND CREEK LPP, LOGAN, WV
'POST AND PANEL WALL
SOIL PRESSURES (PSF)
2000.
0
500.
NET PRESSURE
RIGHTSIDE
LEFTSIDE
ELEV.
(FT)
672.
663.
659.
644.
638.
631.
628.
625.

A-I-45

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 30-AUG-1993 TIME: 16.44.07

INPUT DATA

I.--HEADING:
'ISLAND CREEK LPP, LOGAN, WV

'POST AND PANEL WALL

'WALL HEIGHT = 32', W14 X 233

'TWO ANCHORS, 4' C TO C SPACING, L.C. 1

II.--WALL SEGMENT DATA

ELEVATION AT TOP OF SEGMENT (FT)	MODULUS OF ELASTICICTY (PSI)	MOMENT OF INERTIA (IN**4)	CROSS SECTION AREA (SQIN)
672.00	2.900E+07	753.00	17.13

ELEVATION AT BOTTOM OF WALL = 625.00 (FT).

III.--ANCHOR DATA

ELEVATION AT WALL (FT)	ANCHOR TYPE ('R/F')	ULTIMATE TENSION FORCE (LB)	PRE-STRESS FORCE (LB)	ULTIMATE COMPRESSION FORCE (LB)	ANCHOR STIFFNESS (LB/IN)	ANCHOR SLOPE (FT)
663.00	FLEXIBLE	5.93E+04	3.55E+04	3.55E+04	2.110E+04	1.00
647.00	FLEXIBLE	1.00E+05	6.00E+04	6.00E+04	7.100E+04	1.00
631.00	RIGID					
628.00	RIGID					
625.00	RIGID					

IV.--SURFACE POINT DATA

IV.A.--RIGHTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	672.00

IV.B.-- LEFTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	640.00

V.--SOIL LAYER DATA

V.A.--RIGHTSIDE LAYER DATA

<UNIT WEIGHT>		ANGLE OF INTERNAL	COH-	ANGLE OF WALL	WALL ADH-	<STIFF. COEF.>		<--BOTTOM-->	
SAT.	MOIST	FRICTION	ESION	FRICTION	ESION	ACT.	PASS.	ELEV.	SLOPE

(PCF)	(PCF)	(DEG)	(PSF)	(DEG)	(PSF)	(PCI)	(PCI)	(FT)	(FT)
136.00	110.00	28.00	.00	.00	.00	1.80	1.80	659.20	.00
129.00	110.00	28.00	.00	.00	.00	1.80	1.80	647.60	.00
122.00	110.00	28.00	.00	.00	.00	1.80	1.80	643.90	.00
131.00	123.00	30.00	.00	.00	.00	52.00	52.00	641.40	.00
123.00	110.00	28.00	.00	.00	.00	1.10	1.10	638.20	.00
124.00	114.00	32.00	.00	.00	.00	3.50	3.50	631.00	.00
125.00	125.00	40.00	50.00	.00	.00	.10	.10		

V.B.-- LEFTSIDE LAYER DATA

<UNIT WEIGHT>		ANGLE OF INTERNAL	COH-	ANGLE OF WALL	WALL ADH-	<STIFF. COEF.>		<--BOTTOM-->	
SAT.	MOIST	FRICTION	ESION	FRICTION	ESION	ACT.	PASS.	ELEV.	SLOPE
(PCF)	(PCF)	(DEG)	(PSF)	(DEG)	(PSF)	(PCI)	(PCI)	(FT)	(FT)
123.00	110.00	28.00	.00	.00	.00	1.10	1.10	638.20	.00
124.00	114.00	32.00	.00	.00	.00	3.50	3.50	631.00	.00
125.00	125.00	40.00	50.00	.00	.00	.10	.10		

VI.--INTERACTION ZONE DATA

NONE

VII.--WATER DATA

UNIT WEIGHT = 62.50 (PCF)
RIGHTSIDE ELEVATION = 672.00 (FT)
LEFTSIDE ELEVATION = 642.00 (FT)
NO SEEPAGE

VIII.--SURFACE LOADS

NONE

IX.--HORIZONTAL LOADS

IX.A.--EARTHQUAKE ACCELERATION = .00 (G'S)

IX.B.--HORIZONTAL LINE LOADS

NONE

IX.C.--HORIZONTAL DISTRIBUTED LOADS

ELEVATION (FT)	DIST. LOAD (PSF)
672.00	.00
670.90	2.46
665.80	42.62
664.20	49.22
663.00	50.64
660.60	47.02
652.80	22.40
649.50	15.44
645.50	9.92
640.00	5.60

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 30-AUG-1993 TIME: 16.44.45

SUMMARY OF RESULTS

I.A.--MAXIMA

		MAXIMUM	MINIMUM
BENDING MOMENT (LB-FT)	:	9.802E+04	-3.132E+04
AT ELEVATION (FT)	:	631.00	655.00
DEFLECTION (IN)	:	3.914E-01	-3.360E-03
AT ELEVATION (FT)	:	658.00	630.00
RIGHTSIDE SOIL PRESSURE (PSF)	:	1288.02	
AT ELEVATION (FT)	:	631.00	
LEFTSIDE SOIL PRESSURE (PSF)	:	331.03	
AT ELEVATION (FT)	:	625.00	

I.B.--ANCHOR FORCES

ELEVATION AT ANCHOR (FT)	ANCHOR TYPE	ANCHOR DEFORMATION (IN)	ANCHOR FORCE (LB)
663.00	FLEXIBLE	.29	24375.09
647.00	FLEXIBLE	.21	59330.16
631.00	RIGID	.00	70721.13
628.00	RIGID	.00	-39045.31
625.00	RIGID	.00	11156.44

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 30-AUG-1993 TIME: 16.44.45

COMPLETE RESULTS

II.A.--WALL DEFLECTIONS AND FORCES

	<------DEFLECTION----->		<--WALL INTERNAL FORCES->		
ELEVATION (FT)	AXIAL (IN)	LATERAL (IN)	AXIAL (LB)	SHEAR (LB)	MOMENT (LB-FT)
672.00	-3.173E-02	3.674E-01	0.	0.	0.
671.50	-3.173E-02	3.678E-01	0.	13.	2.
671.00	-3.173E-02	3.682E-01	0.	51.	17.
670.90	-3.173E-02	3.683E-01	0.	61.	22.
670.50	-3.173E-02	3.686E-01	0.	115.	57.
670.00	-3.173E-02	3.690E-01	0.	205.	136.

669.50	-3.173E-02	3.693E-01	0.	322.	267.
669.00	-3.173E-02	3.697E-01	0.	466.	463.
668.50	-3.173E-02	3.701E-01	0.	637.	738.
668.00	-3.173E-02	3.706E-01	0.	835.	1104.
667.50	-3.173E-02	3.710E-01	0.	1059.	1577.
667.00	-3.173E-02	3.715E-01	0.	1310.	2168.
666.50	-3.173E-02	3.720E-01	0.	1588.	2892.
666.00	-3.173E-02	3.726E-01	0.	1893.	3761.
665.80	-3.173E-02	3.728E-01	0.	2022.	4152.
665.50	-3.173E-02	3.732E-01	0.	2224.	4789.
665.00	-3.173E-02	3.740E-01	0.	2581.	5989.
664.50	-3.173E-02	3.748E-01	0.	2964.	7374.
664.20	-3.173E-02	3.754E-01	0.	3206.	8299.
664.00	-3.173E-02	3.758E-01	0.	3372.	8957.
663.50	-3.173E-02	3.770E-01	0.	3806.	10750.
663.00+	-3.173E-02	3.784E-01	0.	4265.	12767.
663.00-	-3.173E-02	3.784E-01	-14569.	-10304.	12767.
662.50	-3.155E-02	3.801E-01	-14569.	-9821.	7734.
662.00	-3.138E-02	3.818E-01	-14569.	-9313.	2950.
661.50	-3.120E-02	3.837E-01	-14569.	-8781.	-1575.
661.00	-3.103E-02	3.855E-01	-14569.	-8225.	-5827.
660.60	-3.088E-02	3.869E-01	-14569.	-7762.	-9025.
660.50	-3.085E-02	3.872E-01	-14569.	-7644.	-9795.
660.00	-3.067E-02	3.887E-01	-14569.	-7039.	-13467.
659.50	-3.050E-02	3.899E-01	-14569.	-6410.	-16830.
659.20+	-3.039E-02	3.905E-01	-14569.	-6022.	-18695.
659.20-	-3.039E-02	3.905E-01	-14569.	-6022.	-18695.
659.00	-3.032E-02	3.908E-01	-14569.	-5758.	-19873.
658.50	-3.015E-02	3.913E-01	-14569.	-5084.	-22585.
658.00	-2.997E-02	3.914E-01	-14569.	-4387.	-24954.
657.50	-2.979E-02	3.910E-01	-14569.	-3667.	-26968.
657.00	-2.962E-02	3.900E-01	-14569.	-2924.	-28617.
656.50	-2.944E-02	3.885E-01	-14569.	-2157.	-29888.
656.00	-2.927E-02	3.864E-01	-14569.	-1368.	-30770.
655.50	-2.909E-02	3.836E-01	-14569.	-555.	-31252.
655.00	-2.891E-02	3.803E-01	-14569.	281.	-31321.
654.50	-2.874E-02	3.763E-01	-14569.	1140.	-30967.
654.00	-2.856E-02	3.718E-01	-14569.	2022.	-30178.
653.50	-2.839E-02	3.666E-01	-14569.	2928.	-28941.
653.00	-2.821E-02	3.608E-01	-14569.	3857.	-27246.
652.80	-2.814E-02	3.584E-01	-14569.	4236.	-26436.
652.50	-2.803E-02	3.546E-01	-14569.	4810.	-25080.
652.00	-2.786E-02	3.478E-01	-14569.	5787.	-22431.
651.50	-2.768E-02	3.406E-01	-14569.	6787.	-19289.
651.00	-2.751E-02	3.330E-01	-14569.	7811.	-15640.
650.50	-2.733E-02	3.251E-01	-14569.	8860.	-11473.
650.00	-2.715E-02	3.169E-01	-14569.	9932.	-6777.
649.50	-2.698E-02	3.087E-01	-14569.	11028.	-1538.
649.00	-2.680E-02	3.004E-01	-14569.	12148.	4256.
648.50	-2.663E-02	2.922E-01	-14569.	13293.	10615.
648.00	-2.645E-02	2.842E-01	-14569.	14462.	17553.
647.60+	-2.631E-02	2.780E-01	-14569.	15415.	23528.
647.60-	-2.631E-02	2.780E-01	-14569.	15415.	23528.
647.50	-2.627E-02	2.765E-01	-14569.	15655.	25081.
647.00+	-2.610E-02	2.693E-01	-14569.	16869.	33211.
647.00-	-2.610E-02	2.693E-01	-49110.	-17672.	33211.
646.50	-2.551E-02	2.628E-01	-49110.	-16434.	24683.
646.00	-2.491E-02	2.567E-01	-49110.	-15173.	16780.
645.50	-2.432E-02	2.510E-01	-49110.	-13889.	9514.
645.00	-2.373E-02	2.454E-01	-49110.	-12582.	2895.
644.50	-2.313E-02	2.400E-01	-49110.	-11250.	-3064.
644.00	-2.254E-02	2.344E-01	-49110.	-9896.	-8351.
643.90+	-2.242E-02	2.333E-01	-49110.	-9622.	-9327.
643.90-	-2.242E-02	2.333E-01	-49110.	-9622.	-9327.

643.50	-2.195E-02	2.287E-01	-49110.	-8652.	-12982.
643.00	-2.135E-02	2.228E-01	-49110.	-7420.	-17001.
642.50	-2.076E-02	2.165E-01	-49110.	-6167.	-20398.
642.00	-2.017E-02	2.097E-01	-49110.	-4892.	-23164.
641.50	-1.957E-02	2.026E-01	-49110.	-3605.	-25288.
641.40+	-1.946E-02	2.011E-01	-49110.	-3346.	-25636.
641.40-	-1.946E-02	2.011E-01	-49110.	-3346.	-25636.
641.00	-1.898E-02	1.949E-01	-49110.	-2156.	-26737.
640.50	-1.839E-02	1.867E-01	-49110.	-660.	-27441.
640.00	-1.779E-02	1.780E-01	-49110.	845.	-27395.
639.50	-1.720E-02	1.688E-01	-49110.	2350.	-26596.
639.00	-1.661E-02	1.590E-01	-49110.	3856.	-25045.
638.50	-1.602E-02	1.487E-01	-49110.	5362.	-22740.
638.20+	-1.566E-02	1.423E-01	-49110.	6265.	-20996.
638.20-	-1.566E-02	1.423E-01	-49110.	6265.	-20996.
638.00	-1.542E-02	1.379E-01	-49110.	6831.	-19687.
637.50	-1.483E-02	1.268E-01	-49110.	8248.	-15917.
637.00	-1.424E-02	1.154E-01	-49110.	9665.	-11439.
636.50	-1.364E-02	1.037E-01	-49110.	11085.	-6251.
636.00	-1.305E-02	9.193E-02	-49110.	12507.	-353.
635.50	-1.246E-02	8.014E-02	-49110.	13932.	6256.
635.00	-1.186E-02	6.847E-02	-49110.	15359.	13579.
634.50	-1.127E-02	5.707E-02	-49110.	16790.	21616.
634.00	-1.068E-02	4.611E-02	-49110.	18224.	30370.
633.50	-1.008E-02	3.574E-02	-49110.	19661.	39841.
633.00	-9.490E-03	2.617E-02	-49110.	21101.	50031.
632.50	-8.897E-03	1.758E-02	-49110.	22545.	60943.
632.00	-8.304E-03	1.020E-02	-49110.	23991.	72576.
631.50	-7.711E-03	4.260E-03	-49110.	25440.	84934.
631.00+	-7.118E-03	0.000E+00	-49110.	26891.	98017.
631.00-	-7.118E-03	0.000E+00	-49110.	-43830.	98017.
630.50	-6.525E-03	-2.436E-03	-49110.	-42501.	76434.
630.00	-5.931E-03	-3.360E-03	-49110.	-41173.	55515.
629.50	-5.338E-03	-3.183E-03	-49110.	-39844.	35261.
629.00	-4.745E-03	-2.309E-03	-49110.	-38515.	15671.
628.50	-4.152E-03	-1.123E-03	-49110.	-37187.	-3254.
628.00+	-3.559E-03	0.000E+00	-49110.	-35858.	-21515.
628.00-	-3.559E-03	0.000E+00	-49110.	3187.	-21515.
627.50	-2.966E-03	7.625E-04	-49110.	4515.	-19590.
627.00	-2.373E-03	1.139E-03	-49110.	5844.	-17000.
626.50	-1.779E-03	1.179E-03	-49110.	7172.	-13746.
626.00	-1.186E-03	9.494E-04	-49110.	8500.	-9828.
625.50	-5.931E-04	5.260E-04	-49110.	9828.	-5246.
625.00	0.000E+00	0.000E+00	-49110.	11156.	0.

II.B.--SOIL PRESSURES

ELEVATION (FT)	<----------SOIL PRESSURES (PSF)---------> LEFTSIDE	RIGHTSIDE	NET
672.00	.00	.00	.00
671.50	.00	18.33	18.33
671.00	.00	36.67	36.67
670.90	.00	40.33	40.33
670.50	.00	55.00	55.00
670.00	.00	73.32	73.32
669.50	.00	91.65	91.65
669.00	.00	109.97	109.97
668.50	.00	128.29	128.29
668.00	.00	146.60	146.60
667.50	.00	164.92	164.92
667.00	.00	183.23	183.23
666.50	.00	201.53	201.53
666.00	.00	219.83	219.83

665.80	.00	227.15	227.15
665.50	.00	238.12	238.12
665.00	.00	256.41	256.41
664.50	.00	274.68	274.68
664.20	.00	285.64	285.64
664.00	.00	292.94	292.94
663.50	.00	311.19	311.19
663.00+	.00	329.41	329.41
663.00-	.00	329.41	329.41
662.50	.00	347.62	347.62
662.00	.00	365.80	365.80
661.50	.00	383.97	383.97
661.00	.00	402.13	402.13
660.60	.00	416.65	416.65
660.50	.00	420.28	420.28
660.00	.00	438.44	438.44
659.50	.00	456.61	456.61
659.20+	.00	467.52	467.52
659.20-	.00	464.19	464.19
659.00	.00	470.73	470.73
658.50	.00	487.09	487.09
658.00	.00	503.48	503.48
657.50	.00	519.93	519.93
657.00	.00	536.43	536.43
656.50	.00	553.00	553.00
656.00	.00	569.65	569.65
655.50	.00	586.37	586.37
655.00	.00	603.19	603.19
654.50	.00	620.10	620.10
654.00	.00	637.11	637.11
653.50	.00	654.22	654.22
653.00	.00	671.44	671.44
652.80	.00	678.36	678.36
652.50	.00	688.77	688.77
652.00	.00	706.20	706.20
651.50	.00	723.74	723.74
651.00	.00	741.38	741.38
650.50	.00	759.11	759.11
650.00	.00	776.92	776.92
649.50	.00	794.80	794.80
649.00	.00	812.75	812.75
648.50	.00	830.73	830.73
648.00	.00	848.72	848.72
647.60+	.00	863.12	863.12
647.60-	.00	857.80	857.80
647.50	.00	861.05	861.05
647.00+	.00	877.29	877.29
647.00-	.00	877.29	877.29
646.50	.00	893.46	893.46
646.00	.00	909.58	909.58
645.50	.00	925.67	925.67
645.00	.00	941.76	941.76
644.50	.00	957.87	957.87
644.00	.00	974.03	974.03
643.90+	.00	977.27	977.27
643.90-	.00	644.12	644.12
643.50	.00	653.25	653.25
643.00	.00	664.67	664.67
642.50	.00	676.08	676.08
642.00	.00	687.50	687.50
641.50	.00	698.92	698.92
641.40+	.00	701.20	701.20
641.40-	.00	1089.01	1089.01
641.00	.00	1102.37	1102.37

640.50	.00	1119.17	1119.17
640.00	.00	1136.08	1136.08
639.50	16.94	1153.10	1136.16
639.00	33.78	1170.23	1136.45
638.50	50.50	1187.46	1136.96
638.20+	60.48	1197.86	1137.38
638.20-	59.66	1014.54	954.88
638.00	66.11	1021.98	955.87
637.50	81.96	1040.79	958.83
637.00	97.40	1059.88	962.48
636.50	112.43	1079.23	966.79
636.00	127.06	1098.78	971.72
635.50	141.29	1118.47	977.18
635.00	155.14	1138.25	983.11
634.50	168.65	1158.03	989.38
634.00	181.86	1177.74	995.88
633.50	194.84	1197.27	1002.43
633.00	207.65	1216.51	1008.86
632.50	220.39	1235.35	1014.96
632.00	233.17	1253.65	1020.48
631.50	246.10	1271.26	1025.16
631.00+	259.34	1288.02	1028.68
631.00-	197.07	978.76	781.69
630.50	208.13	990.44	782.32
630.00	219.24	1001.81	782.57
629.50	230.40	1012.94	782.54
629.00	241.61	1023.92	782.32
628.50	252.83	1034.83	782.00
628.00+	264.05	1045.74	781.69
628.00-	264.05	1045.74	781.69
627.50	275.26	1056.73	781.47
627.00	286.45	1067.80	781.36
626.50	297.62	1078.95	781.34
626.00	308.77	1090.17	781.40
625.50	319.90	1101.43	781.53
625.00	331.03	1112.72	781.69

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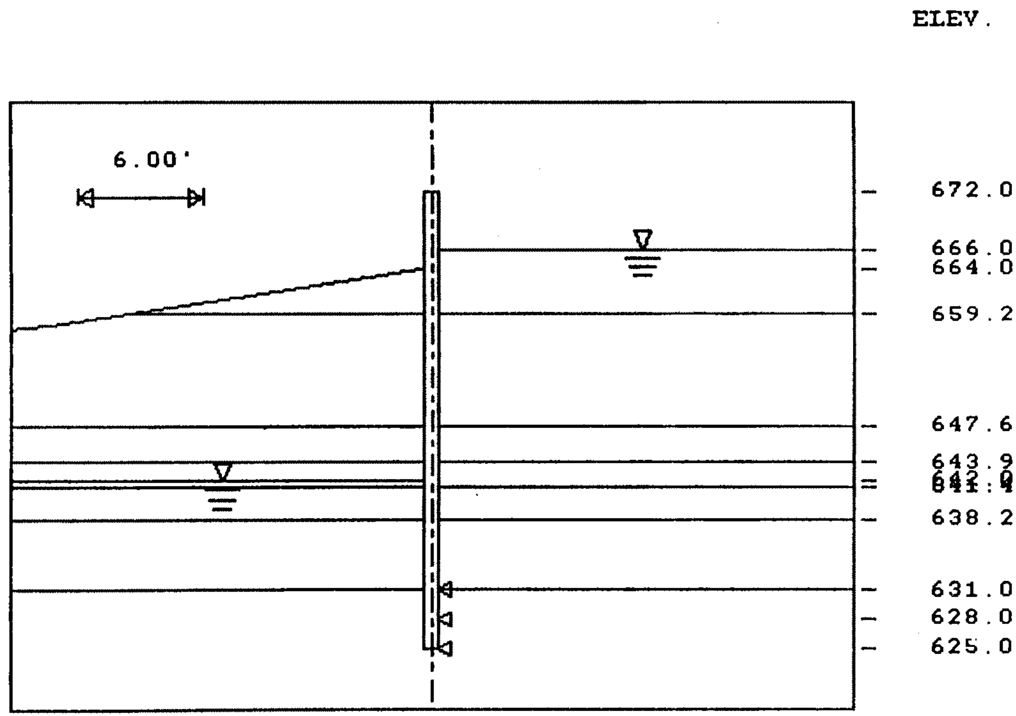
1000 'ISLAND CREEK LPP, LOGAN, WV
1010 'POST AND PANEL WALL
1020 'WALL HEIGHT = 32', W14 X 233
1030 'NO ANCHORS, 4' C TO C SPACING, L.C. 2
1040 WALL   672.00   2.900E+07   7.53E+02   17.13E+00
1050 WALL   625.00
1065 ANCHOR   631.00 R 10.00E+04  0.00      0.00      0.00      0.00
1066 ANCHOR   628.00 R 10.00E+04  0.00      0.00      0.00      0.00
1067 ANCHOR   625.00 R 10.00E+04  0.00      0.00      0.00      0.00
1070 SURFACE RIGHTSIDE   1
1080        .00    666.00
1090 SURFACE  LEFTSIDE   4
1100        .00    664.00  18.0  658.00  37.0  654.00  45.0  645.00
1110 SOIL RIGHTSIDE  STRENGTH    7
1120   136.00  110.00 28.0     .00   .0     .00     1.8     1.8   659.20    0.00
1130   129.00  110.00 28.0     .00   .0     .00     1.8     1.8   647.60    0.00
1135   122.00  110.00 28.0     .00   .0     .00     1.8     1.8   643.90    0.00
1136   131.00  123.00 30.0     .00   .0     .00    52.0    52.0   641.40    0.00
1137   123.00  110.00 28.0     .00   .0     .00     1.1     1.1   638.20    0.00
1138   124.00  114.00 32.0     .00   .0     .00     3.5     3.5   631.00    0.00
1139   125.00  125.00 40.0   50.00   .0     .00     0.1     0.1
1140 SOIL  LEFTSIDE  STRENGTH    8
1150   136.00  110.00 28.0     .00   .0     .00     3.0     3.0   659.20    0.00
1151   129.00  110.00 28.0     .00   .0     .00     3.0     3.0   647.60    0.00
1152   122.00  110.00 28.0     .00   .0     .00     3.0     3.0   643.90    0.00
1153   131.00  123.00 30.0     .00   .0     .00    86.6    86.6   642.00    0.00
1154   131.00  123.00 30.0     .00   .0     .00    52.0    52.0   641.40    0.00
1155   123.00  110.00 28.0     .00   .0     .00     1.1     1.1   638.20    0.00
1156   124.00  114.00 32.0     .00   .0     .00     3.5     3.5   631.00    0.00
1160   125.00  125.00 40.0   50.00   .0     .00     0.1     0.1
1170 WATER ELEVATIONS    62.50  666.00  642.00
1190 FINISH
```

'ISLAND CREEK LPP, LOGAN, WV

'POST AND PANEL WALL

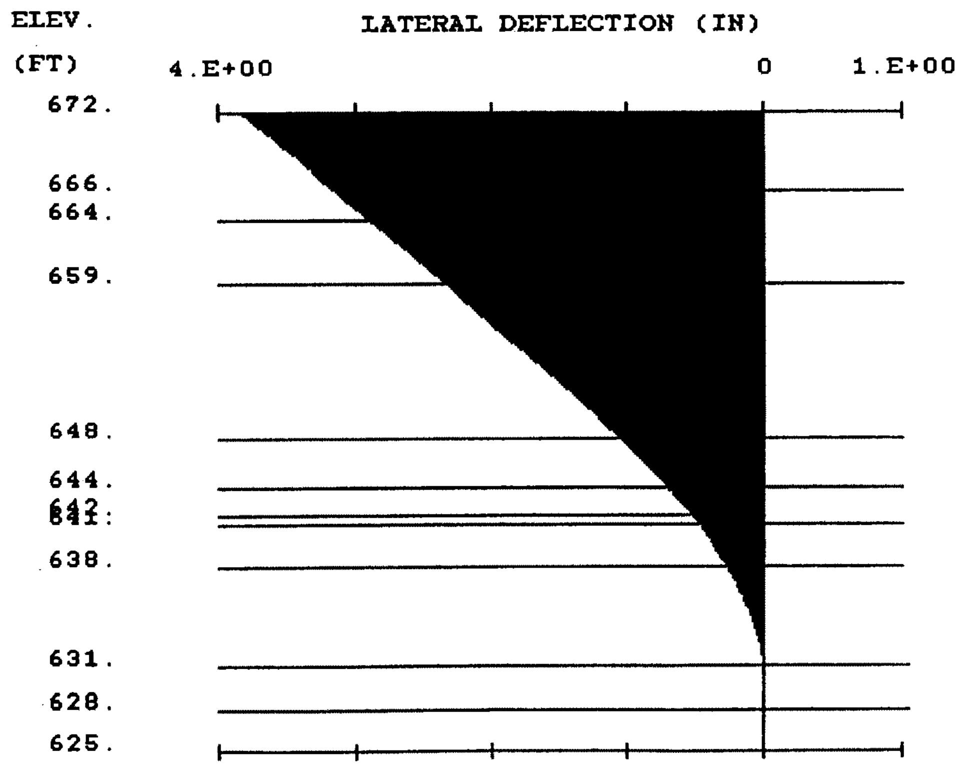


***** INPUT GEOMETRY *****

DATE: 30-AUG-1993 TIME: 16.57.06

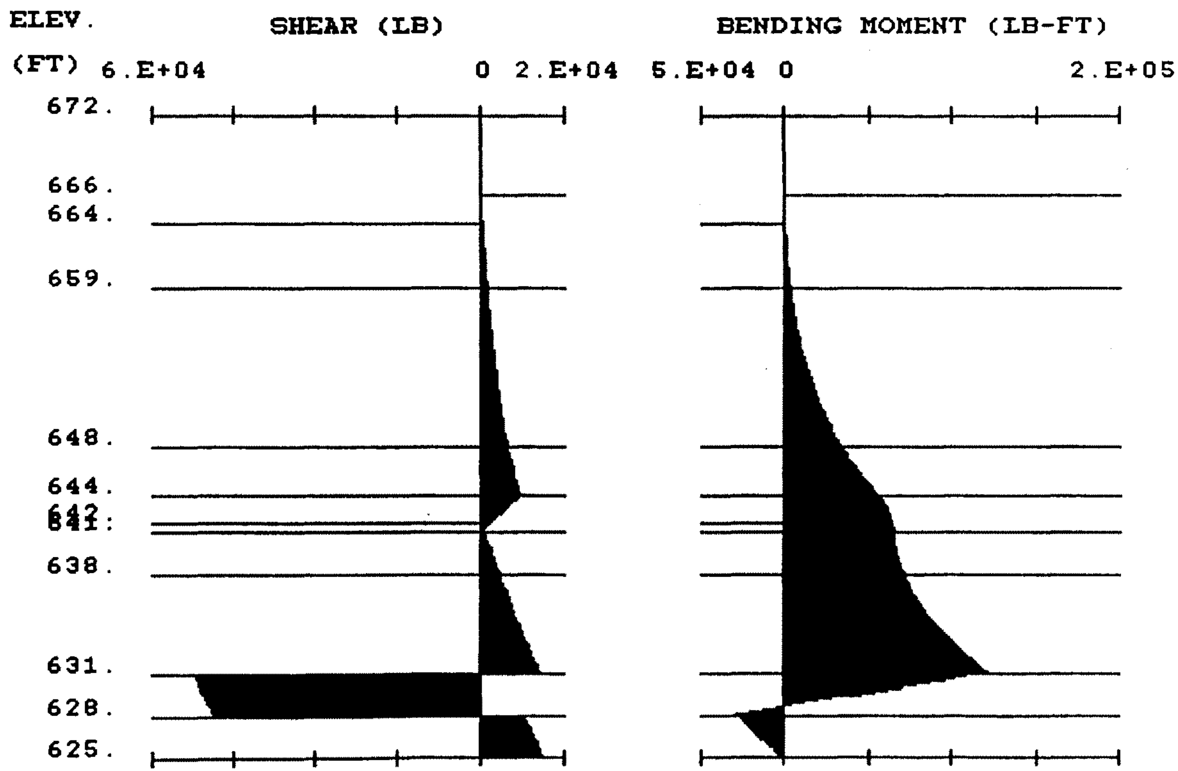
'ISLAND CREEK LPP, LOGAN, WV

'POST AND PANEL WALL



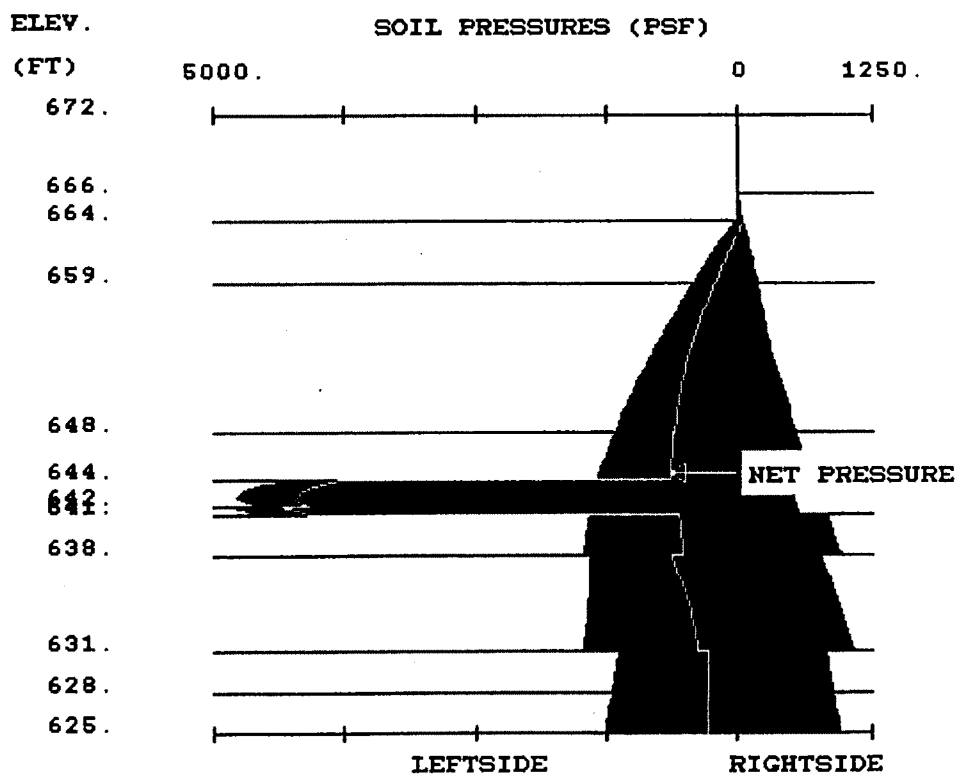
A-I-56

'ISLAND CREEK LPP, LOGAN, WV
'POST AND PANEL WALL



'ISLAND CREEK LPP, LOGAN, WV

'POST AND PANEL WALL



D-T- 57

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 27-AUG-1993 TIME: 17.09.37

INPUT DATA

I.--HEADING:

'ISLAND CREEK LPP, LOGAN, WV

'POST AND PANEL WALL

'WALL HEIGHT = 32', W14 X 233

'NO ANCHORS, 4' C TO C SPACING, L.C. 2

II.--WALL SEGMENT DATA

ELEVATION AT TOP OF SEGMENT (FT)	MODULUS OF ELASTICICTY (PSI)	MOMENT OF INERTIA (IN**4)	CROSS SECTION AREA (SQIN)
672.00	2.900E+07	753.00	17.13

ELEVATION AT BOTTOM OF WALL = 625.00 (FT).

III.--ANCHOR DATA

ELEVATION AT WALL (FT)	ANCHOR TYPE ('R/F')	ULTIMATE TENSION FORCE (LB)	PRE-STRESS FORCE (LB)	ULTIMATE COMPRESSION FORCE (LB)	ANCHOR STIFFNESS (LB/IN)	ANCHOR SLOPE (FT)
631.00	RIGID					
628.00	RIGID					
625.00	RIGID					

IV.--SURFACE POINT DATA

IV.A.--RIGHTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	666.00

IV.B.-- LEFTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	664.00
18.00	658.00
37.00	654.00
45.00	645.00

V.--SOIL LAYER DATA

V.A.--RIGHTSIDE LAYER DATA

<UNIT WEIGHT>	ANGLE OF INTERNAL	COH-	ANGLE OF WALL	WALL ADH-	<STIFF. COEF.>	<--BOTTOM-->

SAT.	MOIST	FRICTION	ESION	FRICTION	ESION	ACT.	PASS.	ELEV.	SLOPE
(PCF)	(PCF)	(DEG)	(PSF)	(DEG)	(PSF)	(PCI)	(PCI)	(FT)	(FT)
136.00	110.00	28.00	.00	.00	.00	1.80	1.80	659.20	.00
129.00	110.00	28.00	.00	.00	.00	1.80	1.80	647.60	.00
122.00	110.00	28.00	.00	.00	.00	1.80	1.80	643.90	.00
131.00	123.00	30.00	.00	.00	.00	52.00	52.00	641.40	.00
123.00	110.00	28.00	.00	.00	.00	1.10	1.10	638.20	.00
124.00	114.00	32.00	.00	.00	.00	3.50	3.50	631.00	.00
125.00	125.00	40.00	50.00	.00	.00	.10	.10		

V.B.-- LEFTSIDE LAYER DATA

<UNIT WEIGHT>		ANGLE OF INTERNAL	COH-	ANGLE OF WALL	WALL ADH-	<STIFF. COEF.>		<--BOTTOM-->	
SAT.	MOIST	FRICTION	ESION	FRICTION	ESION	ACT.	PASS.	ELEV.	SLOPE
(PCF)	(PCF)	(DEG)	(PSF)	(DEG)	(PSF)	(PCI)	(PCI)	(FT)	(FT)
136.00	110.00	28.00	.00	.00	.00	3.00	3.00	659.20	.00
129.00	110.00	28.00	.00	.00	.00	3.00	3.00	647.60	.00
122.00	110.00	28.00	.00	.00	.00	3.00	3.00	643.90	.00
131.00	123.00	30.00	.00	.00	.00	86.60	86.60	642.00	.00
131.00	123.00	30.00	.00	.00	.00	52.00	52.00	641.40	.00
123.00	110.00	28.00	.00	.00	.00	1.10	1.10	638.20	.00
124.00	114.00	32.00	.00	.00	.00	3.50	3.50	631.00	.00
125.00	125.00	40.00	50.00	.00	.00	.10	.10		

VI.--INTERACTION ZONE DATA

NONE

VII.--WATER DATA

UNIT WEIGHT = 62.50 (PCF)
RIGHTSIDE ELEVATION = 666.00 (FT)
LEFTSIDE ELEVATION = 642.00 (FT)
NO SEEPAGE

VIII.--SURFACE LOADS

NONE

IX.--HORIZONTAL LOADS

NONE

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 27-AUG-1993 **TIME: 17.13.36**

SUMMARY OF RESULTS

I.A.--MAXIMA

		MAXIMUM	MINIMUM
BENDING MOMENT (LB-FT)	:	1.217E+05	-2.907E+04
AT ELEVATION (FT)	:	631.00	628.00
DEFLECTION (IN)	:	3.851E+00	-4.240E-03
AT ELEVATION (FT)	:	672.00	630.00
RIGHTSIDE SOIL PRESSURE (PSF)	:	1080.72	
AT ELEVATION (FT)	:	631.00	
LEFTSIDE SOIL PRESSURE (PSF)	:	4897.94	
AT ELEVATION (FT)	:	642.00	

I.B.--ANCHOR FORCES

ELEVATION AT ANCHOR (FT)	ANCHOR TYPE	ANCHOR DEFORMATION (IN)	ANCHOR FORCE (LB)
631.00	RIGID	.00	62860.24
628.00	RIGID	.00	-56321.30
625.00	RIGID	.00	11496.72

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 27-AUG-1993 TIME: 17.13.36

COMPLETE RESULTS

II.A.--WALL DEFLECTIONS AND FORCES

	<------DEFLECTION----->		<--WALL INTERNAL FORCES->		
ELEVATION (FT)	AXIAL (IN)	LATERAL (IN)	AXIAL (LB)	SHEAR (LB)	MOMENT (LB-FT)
672.00	0.000E+00	3.851E+00	0.	0.	0.
671.50	0.000E+00	3.792E+00	0.	0.	0.
671.00	0.000E+00	3.734E+00	0.	0.	0.
670.50	0.000E+00	3.676E+00	0.	0.	0.
670.00	0.000E+00	3.617E+00	0.	0.	0.
669.50	0.000E+00	3.559E+00	0.	0.	0.
669.00	0.000E+00	3.500E+00	0.	0.	0.
668.50	0.000E+00	3.442E+00	0.	0.	0.
668.00	0.000E+00	3.383E+00	0.	0.	0.
667.50	0.000E+00	3.325E+00	0.	0.	0.
667.00	0.000E+00	3.267E+00	0.	0.	0.
666.50	0.000E+00	3.208E+00	0.	0.	0.
666.00	0.000E+00	3.150E+00	0.	0.	0.
665.50	0.000E+00	3.091E+00	0.	11.	2.
665.00	0.000E+00	3.033E+00	0.	45.	15.
664.50	0.000E+00	2.975E+00	0.	100.	50.
664.00	0.000E+00	2.916E+00	0.	178.	119.
663.50	0.000E+00	2.858E+00	0.	267.	230.
663.00	0.000E+00	2.799E+00	0.	356.	386.

662.50	0.000E+00	2.741E+00	0.	445.	586.
662.00	0.000E+00	2.682E+00	0.	534.	831.
661.50	0.000E+00	2.624E+00	0.	625.	1120.
661.00	0.000E+00	2.566E+00	0.	717.	1456.
660.50	0.000E+00	2.507E+00	0.	810.	1837.
660.00	0.000E+00	2.449E+00	0.	905.	2266.
659.50	0.000E+00	2.391E+00	0.	1002.	2743.
659.20	0.000E+00	2.356E+00	0.	1062.	3052.
659.00	0.000E+00	2.333E+00	0.	1102.	3269.
658.50	0.000E+00	2.275E+00	0.	1204.	3845.
658.00	0.000E+00	2.217E+00	0.	1309.	4473.
657.50	0.000E+00	2.159E+00	0.	1416.	5154.
657.00	0.000E+00	2.101E+00	0.	1526.	5889.
656.50	0.000E+00	2.043E+00	0.	1640.	6681.
656.00	0.000E+00	1.985E+00	0.	1758.	7530.
655.50	0.000E+00	1.928E+00	0.	1880.	8440.
655.00	0.000E+00	1.871E+00	0.	2006.	9411.
654.50	0.000E+00	1.814E+00	0.	2137.	10447.
654.00	0.000E+00	1.757E+00	0.	2273.	11549.
653.50	0.000E+00	1.700E+00	0.	2417.	12721.
653.00	0.000E+00	1.644E+00	0.	2568.	13967.
652.50	0.000E+00	1.587E+00	0.	2729.	15291.
652.00	0.000E+00	1.532E+00	0.	2898.	16697.
651.50	0.000E+00	1.476E+00	0.	3077.	18190.
651.00	0.000E+00	1.421E+00	0.	3265.	19775.
650.50	0.000E+00	1.366E+00	0.	3464.	21457.
650.00	0.000E+00	1.312E+00	0.	3674.	23241.
649.50	0.000E+00	1.258E+00	0.	3895.	25133.
649.00	0.000E+00	1.205E+00	0.	4128.	27138.
648.50	0.000E+00	1.152E+00	0.	4372.	29263.
648.00	0.000E+00	1.099E+00	0.	4629.	31512.
647.60+	0.000E+00	1.058E+00	0.	4844.	33407.
647.60-	0.000E+00	1.058E+00	0.	4844.	33407.
647.50	0.000E+00	1.048E+00	0.	4897.	33894.
647.00	0.000E+00	9.969E-01	0.	5172.	36411.
646.50	0.000E+00	9.466E-01	0.	5460.	39068.
646.00	0.000E+00	8.972E-01	0.	5761.	41873.
645.50	0.000E+00	8.485E-01	0.	6076.	44832.
645.00	0.000E+00	8.008E-01	0.	6404.	47951.
644.50	0.000E+00	7.539E-01	0.	6746.	51238.
644.00	0.000E+00	7.082E-01	0.	7102.	54699.
643.90+	0.000E+00	6.991E-01	0.	7175.	55413.
643.90-	0.000E+00	6.991E-01	0.	7175.	55413.
643.50	0.000E+00	6.634E-01	0.	6173.	58087.
643.00	0.000E+00	6.199E-01	0.	4824.	60838.
642.50	0.000E+00	5.775E-01	0.	3420.	62900.
642.00+	0.000E+00	5.364E-01	0.	2080.	64271.
642.00-	0.000E+00	5.364E-01	0.	2080.	64271.
641.50	0.000E+00	4.966E-01	0.	706.	64963.
641.40+	0.000E+00	4.887E-01	0.	444.	65020.
641.40-	0.000E+00	4.887E-01	0.	444.	65020.
641.00	0.000E+00	4.580E-01	0.	818.	65273.
640.50	0.000E+00	4.207E-01	0.	1288.	65799.
640.00	0.000E+00	3.848E-01	0.	1763.	66561.
639.50	0.000E+00	3.501E-01	0.	2242.	67562.
639.00	0.000E+00	3.168E-01	0.	2725.	68804.
638.50	0.000E+00	2.848E-01	0.	3213.	70288.
638.20+	0.000E+00	2.663E-01	0.	3507.	71296.
638.20-	0.000E+00	2.663E-01	0.	3507.	71296.
638.00	0.000E+00	2.543E-01	0.	3681.	72015.
637.50	0.000E+00	2.251E-01	0.	4124.	73966.
637.00	0.000E+00	1.975E-01	0.	4580.	76141.
636.50	0.000E+00	1.713E-01	0.	5047.	78547.
636.00	0.000E+00	1.467E-01	0.	5525.	81190.

635.00	0.000E+00	1.023E-01	0.	6514.	87206.
634.50	0.000E+00	8.272E-02	0.	7023.	90590.
634.00	0.000E+00	6.490E-02	0.	7542.	94231.
633.50	0.000E+00	4.894E-02	0.	8069.	98133.
633.00	0.000E+00	3.492E-02	0.	8603.	102301.
632.50	0.000E+00	2.293E-02	0.	9144.	106738.
632.00	0.000E+00	1.305E-02	0.	9691.	111446.
631.50	0.000E+00	5.372E-03	0.	10243.	116430.
631.00+	0.000E+00	0.000E+00	0.	10798.	121690.
631.00-	0.000E+00	0.000E+00	0.	-52062.	121690.
630.50	0.000E+00	-3.068E-03	0.	-51459.	95809.
630.00	0.000E+00	-4.240E-03	0.	-50855.	70231.
629.50	0.000E+00	-4.022E-03	0.	-50251.	44954.
629.00	0.000E+00	-2.914E-03	0.	-49648.	19979.
628.50	0.000E+00	-1.411E-03	0.	-49044.	-4694.
628.00+	0.000E+00	0.000E+00	0.	-48441.	-29065.
628.00-	0.000E+00	0.000E+00	0.	7880.	-29065.
627.50	0.000E+00	9.294E-04	0.	8483.	-24974.
627.00	0.000E+00	1.365E-03	0.	9086.	-20582.
626.50	0.000E+00	1.394E-03	0.	9688.	-15889.
626.00	0.000E+00	1.110E-03	0.	10291.	-10894.
625.50	0.000E+00	6.099E-04	0.	10894.	-5598.
625.00	0.000E+00	0.000E+00	0.	11497.	0.

II.B.--SOIL PRESSURES

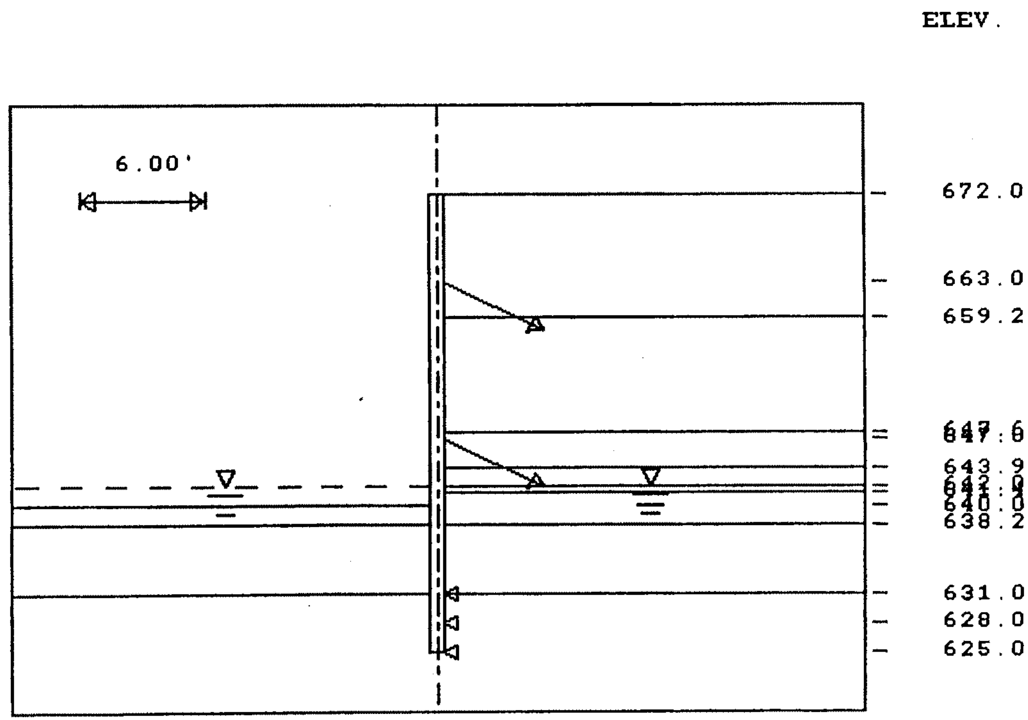
ELEVATION	<---------SOIL	PRESSURES (PSF)-------->	
(FT)	LEFTSIDE	RIGHTSIDE	NET
672.00	.00	.00	.00
671.50	.00	.00	.00
671.00	.00	.00	.00
670.50	.00	.00	.00
670.00	.00	.00	.00
669.50	.00	.00	.00
669.00	.00	.00	.00
668.50	.00	.00	.00
668.00	.00	.00	.00
667.50	.00	.00	.00
667.00	.00	.00	.00
666.50	.00	.00	.00
666.00	.00	.00	.00
665.50	.00	13.27	13.27
665.00	.00	26.54	26.54
664.50	.00	39.80	39.80
664.00	.00	53.07	53.07
663.50	45.01	66.34	21.33
663.00	89.37	79.61	-9.76
662.50	133.08	92.88	-40.20
662.00	176.14	106.14	-70.00
661.50	218.56	119.41	-99.15
661.00	260.34	132.68	-127.66
660.50	301.46	145.95	-155.52
660.00	341.95	159.22	-182.73
659.50	381.79	172.48	-209.31
659.20	405.39	180.44	-224.94
659.00	420.99	185.25	-235.74
658.50	459.55	197.25	-262.29
658.00	497.46	209.26	-288.21
657.50	534.75	221.26	-313.49
657.00	571.39	233.26	-338.13
656.50	607.41	245.27	-362.14
656.00	642.80	257.27	-385.53
655.50	677.57	269.28	-408.29

655.00	711.71	281.28	-430.43
654.50	745.24	293.29	-451.96
654.00	778.16	307.40	-470.76
653.50	810.48	324.22	-486.26
653.00	842.20	341.38	-500.82
652.50	873.33	358.87	-514.46
652.00	903.88	376.69	-527.19
651.50	933.85	394.83	-539.02
651.00	963.27	413.28	-549.98
650.50	992.13	432.04	-560.08
650.00	1020.45	451.11	-569.34
649.50	1048.24	470.46	-577.77
649.00	1075.51	490.11	-585.41
648.50	1102.29	510.02	-592.27
648.00	1128.59	530.21	-598.38
647.60+	1149.29	546.54	-602.75
647.60-	1149.29	531.49	-617.80
647.50	1154.42	535.37	-619.05
647.00	1179.81	554.92	-624.88
646.50	1204.77	574.69	-630.08
646.00	1229.32	594.66	-634.66
645.50	1253.50	614.83	-638.68
645.00	1277.33	635.16	-642.17
644.50	1300.84	655.65	-645.18
644.00	1324.05	676.28	-647.76
643.90+	1328.66	680.42	-648.23
643.90-	4252.64	497.12	-3755.52
643.50	4550.62	506.25	-4044.37
643.00	4711.91	517.67	-4194.25
642.50	4769.58	529.08	-4240.50
642.00+	4631.35	540.50	-4090.85
642.00-	4897.94	540.50	-4357.44
641.50	4689.70	551.92	-4137.78
641.40+	4648.20	554.20	-4094.00
641.40-	1400.35	830.17	-570.18
641.00	1408.80	845.56	-563.24
640.50	1419.42	864.81	-554.61
640.00	1430.12	884.06	-546.06
639.50	1440.90	903.30	-537.60
639.00	1451.77	922.52	-529.26
638.50	1462.76	941.71	-521.05
638.20+	1469.40	953.20	-516.21
638.20-	1409.49	773.75	-635.74
638.00	1409.14	783.38	-625.76
637.50	1408.57	807.33	-601.23
637.00	1408.47	831.08	-577.39
636.50	1408.89	854.58	-554.31
636.00	1409.89	877.78	-532.12
635.50	1411.54	900.63	-510.91
635.00	1413.90	923.08	-490.82
634.50	1417.03	945.08	-471.96
634.00	1421.02	966.56	-454.46
633.50	1425.94	987.46	-438.48
633.00	1431.88	1007.71	-424.17
632.50	1438.92	1027.24	-411.68
632.00	1447.17	1045.97	-401.20
631.50	1456.72	1063.83	-392.90
631.00+	1467.69	1080.72	-386.97
631.00-	1115.29	821.23	-294.06
630.50	1125.71	832.94	-292.77
630.00	1136.58	844.33	-292.25
629.50	1147.78	855.46	-292.32
629.00	1159.21	866.43	-292.79
628.50	1170.75	877.31	-293.44

628.00+	1182.27	888.21	-294.06
628.00-	1182.27	888.21	-294.06
627.50	1193.67	899.19	-294.48
627.00	1204.95	910.27	-294.68
626.50	1216.12	921.42	-294.70
626.00	1227.21	932.64	-294.57
625.50	1238.24	943.90	-294.34
625.00	1249.24	955.19	-294.06

```
1000 'ISLAND CREEK LPP, LOGAN, WV
1010 'POST AND PANEL WALL
1020 'WALL HEIGHT = 32', W14 X 233
1030 'TWO ANCHORS, 4' C TO C SPACING, L.C. 3
1040 WALL   672.00   2.900E+07   7.53E+02   17.13E+00
1050 WALL   625.00
1060 ANCHOR    663.00 F  5.93E+04  3.55E+04  3.55E+04  2.10E+04  1.000E+00
1062 ANCHOR    647.00 F 10.00E+04  6.00E+04  6.00E+04  7.10E+04  1.000E+00
1065 ANCHOR    631.00 R 10.00E+04  0.00      0.00      0.00      0.00
1066 ANCHOR    628.00 R 10.00E+04  0.00      0.00      0.00      0.00
1067 ANCHOR    625.00 R 10.00E+04  0.00      0.00      0.00      0.00
1070 SURFACE RIGHTSIDE   1
1080       .00    672.00
1090 SURFACE  LEFTSIDE   1
1100       .00    640.00
1110 SOIL RIGHTSIDE  STRENGTH    8
1120   136.00  110.00 28.0      .00   .0     .00     3.0     3.0   659.20    0.00
1130   129.00  110.00 28.0      .00   .0     .00     3.0     3.0   647.60    0.00
1131   122.00  110.00 28.0      .00   .0     .00     3.0     3.0   643.90    0.00
1132   131.00  123.00 30.0      .00   .0     .00    86.6    86.6   642.00    0.00
1133   131.00  123.00 30.0      .00   .0     .00    52.0    52.0   641.40    0.00
1137   123.00  110.00 28.0      .00   .0     .00     1.1     1.1   638.20    0.00
1138   124.00  114.00 32.0      .00   .0     .00     3.5     3.5   631.00    0.00
1139   125.00  125.00 40.0    50.00   .0     .00     0.1     0.1
1140 SOIL  LEFTSIDE  STRENGTH    3
1150   123.00  110.00 28.0      .00   .0     .00     1.1     1.1   638.20    0.00
1155   124.00  114.00 32.0      .00   .0     .00     3.5     3.5   631.00    0.00
1160   125.00  125.00 40.0    50.00   .0     .00     0.1     0.1
1170 WATER ELEVATIONS    62.50  642.00  642.00
1190 FINISH
```

'ISLAND CREEK LPP, LOGAN, WV
'POST AND PANEL WALL

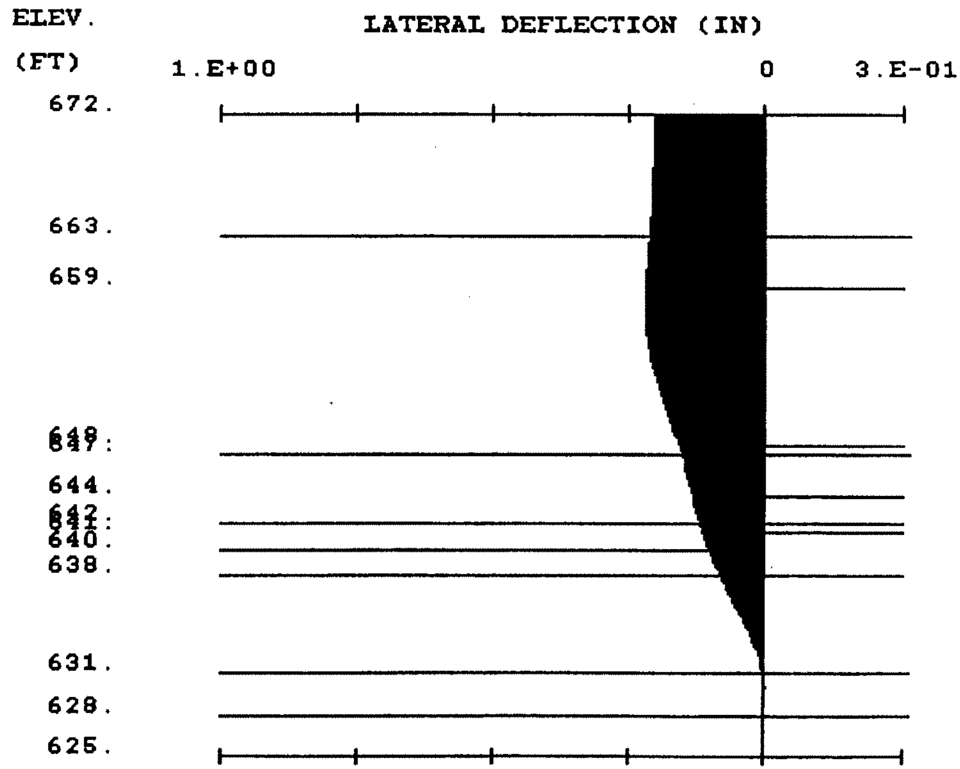


***** INPUT GEOMETRY *****
DATE: 30-AUG-1993 TIME: 16.31.48

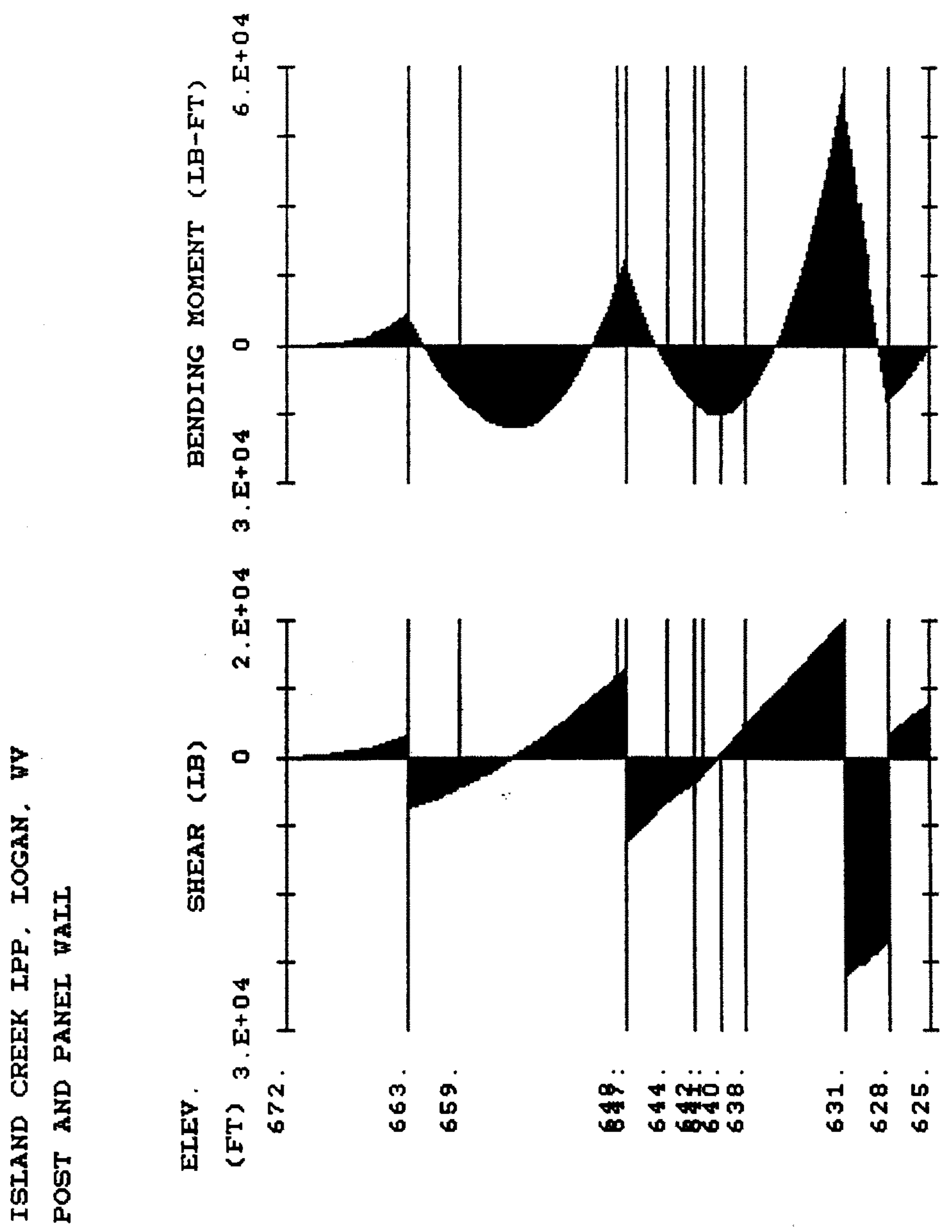
A-I-66

'ISLAND CREEK LPP, LOGAN, WV

'POST AND PANEL WALL

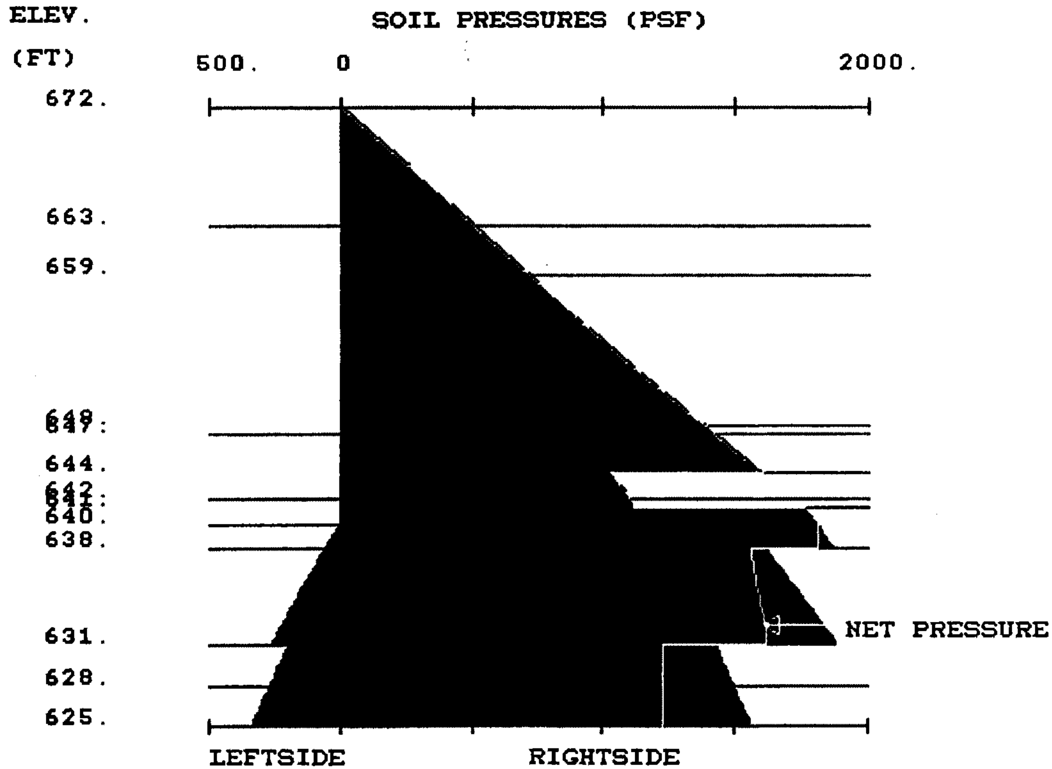


A-I-67


'ISLAND CREEK LPP, LOGAN, WV
'POST AND PANEL WALL
ELEV.
(FT)
672.
663.
659.
648.
647.
644.
642.
641.
640.
638.
631.
628.
625.
SHEAR (LB)
3.E+04
0
2.E+04
BENDING MOMENT (LB-FT)
3.E+04
0
6.E+04

'ISLAND CREEK LPP, LOGAN, WV

'POST AND PANEL WALL



A-I-69

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 30-AUG-1993 TIME: 16.31.27

INPUT DATA

I.--HEADING:
'ISLAND CREEK LPP, LOGAN, WV

'POST AND PANEL WALL

'WALL HEIGHT = 32', W14 X 233

'TWO ANCHORS, 4' C TO C SPACING, L.C. 3

II.--WALL SEGMENT DATA

ELEVATION AT TOP OF SEGMENT (FT)	MODULUS OF ELASTICICTY (PSI)	MOMENT OF INERTIA (IN**4)	CROSS SECTION AREA (SQIN)
672.00	2.900E+07	753.00	17.13

ELEVATION AT BOTTOM OF WALL = 625.00 (FT).

III.--ANCHOR DATA

ELEVATION AT WALL (FT)	ANCHOR TYPE ('R/F')	ULTIMATE TENSION FORCE (LB)	PRE-STRESS FORCE (LB)	ULTIMATE COMPRESSION FORCE (LB)	ANCHOR STIFFNESS (LB/IN)	ANCHOR SLOPE (FT)
663.00	FLEXIBLE	5.93E+04	3.55E+04	3.55E+04	2.100E+04	1.00
647.00	FLEXIBLE	1.00E+05	6.00E+04	6.00E+04	7.100E+04	1.00
631.00	RIGID					
628.00	RIGID					
625.00	RIGID					

IV.--SURFACE POINT DATA

IV.A.--RIGHTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	672.00

IV.B.-- LEFTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	640.00

V.--SOIL LAYER DATA

V.A.--RIGHTSIDE LAYER DATA

<UNIT WEIGHT>		ANGLE OF INTERNAL	COH-	ANGLE OF WALL	WALL ADH-	<STIFF. COEF.>		<--BOTTOM-->	
SAT.	MOIST	FRICTION	ESION	FRICTION	ESION	ACT.	PASS.	ELEV.	SLOPE

(PCF)	(PCF)	(DEG)	(PSF)	(DEG)	(PSF)	(PCI)	(PCI)	(FT)	(FT)
136.00	110.00	28.00	.00	.00	.00	3.00	3.00	659.20	.00
129.00	110.00	28.00	.00	.00	.00	3.00	3.00	647.60	.00
122.00	110.00	28.00	.00	.00	.00	3.00	3.00	643.90	.00
131.00	123.00	30.00	.00	.00	.00	86.60	86.60	642.00	.00
131.00	123.00	30.00	.00	.00	.00	52.00	52.00	641.40	.00
123.00	110.00	28.00	.00	.00	.00	1.10	1.10	638.20	.00
124.00	114.00	32.00	.00	.00	.00	3.50	3.50	631.00	.00
125.00	125.00	40.00	50.00	.00	.00	.10	.10		

V.B.-- LEFTSIDE LAYER DATA

<UNIT WEIGHT>		ANGLE OF INTERNAL	COH-	ANGLE OF WALL	WALL ADH-	<STIFF. COEF.>		<--BOTTOM-->	
SAT.	MOIST	FRICTION	ESION	FRICTION	ESION	ACT.	PASS.	ELEV.	SLOPE
(PCF)	(PCF)	(DEG)	(PSF)	(DEG)	(PSF)	(PCI)	(PCI)	(FT)	(FT)
123.00	110.00	28.00	.00	.00	.00	1.10	1.10	638.20	.00
124.00	114.00	32.00	.00	.00	.00	3.50	3.50	631.00	.00
125.00	125.00	40.00	50.00	.00	.00	.10	.10		

VI.--INTERACTION ZONE DATA
NONE

VII.--WATER DATA

UNIT WEIGHT = 62.50 (PCF)
RIGHTSIDE ELEVATION = 642.00 (FT)
LEFTSIDE ELEVATION = 642.00 (FT)
NO SEEPAGE

VIII.--SURFACE LOADS
NONE

IX.--HORIZONTAL LOADS
NONE

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 30-AUG-1993 TIME: 16.33.33

SUMMARY OF RESULTS

I.A.--MAXIMA

	MAXIMUM	MINIMUM
BENDING MOMENT (LB-FT) :	5.432E+04	-1.801E+04

```
    AT ELEVATION (FT)       :        631.00          655.00
DEFLECTION (IN)             :      2.177E-01      -1.870E-03
    AT ELEVATION (FT)       :        658.00          630.00
RIGHTSIDE SOIL PRESSURE (PSF):      1881.36
    AT ELEVATION (FT)       :        631.00
LEFTSIDE SOIL PRESSURE (PSF) :       331.03
    AT ELEVATION (FT)       :        625.00
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I.B.--ANCHOR FORCES

ELEVATION AT ANCHOR (FT)	ANCHOR TYPE	ANCHOR DEFORMATION (IN)	ANCHOR FORCE (LB)
663.00	FLEXIBLE	.16	13390.78
647.00	FLEXIBLE	.12	33040.20
631.00	RIGID	.00	38962.95
628.00	RIGID	.00	-22537.90
625.00	RIGID	.00	5913.08

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 30-AUG-1993 TIME: 16.33.33

COMPLETE RESULTS

II.A.--WALL DEFLECTIONS AND FORCES

	<------DEFLECTION----->		<--WALL INTERNAL FORCES->		
ELEVATION (FT)	AXIAL (IN)	LATERAL (IN)	AXIAL (LB)	SHEAR (LB)	MOMENT (LB-FT)
672.00	-1.757E-02	1.989E-01	0.	0.	0.
671.50	-1.757E-02	1.993E-01	0.	7.	1.
671.00	-1.757E-02	1.997E-01	0.	28.	9.
670.50	-1.757E-02	2.002E-01	0.	63.	32.
670.00	-1.757E-02	2.006E-01	0.	113.	75.
669.50	-1.757E-02	2.010E-01	0.	176.	146.
669.00	-1.757E-02	2.015E-01	0.	253.	253.
668.50	-1.757E-02	2.019E-01	0.	344.	402.
668.00	-1.757E-02	2.024E-01	0.	450.	600.
667.50	-1.757E-02	2.028E-01	0.	569.	854.
667.00	-1.757E-02	2.033E-01	0.	703.	1172.
666.50	-1.757E-02	2.038E-01	0.	850.	1559.
666.00	-1.757E-02	2.043E-01	0.	1012.	2024.
665.50	-1.757E-02	2.049E-01	0.	1188.	2574.
665.00	-1.757E-02	2.055E-01	0.	1377.	3214.
664.50	-1.757E-02	2.062E-01	0.	1581.	3954.
664.00	-1.757E-02	2.070E-01	0.	1799.	4798.
663.50	-1.757E-02	2.078E-01	0.	2030.	5755.
663.00+	-1.757E-02	2.088E-01	0.	2276.	6831.
663.00-	-1.757E-02	2.088E-01	-7999.	-5723.	6831.
662.50	-1.748E-02	2.099E-01	-7999.	-5463.	4034.
662.00	-1.738E-02	2.111E-01	-7999.	-5189.	1370.

661.50	-1.728E-02	2.123E-01	-7999.	-4902.	-1153.
661.00	-1.719E-02	2.135E-01	-7999.	-4600.	-3529.
660.50	-1.709E-02	2.146E-01	-7999.	-4284.	-5751.
660.00	-1.699E-02	2.156E-01	-7999.	-3955.	-7811.
659.50	-1.690E-02	2.164E-01	-7999.	-3611.	-9703.
659.20	-1.684E-02	2.169E-01	-7999.	-3399.	-10755.
659.00	-1.680E-02	2.171E-01	-7999.	-3254.	-11420.
658.50	-1.670E-02	2.175E-01	-7999.	-2882.	-12955.
658.00	-1.661E-02	2.177E-01	-7999.	-2497.	-14301.
657.50	-1.651E-02	2.176E-01	-7999.	-2098.	-15450.
657.00	-1.641E-02	2.172E-01	-7999.	-1684.	-16396.
656.50	-1.632E-02	2.164E-01	-7999.	-1256.	-17131.
656.00	-1.622E-02	2.153E-01	-7999.	-815.	-17650.
655.50	-1.612E-02	2.139E-01	-7999.	-359.	-17944.
655.00	-1.603E-02	2.121E-01	-7999.	111.	-18007.
654.50	-1.593E-02	2.100E-01	-7999.	595.	-17831.
654.00	-1.583E-02	2.075E-01	-7999.	1093.	-17409.
653.50	-1.574E-02	2.047E-01	-7999.	1606.	-16735.
653.00	-1.564E-02	2.015E-01	-7999.	2133.	-15801.
652.50	-1.554E-02	1.980E-01	-7999.	2675.	-14599.
652.00	-1.545E-02	1.943E-01	-7999.	3231.	-13124.
651.50	-1.535E-02	1.902E-01	-7999.	3801.	-11366.
651.00	-1.525E-02	1.860E-01	-7999.	4386.	-9320.
650.50	-1.516E-02	1.816E-01	-7999.	4985.	-6978.
650.00	-1.506E-02	1.770E-01	-7999.	5599.	-4333.
649.50	-1.496E-02	1.723E-01	-7999.	6228.	-1376.
649.00	-1.487E-02	1.677E-01	-7999.	6872.	1898.
648.50	-1.477E-02	1.630E-01	-7999.	7530.	5498.
648.00	-1.467E-02	1.585E-01	-7999.	8203.	9430.
647.60	-1.460E-02	1.550E-01	-7999.	8752.	12821.
647.50	-1.458E-02	1.541E-01	-7999.	8890.	13703.
647.00+	-1.448E-02	1.500E-01	-7999.	9593.	18323.
647.00-	-1.448E-02	1.500E-01	-27249.	-9658.	18323.
646.50	-1.415E-02	1.463E-01	-27249.	-8941.	13673.
646.00	-1.382E-02	1.428E-01	-27249.	-8209.	9385.
645.50	-1.349E-02	1.395E-01	-27249.	-7462.	5466.
645.00	-1.316E-02	1.364E-01	-27249.	-6701.	1925.
644.50	-1.284E-02	1.332E-01	-27249.	-5926.	-1233.
644.00	-1.251E-02	1.301E-01	-27249.	-5135.	-3998.
643.90+	-1.244E-02	1.294E-01	-27249.	-4975.	-4504.
643.90-	-1.244E-02	1.294E-01	-27249.	-4975.	-4504.
643.50	-1.218E-02	1.268E-01	-27249.	-4560.	-6411.
643.00	-1.185E-02	1.234E-01	-27249.	-4031.	-8559.
642.50	-1.152E-02	1.199E-01	-27249.	-3493.	-10441.
642.00	-1.119E-02	1.162E-01	-27249.	-2944.	-12050.
641.50	-1.086E-02	1.122E-01	-27249.	-2387.	-13383.
641.40+	-1.079E-02	1.114E-01	-27249.	-2275.	-13616.
641.40-	-1.079E-02	1.114E-01	-27249.	-2275.	-13616.
641.00	-1.053E-02	1.079E-01	-27249.	-1567.	-14385.
640.50	-1.020E-02	1.034E-01	-27249.	-675.	-14946.
640.00	-9.873E-03	9.858E-02	-27249.	225.	-15059.
639.50	-9.544E-03	9.346E-02	-27249.	1129.	-14720.
639.00	-9.215E-03	8.805E-02	-27249.	2034.	-13929.
638.50	-8.886E-03	8.236E-02	-27249.	2939.	-12686.
638.20+	-8.689E-03	7.883E-02	-27249.	3483.	-11723.
638.20-	-8.689E-03	7.883E-02	-27249.	3483.	-11723.
638.00	-8.557E-03	7.642E-02	-27249.	3795.	-10995.
637.50	-8.228E-03	7.027E-02	-27249.	4577.	-8902.
637.00	-7.899E-03	6.394E-02	-27249.	5361.	-6418.
636.50	-7.570E-03	5.748E-02	-27249.	6146.	-3541.
636.00	-7.241E-03	5.096E-02	-27249.	6934.	-271.
635.50	-6.911E-03	4.443E-02	-27249.	7724.	3393.
635.00	-6.582E-03	3.797E-02	-27249.	8516.	7453.
634.50	-6.253E-03	3.165E-02	-27249.	9311.	11910.

634.00	-5.924E-03	2.557E-02	-27249.	10108.	16764.
633.50	-5.595E-03	1.983E-02	-27249.	10908.	22018.
633.00	-5.266E-03	1.452E-02	-27249.	11711.	27673.
632.50	-4.937E-03	9.757E-03	-27249.	12516.	33730.
632.00	-4.608E-03	5.664E-03	-27249.	13323.	40189.
631.50	-4.279E-03	2.366E-03	-27249.	14132.	47053.
631.00+	-3.949E-03	0.000E+00	-27249.	14942.	54321.
631.00-	-3.949E-03	0.000E+00	-27249.	-24021.	54321.
630.50	-3.620E-03	-1.355E-03	-27249.	-23405.	42464.
630.00	-3.291E-03	-1.870E-03	-27249.	-22788.	30916.
629.50	-2.962E-03	-1.772E-03	-27249.	-22171.	19676.
629.00	-2.633E-03	-1.285E-03	-27249.	-21555.	8745.
628.50	-2.304E-03	-6.242E-04	-27249.	-20938.	-1878.
628.00+	-1.975E-03	0.000E+00	-27249.	-20322.	-12193.
628.00-	-1.975E-03	0.000E+00	-27249.	2216.	-12193.
627.50	-1.646E-03	4.206E-04	-27249.	2832.	-10931.
627.00	-1.316E-03	6.254E-04	-27249.	3448.	-9361.
626.50	-9.873E-04	6.456E-04	-27249.	4064.	-7483.
626.00	-6.582E-04	5.182E-04	-27249.	4681.	-5297.
625.50	-3.291E-04	2.866E-04	-27249.	5297.	-2802.
625.00	0.000E+00	0.000E+00	-27249.	5913.	0.

II.B.--SOIL PRESSURES

ELEVATION (FT)	<---------SOIL PRESSURES (PSF)--------> LEFTSIDE	RIGHTSIDE	NET
672.00	.00	.00	.00
671.50	.00	28.13	28.13
671.00	.00	56.25	56.25
670.50	.00	84.37	84.37
670.00	.00	112.49	112.49
669.50	.00	140.60	140.60
669.00	.00	168.71	168.71
668.50	.00	196.81	196.81
668.00	.00	224.90	224.90
667.50	.00	252.99	252.99
667.00	.00	281.08	281.08
666.50	.00	309.16	309.16
666.00	.00	337.23	337.23
665.50	.00	365.29	365.29
665.00	.00	393.35	393.35
664.50	.00	421.39	421.39
664.00	.00	449.42	449.42
663.50	.00	477.43	477.43
663.00+	.00	505.42	505.42
663.00-	.00	505.42	505.42
662.50	.00	533.39	533.39
662.00	.00	561.34	561.34
661.50	.00	589.27	589.27
661.00	.00	617.20	617.20
660.50	.00	645.12	645.12
660.00	.00	673.04	673.04
659.50	.00	700.97	700.97
659.20	.00	717.74	717.74
659.00	.00	728.92	728.92
658.50	.00	756.89	756.89
658.00	.00	784.90	784.90
657.50	.00	812.95	812.95
657.00	.00	841.05	841.05
656.50	.00	869.20	869.20
656.00	.00	897.43	897.43
655.50	.00	925.72	925.72
655.00	.00	954.09	954.09

654.50	.00	982.55	982.55
654.00	.00	1011.09	1011.09
653.50	.00	1039.73	1039.73
653.00	.00	1068.46	1068.46
652.50	.00	1097.30	1097.30
652.00	.00	1126.22	1126.22
651.50	.00	1155.25	1155.25
651.00	.00	1184.37	1184.37
650.50	.00	1213.57	1213.57
650.00	.00	1242.85	1242.85
649.50	.00	1272.20	1272.20
649.00	.00	1301.61	1301.61
648.50	.00	1331.05	1331.05
648.00	.00	1360.52	1360.52
647.60	.00	1384.10	1384.10
647.50	.00	1389.99	1389.99
647.00+	.00	1419.43	1419.43
647.00-	.00	1419.43	1419.43
646.50	.00	1448.82	1448.82
646.00	.00	1478.18	1478.18
645.50	.00	1507.53	1507.53
645.00	.00	1536.88	1536.88
644.50	.00	1566.25	1566.25
644.00	.00	1595.66	1595.66
643.90+	.00	1601.55	1601.55
643.90-	.00	1030.33	1030.33
643.50	.00	1046.73	1046.73
643.00	.00	1067.23	1067.23
642.50	.00	1087.73	1087.73
642.00	.00	1108.23	1108.23
641.50	.00	1119.65	1119.65
641.40+	.00	1121.93	1121.93
641.40-	.00	1761.72	1761.72
641.00	.00	1775.13	1775.13
640.50	.00	1791.95	1791.95
640.00	.00	1808.87	1808.87
639.50	16.54	1825.86	1809.32
639.00	33.03	1842.94	1809.92
638.50	49.45	1860.11	1810.66
638.20+	59.27	1870.45	1811.17
638.20-	55.88	1617.12	1561.24
638.00	62.03	1624.43	1562.39
637.50	77.26	1642.84	1565.58
637.00	92.27	1661.46	1569.20
636.50	107.04	1680.25	1573.21
636.00	121.59	1699.17	1577.58
635.50	135.92	1718.18	1582.26
635.00	150.04	1737.21	1587.17
634.50	163.98	1756.21	1592.24
634.00	177.74	1775.11	1597.37
633.50	191.38	1793.83	1602.45
633.00	204.92	1812.28	1607.36
632.50	218.43	1830.37	1611.94
632.00	231.95	1847.99	1616.04
631.50	245.56	1865.02	1619.46
631.00+	259.34	1881.36	1622.01
631.00-	197.07	1429.64	1232.56
630.50	208.18	1441.22	1233.04
630.00	219.31	1452.54	1233.23
629.50	230.47	1463.68	1233.21
629.00	241.66	1474.69	1233.04
628.50	252.85	1485.65	1232.79
628.00+	264.05	1496.61	1232.56
628.00-	264.05	1496.61	1232.56

627.50	275.24	1507.64	1232.40
627.00	286.42	1518.73	1232.32
626.50	297.58	1529.89	1232.31
626.00	308.74	1541.09	1232.36
625.50	319.89	1552.33	1232.45
625.00	331.03	1563.59	1232.56

US Army Corps of Engineers Ohio River Division	Subject ISLAND CREEK, W.V. LPP POST & PANEL WALL	Page ___ Of ___ Pages Computed by BL Date 3/1/93 Checked by ___ Date ___

MATERIAL - A-588 STEEL

ASSUME $\sigma_b = .55 * 50 = 27.5^{ksi}$
$\sigma_b = .5 * 50 = 25.0^{ksi}$
$\sigma_{b_u}^{d} = .73 * 50 = 36.5^{ksi}$

32 FT. WALL

SOLDIER PILE: W14×233
$S_{REQ} = 261.39 IN^2$ (A-36)

$S_{MOD} = 261.39 * \frac{18}{25} = 188.2 IN^3$

USE W14×120 $S_{PROV} = 190 IN^3$ A-588
$b_f = 14.670$
$d = 14.48$
$R = 20.6$

ASSUME 4' COVER
USE: BORING: 21+8=29 SAY 30"

WALES: (MC10×28.5)
S_{REQ} A-36 = 23.4 IN^3
TOP: $S_{RED} = 23.4 \times \frac{20}{27.5} = 17.0 IN^3$

USE MC 10×22
$S = 20.5 IN^3$
$b_f = 3.315$ IN. O.K.
$t_w = 0.29$

SHEAR: $37.6/(10*.29) = 13$ KSI O.K. $< 16.5^{ksi}$

(MC18×51.9)
S_{REQ} A-36 = 57 IN^3
BOTTOM: $S_{RED} = 57.0 \times \frac{20}{27.5} = 41.4 IN$

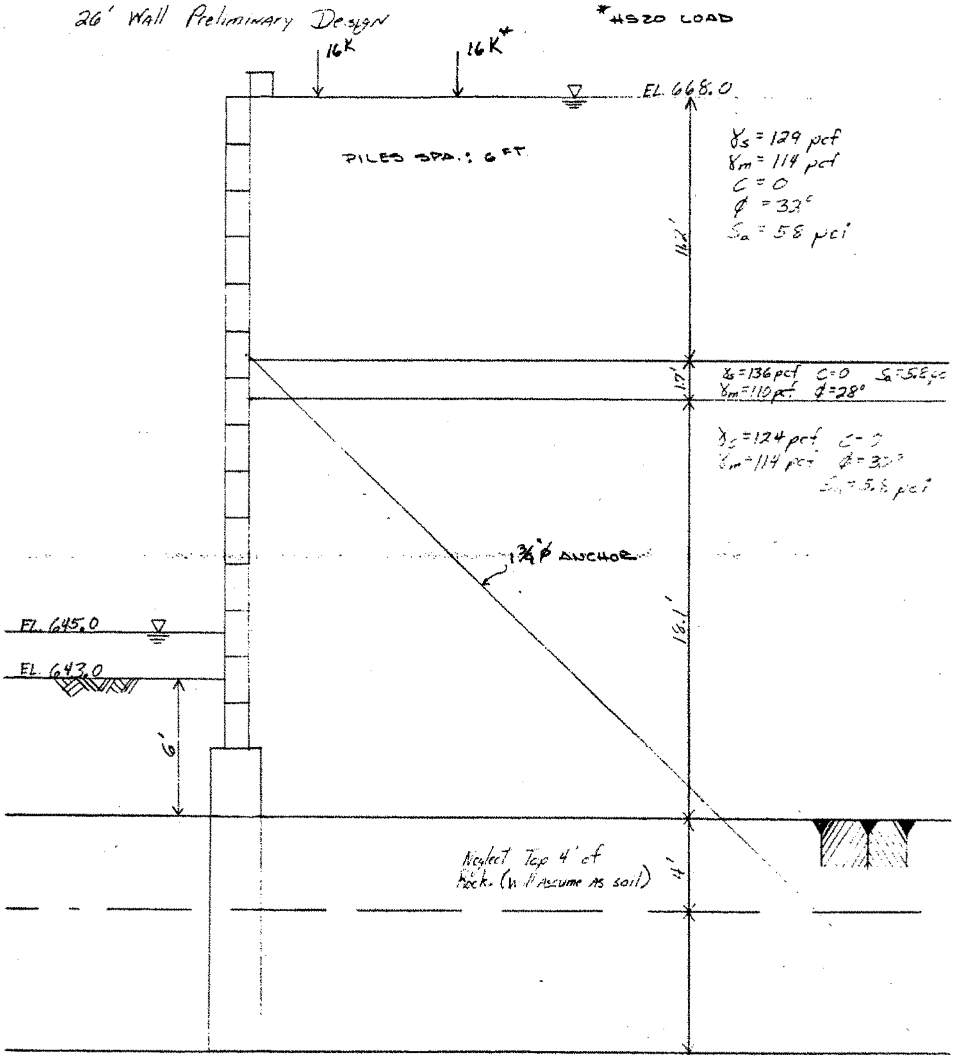
MC12×50 / MC18×42.7
$S = 44.9 IN^3$ / $S = 61.6$
$b_f = 4.135$ / $b_f = 3.9$
$t_w = .835$ / $t_w = .4$

$V = 69.42/12 * .835$
$V = 6.93$ KSI $< 16.5^{ksi}$ OK

USE MC18×42.7

US Army Corps of Engineers Ohio River Division	Subject Island Creek, WV, LPP Proposed Project	Page Of Pages Computed by Date Checked by Date

26' Wall Preliminary Design



US Army Corps of Engineers Ohio River Division	Subject ISLAND CREEK, W.V. L.P.P. POST & PANEL WALL	Page Of Pages Computed by RJL Date 8/26/92 Checked by Date

26 FT POST AND PANEL SECTION

TWO 26 FT SECTIONS WERE DESIGNED FOR THREE DIFFERENT LOAD CASES. THE DESIGN OF THE SEC. BEHIND APPALACHIAN POWER WAS BASED IN BORING C-90-2 AND THE DESIGN OF THE SEC. BEHIND THE BAISDEN HARDWARE WAS BASED IN BORING C-90-6.

*THE THREE LOAD CASES ARE DESCRIBED IN PAGE: A-I-5

SUMMARY OF RESULTS

WALL BEHIND APPALACHIAN POWER

LOAD CASE	MOM (ft-k)	MAX Δ (IN)	ANCHOR FORCE (K)
CRITICAL	1.494×10^5	0.41	33.77
OPERATION	8.761×10^4	0.24	17.69
CONSTRUCTION	1.787×10^5	3.51	—

WALL BEHIND BAISDEN HARDWARE

LOAD CASE	MOM (FT-#)	MAX. Δ (IN)	ANCHOR FORCE (K)
CRITICAL	1.399×10^5	0.38	30.43
OPERATION			
CONSTRUCTION	1.549×10^5	3.50	—

ORD Form 497

US Army Corps of Engineers Ohio River Division	Subject ISLAND CREEK, W.V. LPP POST AND PANEL WALL	Page Of Pages Computed by PJL Date 8/28/23 Checked by Date

POST DESIGN

L.C.1: $M_{MAX} = 1.494 \times 10^5$ FT-#

$S_{REQ} = \dfrac{1.494 \times 10^5 \times 6 \times 12}{.55 \times 36000} = 543.27 \text{ IN}^3$ (6 = SPA.)   TRY W 14 x 370, S = 607

DURING CONSTRUCTION:

L.C.4: $M_{MAX} = \dfrac{1.249 \times 10^5 \times 6 \times 12}{607} = 23.1^{KSI} < .73(36) = 26.3^{KSI}$

ANCHORS DESIGN:

$F_{MAX} = 33.77^K \times 6 = 202.2^K < 240^K$ (PRESTRESS FORCE = $.6F_u$)

USE MULTIPLE CORROSION PROTECTION ANCHORS - $1\frac{3}{4}$" DIA

ASTM A722 - WILLIAMS R71 OR EQUAL

$F_y = 127.7$ KSI, $F_u = 150$ KSI ($F_u = 400^K$)

ELONGATION OVER 20 BAR DIA.

REDUCTION OF AREA 20%

AREA = 2.66 IN²

PRESTRESING FORCE = 240^K

ORD Form 427

US Army Corps of Engineers Ohio River Division	Subject ISLAND CREEK, W.V. L.P.P POST & PANEL WALL	Page Of Pages Computed by PJL Date 8/20/93 Checked by Date

CHECK BEARING OF PILES AGAINST THE ROCK (26^{FT} SEC.)

ASSUME A CONCRETE CILINDER OF 24" DIA. (CONSERVATIVE)

RIGID ANCHOR FORCES

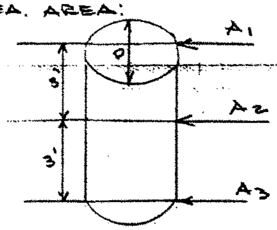
APPALACHIAN POWER WALL

ANCHORS	CRITICAL F(K)	OPERATING F(K)	CONSTRUCTION F(K)
1	95.9	55.7	89.5
2	-66.8	-40.1	-85.7
3	14.8	8.4	16.3

BAISDEN HARDWARE WALL

ANCHORS	CRITICAL (K)	OPERATING(K)	CONSTRUCTION(K)
1	89.9		98.6
2	-62.4		94.0
3	13.9		17.3

ASSUME BEA. AREA:



ASSUME D=24"

ANCHOR 1 $P_{MAX} = 98.6 \times 6/24 \times 18 = 1.4^{ksi} < 3^{ksi}$ * *GEOLOGIST

ANCHOR 2 $P_{MAX} = 94 \times 6/24 \times 36 = 0.6^{ksi}$

ANCHOR 3 $P_{MAX} = 17.3 \times 6/24 \times 18 = 0.2^{ksi}$

SHEAR ON FAILURE PLANE:

AREA OF PLANE = $2^{ft} \times 10.379$ (CSLIDE) $= 20.76\ FT^2 = 2989.4\ IN^2$

LOAD ON PLANE:

X-DIR = $-3.39 \sin 35.32 + 54.84 \cos 35.32 = 42.79^K$

$\tau = 42.79/2989.4 = .0143\ ksi = 14.3\ psi < 50\ psi$ .OK

ORD Form 427
1 APR 83

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US Army Corps of Engineers Ohio River Division	Subject: Island Creek, WV, LPP Post & Panel Wall	Page Of Pages
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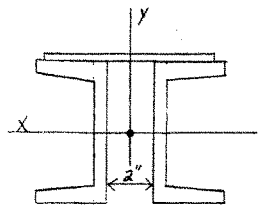
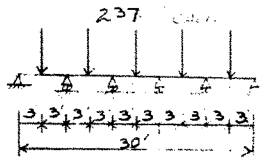
Wales

Two channels will be used back to back with a 2" space between them for the 1 3/4" ϕ Anchor rods.



$P = 202.6^k$ but use $P = 237^k$ prestress force $(P * 1.17)$



Determine size of channels

Assume wales will be installed in 30' sections ∴ 5 spans of 6' / section

From AISC Manual, 9th ed page 2-312

$M_{max} = 0.171\ PL$ and $V_{max} = 0.66\ P$

$P_{max} = 237^k$ (L.C. # 1, App. Power)

$M_{max} = 0.171\,(237)(6) = 243.2^{\ k\cdot ft}$

$V_{max} = 0.66\,(237) = 156.4^{\ k}$

$S_{Req'd} = \frac{243.2 \times 12}{20} = 145.9\ in^3$

Since 2 channels $S_{Req'd}$ / channel $= \frac{145.9}{2} = 72.96\ in^3$

Try MC 18 × 58 $S = 75.1\ in^3$

Check shear

$V_{chan} = \frac{156.4}{2} = 78.2^{\ k}$

$f_v = \frac{78.2}{18(.7)} = 6.2$ ksi < 12.0 ksi ok

CHECK TEST LOAD

$P = 237 \times 1.33 = 315.2^K$ $\sigma_{allow} = .73 * 36 = 26.28^{ksi}$

$f_v \times 1.33 = 8.2^{ksi} < 12^{ksi}$ $\sigma = \frac{(.171 \times 315.2 \times 6 \times 12)/2}{75.1} = 25.8^{ksi} < 26.3^{ksi}$ ok

ORD Form 427

US Army Corps of Engineers Ohio River Division	Subject: Island Creek, WV, LPP Post & Panel Wall	Page Of Pages Computed by DAK Date 8-27-93 Checked by Date

Wales (con't)

Determine Size of Plate Washers

"Assume 1/2 of Anchor load is distributed by nut [illegible] direct bearing through washer to webs of wales; Remainder Distributed by means of flexure in plate"

$m_1 = \frac{PL}{4} = \frac{315.2(2)}{(2)4} = 78.9^{\text{"-k}}$ ↑5c'c $m_2 = 237 \times 2/(2 \times 4) = 59.3^{\text{"-k}}$

$S_{Req'd} = 78.9/20 = 3.9\ in^3$ $S_{prov} = \frac{(10.5)(1.75)^2}{6} = 4.[illegible]\ in^3$

$S_2 = 59.3/18 = 3.3\ in^3$

Use 10" × 1.75" Washers

Check Bearing on webs of wales MC18 × 58 k = 1.375" $P_L = 315.2^k$, $P_{max} = 237^k$, $P_{max} = 1.2\,P_{max}$

web yielding (AISC Spec. Sect K1.3, 9th ed Manual) $t_w = 0.70$"

@ Interior load (per 1 channel) $N = 9$"

$\frac{284.4}{2} = (0.70)(9 + 5(1.375))\,f_y$
2 cha. $f_y = 12.8^{ksi} < 0.55 F_y = 19.8\,KSI$ ok

@ end load

$\frac{0.34(237)}{2} = (0.70)(4 + 2.5(1.375))\,f_y$

$f_y = 7.74$ Ksi o.k.

When the Anchors are prestressed they will be loaded to 80% of the ultimate strength. Web yielding should also be checked at this condition

@ Interior Load

$(\frac{1}{2})1.2 \times 315.2 = (0.70)(9 + 5(1.375))\,f_y$

$f_y = 17.0$ ksi < 23.8 ksi ok

@ End Load

$\frac{0.34(315.2)}{2} = (0.70)(9 + 2.5(1.375))\,f_y \Rightarrow f_y = 6.2$ ksi < 23.8 k[illegible]

US Army Corps of Engineers Ohio River Division	Subject Island Creek, WV, LPP Post & Panel Wall	Page Of Pages Computed by DAK Date 8-24-93 Checked by Date

Wales (con't)

Web Crippling (AISC Spec. Sect K1.4, 9th ed. Manual)

@ Interior Loads

$\frac{1.2 * 237}{2} \leq 67.5(0.70)^2[1+3(\frac{9}{18})(\frac{0.70}{0.625})^{1.5}]\sqrt{F_y\, 0.625/0.70}$

$F_y = 4.19$ ksi < 18 ksi ok

@ End Load

$\frac{.34 * 237}{2}$ (40.3) $\leq 34.0(0.70)^2[1+3(\frac{4}{18})(\frac{0.70}{0.625})^{1.5}]\sqrt{F_y\, 0.625/.70}$

$F_y = 2.0$ ksi < .7 F_y ok

Check for prestressing force

@ Interior Loads

$\frac{1.2 * 315.2}{2} \leq 67.5(0.70)^2[1+3(\frac{9}{18})(\frac{0.70}{0.625})^{1.5}]\sqrt{F_y\, 0.625/0.70}$

$F_y = 4.74$ ksi

@ End Load

$\frac{.34 * 315.2}{2} \leq 34(0.70)^2[1+3(\frac{4}{18})(\frac{0.70}{0.625})^{1.5}]\sqrt{F_y\, 0.625/0.70}$

$F_y = 7.26$ ksi o.k.

Design Bearing Stiffener for Interior Loads (OPTIONAL)*

use 3.5" × 3/4" bars

Width-Thickness Ratio = $\frac{3.5}{.75}$ = 4.67 < 15.8 ok

check compressive stress

$I = 3/4 \times \frac{(18-2(.625))^3}{12} = 293.71 in^4$

$A_{eff} = 3.5 \times 3/4 + 25(0.45)^2 = 7.69 in^2$

$r = \sqrt{293.71/7.69} = 6.18$ in

$K\ell = 3/4 \times 16.75 = 12.56$ in

US Army Corps of Engineers Ohio River Division	Subject Island Creek, WV, LPP Post & Panel Wall	Page Of Pages
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Wales (CON'T)

$\frac{Kl}{r} = \frac{12.56}{6.18} = 2.03$

OPTIONAL: STIFFENERS

From Table C-36, AISC Manual 9th ed

$F_A = 21.52$ ksi

$f_a = \frac{160.0}{7.69} = 20.81$ ksi < 21.52 ksi

use 3/4" × 3 1/2" × 16 3/4" stiffeners at anchor locations

Anchorage

Max Anchor Force (Appalachian Power) = $33.77 \times 6 = 202.6^K$

Max Anchor Force (Baisden Hardware) = 30.4

Assume pull out Resistance of Rock/Grout is 30 psi Also use a 6" ∅ Drill Hole.

use $P_1 = 202.6 * 1.17 * 1.33 = 315.3^K$

Rock/Grout Surface Area = $\pi(6)(12) = 226.19$ in²/L.F.

Resistance = 30 psi (315.3) = 9.46 Kips/L.F of Anchor

For wall behind Appalachian Power the anchor embedment Length in Rock is

$\frac{315.3}{A_{ST}} = 0.030$ ksi $A_{ST} = 10510$ in²

$A_s = 2\pi(3) = 18.84$ in² (6") $L = 10510/(18.84) = 557.9" = 46.5$ FT

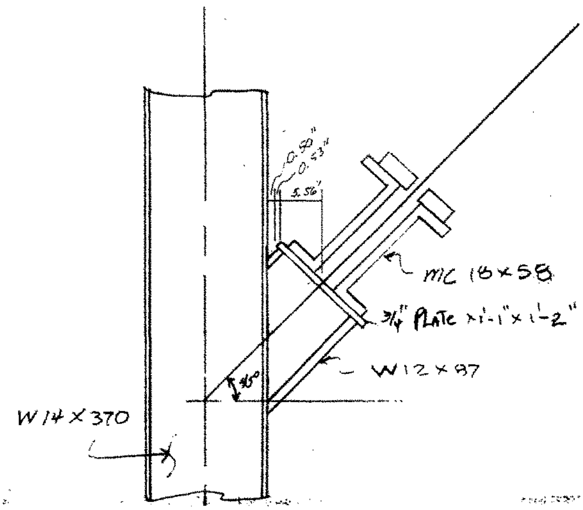
TRY $\phi = 8"$

$A_s = 2\pi 4 = 25.13$ in² $L = 418.2$ in $= 34.8$ FT

ORD Form 427

US Army Corps of Engineers Ohio River Division	Subject Island Creek, WV, LPP Post & Panel Wall	Page Of Pages Computed by DAK Date 8-24-93 Checked by Date

Wale Support



$P_{max} = 315.2^k$ $R_{support} = 1.2 * 315.2 = 378.2^k$

CHECK COMP. ON W14×370

MAX AXIAL LOAD = $378.2 \cos 45° = 267.4^k$

$f_A = \frac{267.4}{109} = 2.45$ ksi very low ∴ < F_a ok

CHECK SHEAR ON W12×87, $A = 25.6 \text{ in}^2$

Area for support member

$\sigma_c = \frac{378.2}{25.6} = 14.8$ ksi

$V = 378.2 * \cos 45° = 267.4^k$

$L_{WELD} = (4b_f - 2t_w) + (2d - 4t_f) = 71$ in   FOR E70 & A-36 STEEL: USE .925 k/in, SINCE $t_w > \frac{1}{2}$"

$L @ 45° = 81$ in

$267.4^k / 4.625 \text{ k/in} = 57.82 \text{ in} < 71"$ TRY: .925×5 = 4.625 k/in
5/16" FILLET

US Army Corps of Engineers Ohio River Division	Subject ISLAND CREEK, W.V. L.P.P POST & PANEL WALL	Page __ Of __ Pages Computed by PJL Date 9/2/83 Checked by __ Date __

MATERIAL — A-588 STEEL

26' FT. SECTION

A-36 SOLDIER PILE: W14×370 S=607

$S_{REQ} = (1.494\times10^5 * 6.17 * 12)/.50 * 50000 = 442.5\ IN^3$
LC1

W14×283 S=459 IN³

$\sigma_b = \dfrac{(1.949*10^5 * 6.17 * 12)}{459} = 31.4^{KSI} < .73*50\ (36.50)$
LC4

USE W14×283 A-588

WALES: A-36—MC18×58

$M_{MAX} = .171 * 237 * 6.17 = 250.1^{FT-K}$
$V_{MAX} = .66 * 237 = 156.5^K$

$S_{REQ} = 250.1\times12/27.5 = 109.1\ IN^3 \qquad S/2 = 54.6\ IN^3$

USE MC18×42.7 A-588 S=61.6 IN³

SHEAR
$V = 156.5/2 = 78.2^K$
$f_v = 78.2/(18\times.45) = 9.65^{KSI} < V_a$ OK

TEST LOAD: $f_v \times 1.33 = 12.83^{KSI} < 16.5^{KSI}$

$\sigma = \dfrac{(.171\times(237\times1.33)*6.17*12)/2}{61.6}$

$\sigma = 32.4^{KSI} < .53*50$
(36.5 KSI)

ORD Form 427
1 APR 83

```
10010 TITL ISLAND CREEK, WV, LPP
10020 TITL POST AND PANEL WALL
10030 TITL 26' WALL, L.C. #1
10040 STRU  4       .15000      625.00      1.00000
10050           .00        625.00
10060           .00        666.00
10070          2.00        666.00
10080          2.00        625.00
10090 SOLT  1  1        40.00       7.200        .1250        631.00
10100        -50.00        631.00
10110 SORT  1  1        40.00       7.200        .1250        631.00
10120         50.00        631.00
10230 SOST        40.00       7.20000
10240 METH  1
10250 WATR       620.00       620.00       .06250          0.
10260 EQAC       .06700       .10000
10270 FACT          .50         1.50       1.0000
10280 HOLO  2      87.8
10290 END
```

PROGRAM CSLIDE - ECHOPRINT

DATE: 10-15-93 TIME: 14:01:09

ISLAND CREEK, WV, LPP
POST AND PANEL WALL
26' WALL, L.C. #1

SINGLE FAILURE PLANE ANALYSIS

HYDROSTATIC WATER FORCE COMPUTED FOR WEDGES

NO OF CORNERS IN STRUCTURE ---------- 4
DENSITY OF CONCRETE ---------------- .1500(KCF)
DENSITY OF WATER ------------------- .0625(KCF)
WATER LEVEL LEFT SIDE -------------- 620.00(FT)
WATER LEVEL RIGHT SIDE ------------- 620.00(FT)
NO. OF SOIL LAYERS LEFT SIDE -------- 1
NO. OF SOIL LAYERS RIGHT SIDE ------- 1

ELEV. OF WEDGE-STRUCTURE INTERSECTION
ON ACTIVE SIDE OF STRUCTURE ---------625.000(FT)

STRUCTURE INFORMATION

POINT	X-COORD	Y-COORD
1	.00	625.00
2	.00	666.00
3	2.00	666.00
4	2.00	625.00

LEFTSIDE SOIL DATA

LAYER NO.	FRICTION ANGLE (DEG)	COHESION (KSF)	UNIT WEIGHT (KCF)	ELEV AT STRUCTURE (FT)
1	40.00	7.2000	.125	631.00

LAYER NO	POINT NO. 1 X-COORD	POINT NO. 1 Y-COORD
1	-50.00	631.00

A-I-89

SOIL DATA BELOW STRUCTURE

FRICTION ANGLE --------- 40.00
COHESION -------------- 7.2000

RIGHTSIDE SOIL DATA

LAYER NO.	FRICTION ANGLE (DEG)	COHESION (KSF)	UNIT WEIGHT (KCF)	ELEV AT STRUCTURE (FT)
1	40.00	7.2000	.125	631.00

LAYER NO	POINT NO. 1 X-COORD	Y-COORD
1	50.00	631.00

SEISMIC ACCELERATIONS

VERTICAL --------- .067
HORIZONTAL ------- .100

HORIZONTAL LOADS

WEDGE NO	LOAD
2	87.800

PROGRAM CSLIDE - FINAL RESULTS

DATE: 10-15-93 TIME: 14:01:18

ISLAND CREEK, WV, LPP
POST AND PANEL WALL
26' WALL, L.C. #1

SINGLE FAILURE PLANE ANALYSIS

HYDROSTATIC WATER FORCE COMPUTED FOR WEDGES

WEDGE NUMBER	HORIZONTAL LOADS LEFT SIDE (KIPS)	HORIZONTAL LOADS RIGHT SIDE (KIPS)	VERTICAL LOAD (KIPS)
1	.162	.000	.108
2	89.030	.000	.824
3	.318	.000	.213

WATER PRESSURES ON WEDGES

LEFTSIDE WEDGES

WEDGE NO.	TOP PRESSURE (KSF)	BOTTOM PRESSURE (KSF)
1	.000	.000

STRUCTURAL WEDGE

X-COORD. (FT)	PRESSURE (KSF)
.00	.000
2.00	.000

RIGHTSIDE WEDGES

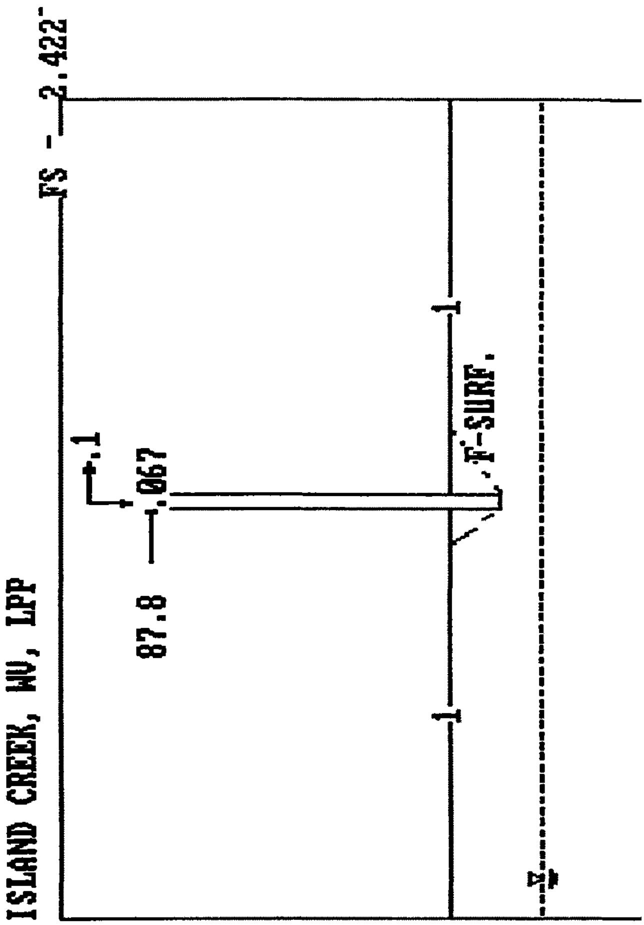
WEDGE NO.	TOP PRESSURE (KSF)	BOTTOM PRESSURE (KSF)
3	.000	.000

WEDGE NUMBER	FAILURE ANGLE (DEG)	TOTAL LENGTH (FT)	WEIGHT OF WEDGE (KIPS)	SUBMERGED LENGTH (FT)	UPLIFT FORCE (KIPS)
1	-54.302	7.388	1.617	.000	.000
2	.000	2.000	12.300	.000	.000
3	35.317	10.379	3.176	.000	.000

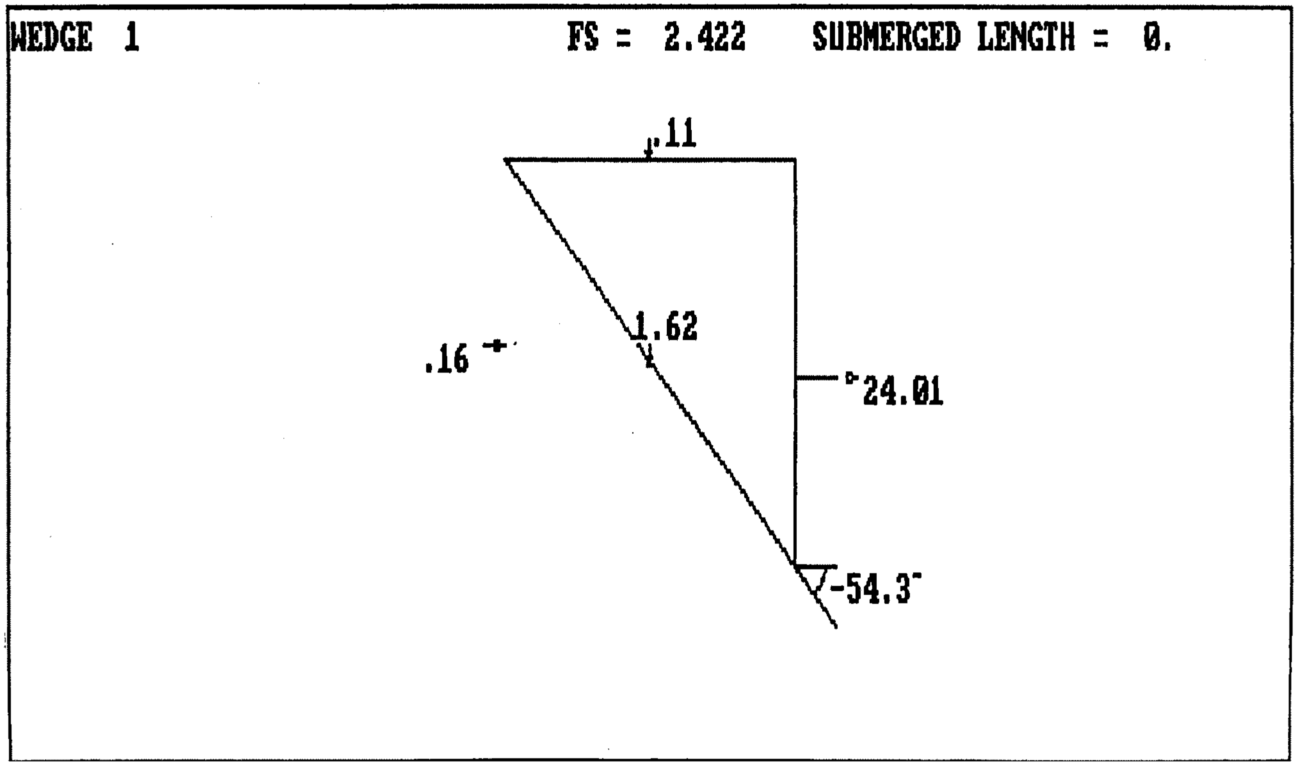
WEDGE NUMBER	NET FORCE ON WEDGE (KIPS)
1	24.015
2	-78.539
3	54.524

SUM OF FORCES ON SYSTEM ---- .000

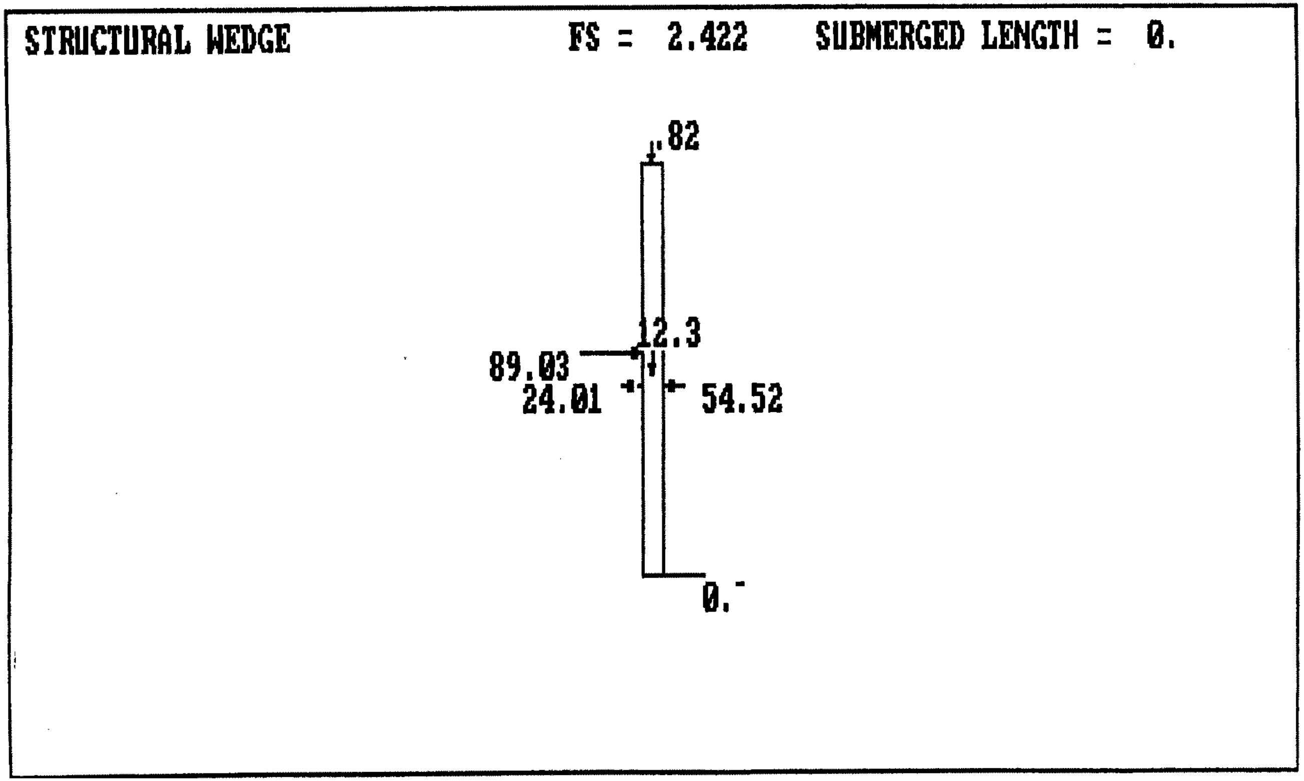
FACTOR OF SAFETY ----------- 2.422

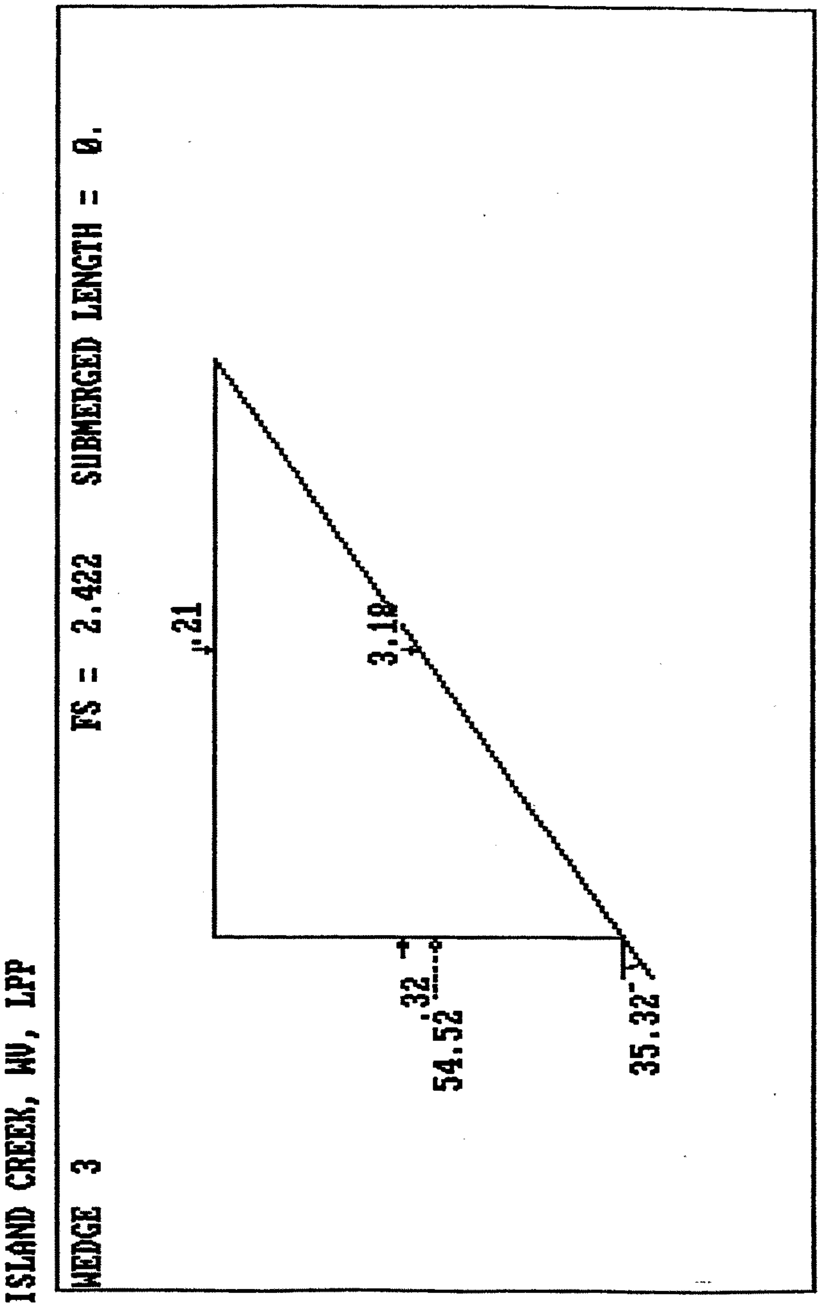

ISLAND CREEK, WV, LPP
FS - 2.422
87.8
.067
1
F-SURF.
1
1

ISLAND CREEK, WV, LPP



ISLAND CREEK, WV, LPP

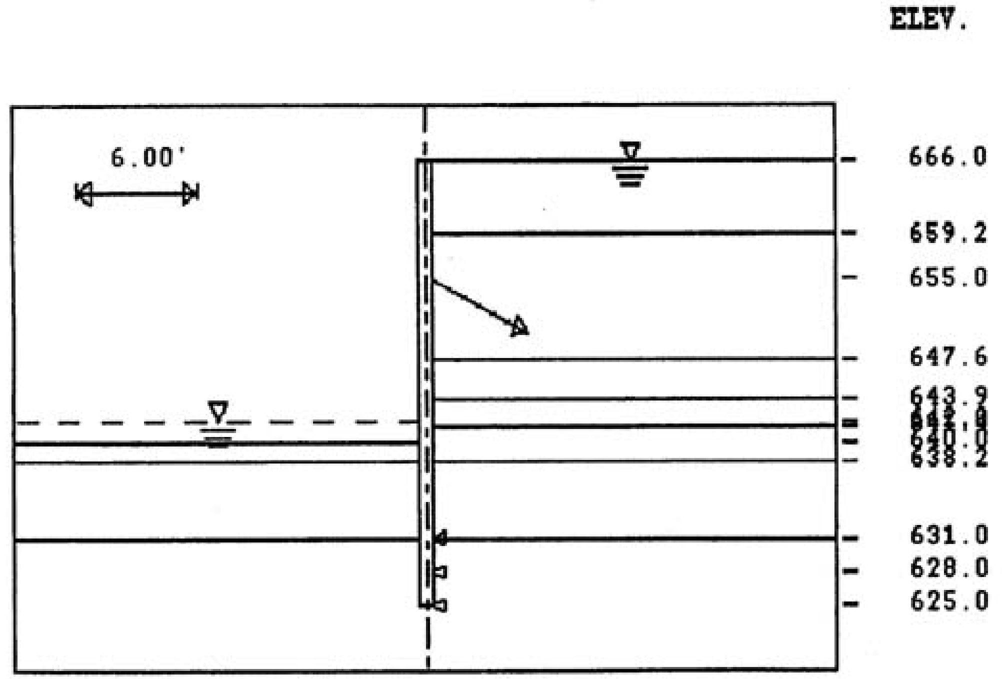



ISLAND CREEK, WV, LPP
WEDGE 3
FS = 2.422
SUBMERGED LENGTH = 0.
21
3.18
32
54.52
35.32

```
1000 'ISLAND CREEK LPP, LOGAN, WV
1010 'APPALACHIAN-L.C. 1-CRITICAL
1020 'WALL HEIGHT = 26', W14 X 370
1030 'ONE ANCHOR, 6' C TO C SPACING, L.C. 1
1040 WALL    666.00    2.900E+07    9.07E+02    18.17E+00
1050 WALL    625.00
1060 ANCHOR    655.00 F  6.67E+04  4.00E+04  4.00E+04  3.15E+04  1.000E+00
1065 ANCHOR    631.00 R  6.00E+04  0.00      0.00      0.00      0.00
1066 ANCHOR    628.00 R  6.00E+04  0.00      0.00      0.00      0.00
1067 ANCHOR    625.00 R  6.00E+04  0.00      0.00      0.00      0.00
1070 SURFACE RIGHTSIDE   1
1080       .00    666.00
1090 SURFACE  LEFTSIDE   1
1100       .00    640.00
1110 SOIL RIGHTSIDE  STRENGTH    7
1120   136.00  110.00 28.0     .00   .0    .00    1.8    1.8   659.20   0.00
1130   129.00  110.00 28.0     .00   .0    .00    1.8    1.8   647.60   0.00
1135   122.00  110.00 28.0     .00   .0    .00    1.8    1.8   643.90   0.00
1136   131.00  123.00 30.0     .00   .0    .00   52.2   52.2   641.40   0.00
1137   123.00  110.00 28.0     .00   .0    .00    1.1    1.1   638.20   0.00
1138   124.00  114.00 32.0     .00   .0    .00    3.5    3.5   631.00   0.00
1139   125.00  125.00 40.0   50.00   .0    .00    0.1    0.1
1140 SOIL  LEFTSIDE  STRENGTH    3
1150   123.00  110.00 28.0     .00   .0    .00    1.1    1.1  638.20    0.00
1155   124.00  114.00 32.0     .00   .0    .00    3.5    3.5  631.00    0.00
1160   125.00  125.00 40.0   50.00   .0    .00    0.1    0.1
1170 WATER ELEVATIONS    62.50  666.00  642.00
1180 H D 12 666. 0 664. 5.48 660. 31.64
1181 658.5 38.46 657.5 41.08
1182 656. 42.32 654.5 41.04
1185 646. 20.74 642.5 14.46
1186 639. 10.1 635. 6.82 631. 4.68
1190 FINISH
```

A-I-98

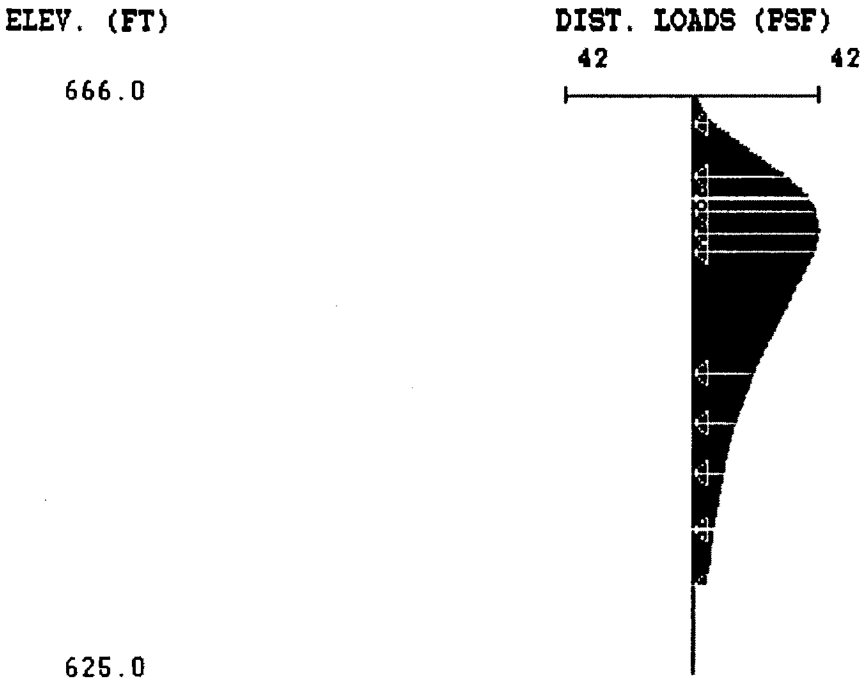
ISLAND CREEK LPP, LOGAN, WV
APPALACHIAN-L.C. 1-CRITICAL



***** INPUT GEOMETRY *****
DATE: 27-AUG-1993 TIME: 18.23.42

A-T 99

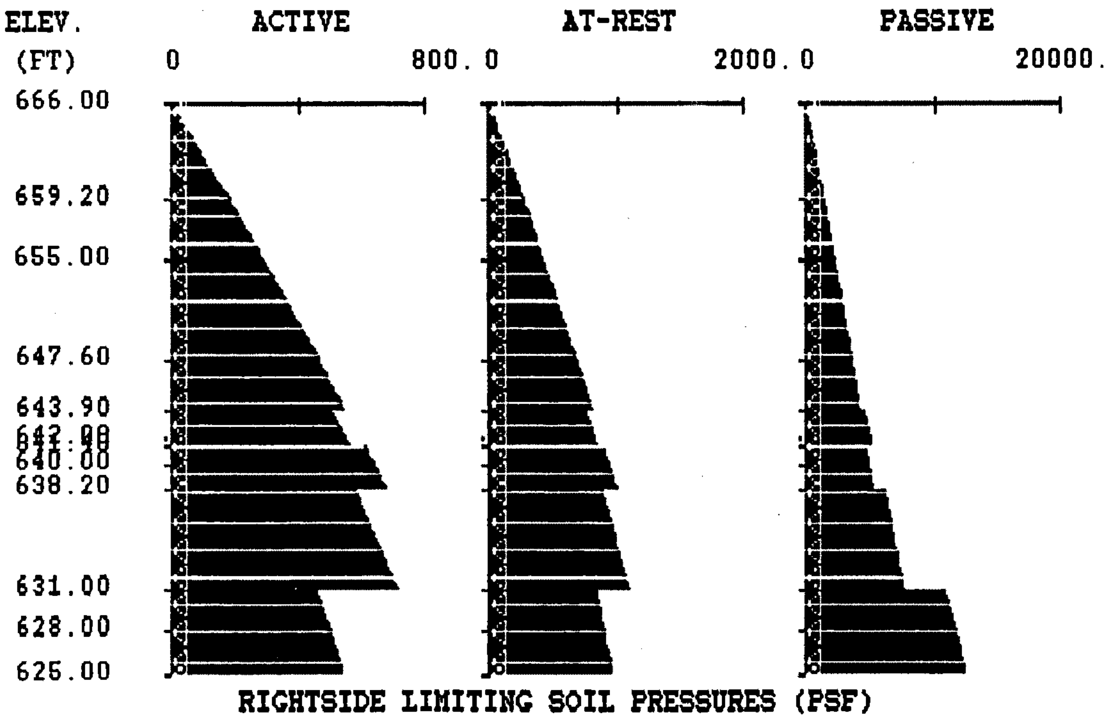
'ISLAND CREEK LPP, LOGAN, WV
'APPALACHIAN-L.C. 1-CRITICAL



***** INPUT HORIZONTAL LOADS *****
DATE: 27-AUG-1993 TIME: 18.24.02

A-I 100

ISLAND CREEK LPP, LOGAN, WV
APPALACHIAN-L.C. 1-CRITICAL



A-I 101

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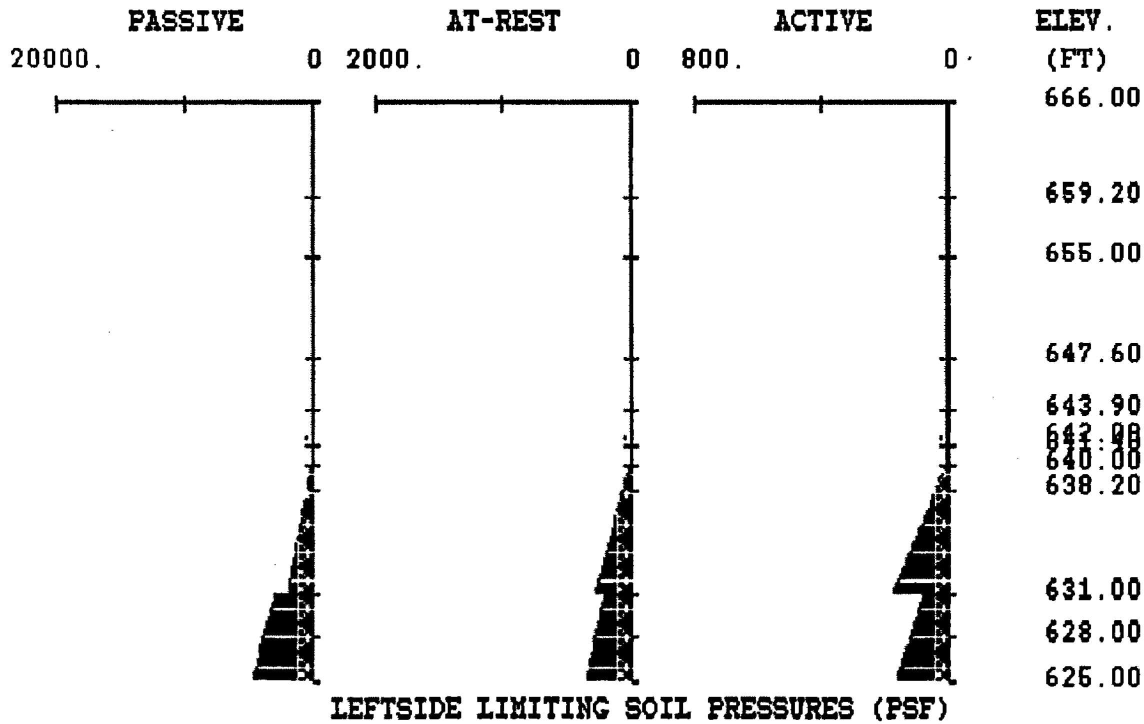
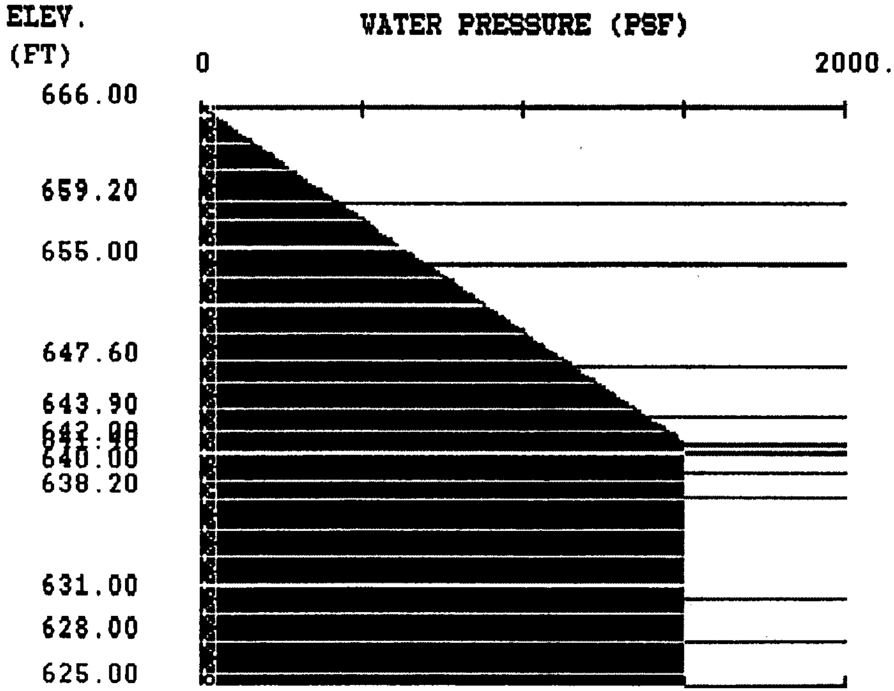


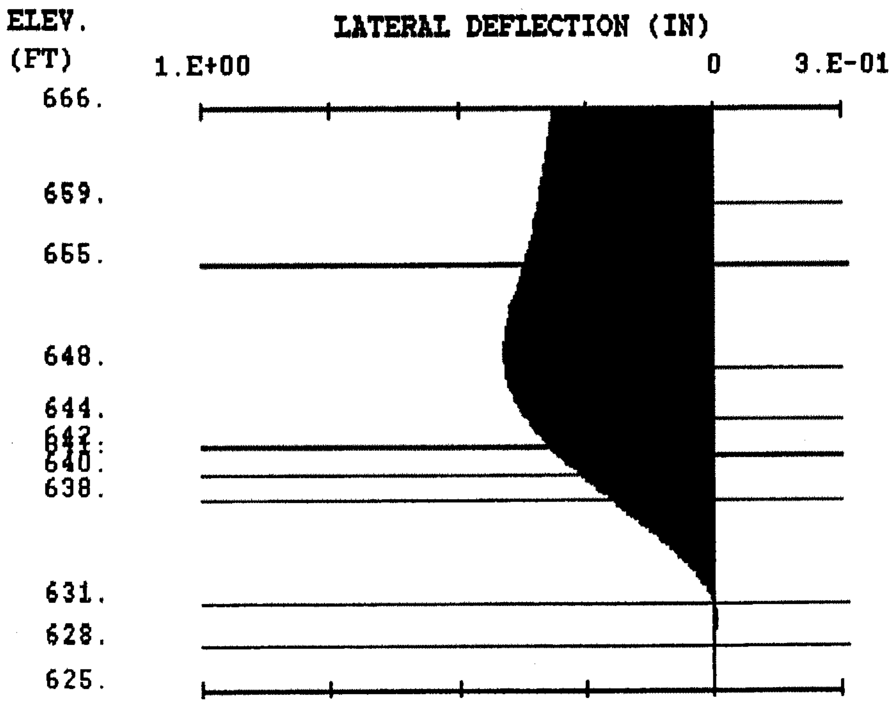
A-I-102

'ISLAND CREEK LPP, LOGAN, WV
'APPALACHIAN-L.C. 1-CRITICAL



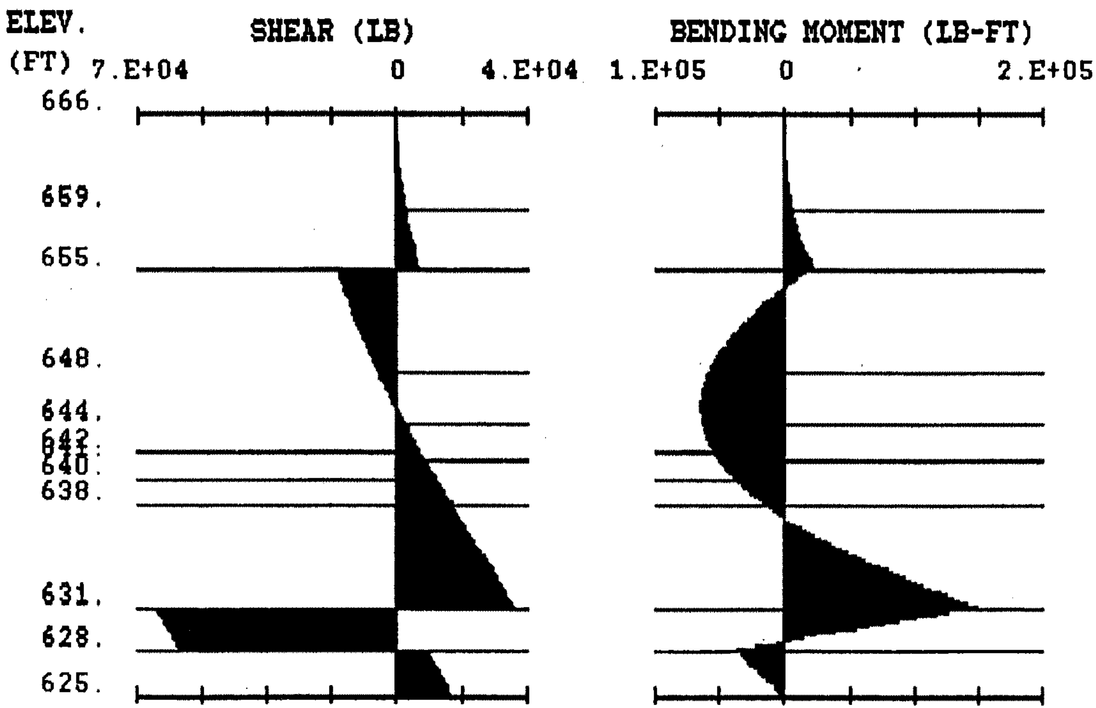
A-II-103

'ISLAND CREEK LPP, LOGAN, WV
'APPALACHIAN-L.C. 1-CRITICAL

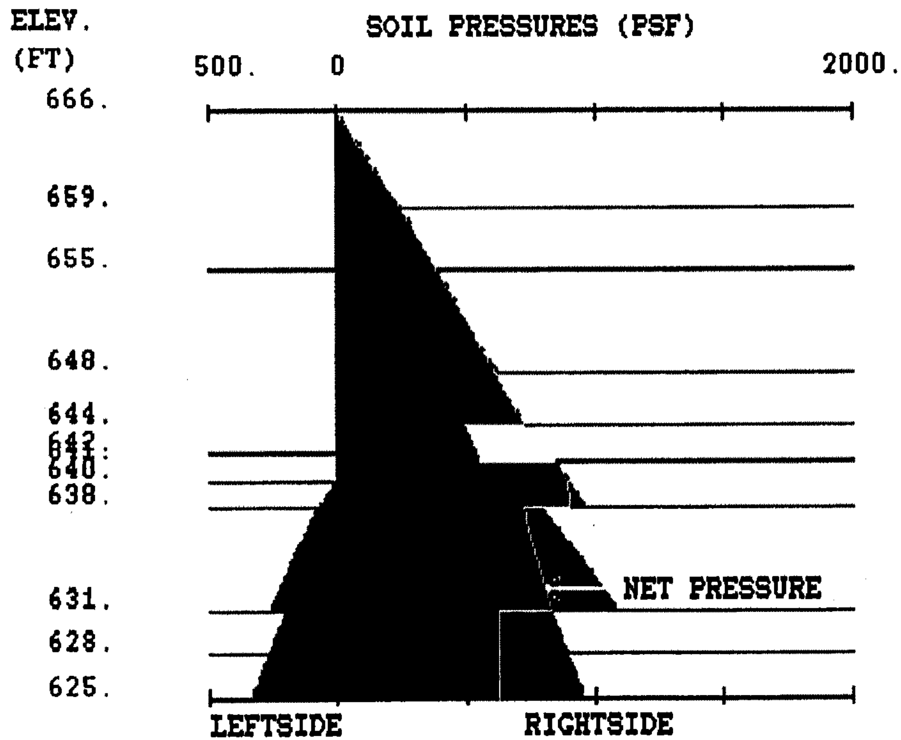


A-I-104

'ISLAND CREEK LPP, LOGAN, WV
'APPALACHIAN-L.C. 1-CRITICAL



'ISLAND CREEK LPP, LOGAN, WV
'APPALACHIAN-L.C. 1-CRITICAL



A-II-105

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 27-AUG-1993 TIME: 18.23.12

INPUT DATA

I.--HEADING:

'ISLAND CREEK LPP, LOGAN, WV

'APPALACHIAN-L.C. 1-CRITICAL

'WALL HEIGHT = 26', W14 X 370

'ONE ANCHOR, 6' C TO C SPACING, L.C. 1

II.--WALL SEGMENT DATA

ELEVATION AT TOP OF SEGMENT (FT)	MODULUS OF ELASTICICTY (PSI)	MOMENT OF INERTIA (IN**4)	CROSS SECTION AREA (SQIN)
666.00	2.900E+07	907.00	18.17

ELEVATION AT BOTTOM OF WALL = 625.00 (FT).

III.--ANCHOR DATA

ELEVATION AT WALL (FT)	ANCHOR TYPE ('R/F')	ULTIMATE TENSION FORCE (LB)	PRE-STRESS FORCE (LB)	ULTIMATE COMPRESSION FORCE (LB)	ANCHOR STIFFNESS (LB/IN)	ANCHOR SLOPE (FT)
655.00	FLEXIBLE	6.67E+04	4.00E+04	4.00E+04	3.150E+04	1.00
631.00	RIGID					
628.00	RIGID					
625.00	RIGID					

IV.--SURFACE POINT DATA

IV.A.--RIGHTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	666.00

IV.B.-- LEFTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	640.00

V.--SOIL LAYER DATA

V.A.--RIGHTSIDE LAYER DATA

<UNIT WEIGHT> SAT. (PCF)	MOIST (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	WALL ADH-ESION (PSF)	<STIFF. COEF.> ACT. (PCI)	PASS. (PCI)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT)

136.00	110.00	28.00	.00	.00	.00	1.80	1.80	659.20	.00
129.00	110.00	28.00	.00	.00	.00	1.80	1.80	647.60	.00
122.00	110.00	28.00	.00	.00	.00	1.80	1.80	643.90	.00
131.00	123.00	30.00	.00	.00	.00	52.20	52.20	641.40	.00
123.00	110.00	28.00	.00	.00	.00	1.10	1.10	638.20	.00
124.00	114.00	32.00	.00	.00	.00	3.50	3.50	631.00	.00
125.00	125.00	40.00	50.00	.00	.00	.10	.10		

V.B.-- LEFTSIDE LAYER DATA

<UNIT	WEIGHT>	ANGLE OF INTERNAL	COH-	ANGLE OF WALL	WALL ADH-	<STIFF.	COEF.>	<--BOTTOM-->	
SAT.	MOIST	FRICTION	ESION	FRICTION	ESION	ACT.	PASS.	ELEV.	SLOPE
(PCF)	(PCF)	(DEG)	(PSF)	(DEG)	(PSF)	(PCI)	(PCI)	(FT)	(FT)
123.00	110.00	28.00	.00	.00	.00	1.10	1.10	638.20	.00
124.00	114.00	32.00	.00	.00	.00	3.50	3.50	631.00	.00
125.00	125.00	40.00	50.00	.00	.00	.10	.10		

VI.--INTERACTION ZONE DATA
NONE

VII.--WATER DATA

UNIT WEIGHT = 62.50 (PCF)
RIGHTSIDE ELEVATION = 666.00 (FT)
LEFTSIDE ELEVATION = 642.00 (FT)
NO SEEPAGE

VIII.--SURFACE LOADS
NONE

IX.--HORIZONTAL LOADS

IX.A.--EARTHQUAKE ACCELERATION = .00 (G'S)

IX.B.--HORIZONTAL LINE LOADS
NONE

IX.C.--HORIZONTAL DISTRIBUTED LOADS

ELEVATION (FT)	DIST. LOAD (PSF)
666.00	.00
664.00	5.48
660.00	31.64
658.50	38.46
657.50	41.08
656.00	42.32
654.50	41.04
646.00	20.74
642.50	14.46
639.00	10.10
635.00	6.82
631.00	4.68

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 27-AUG-1993 TIME: 18.26.05

SUMMARY OF RESULTS

I.A.--MAXIMA

		MAXIMUM	MINIMUM
BENDING MOMENT (LB-FT)	:	1.494E+05	-6.391E+04
AT ELEVATION (FT)	:	631.00	645.00
DEFLECTION (IN)	:	4.082E-01	-4.305E-03
AT ELEVATION (FT)	:	648.50	630.00
RIGHTSIDE SOIL PRESSURE (PSF)	:	1080.72	
AT ELEVATION (FT)	:	631.00	
LEFTSIDE SOIL PRESSURE (PSF)	:	331.03	
AT ELEVATION (FT)	:	625.00	

I.B.--ANCHOR FORCES

ELEVATION AT ANCHOR (FT)	ANCHOR TYPE	ANCHOR DEFORMATION (IN)	ANCHOR FORCE (LB)
655.00	FLEXIBLE	.27	33770.57
631.00	RIGID	.00	95886.61
628.00	RIGID	.00	-66754.42
625.00	RIGID	.00	14842.68

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 27-AUG-1993 TIME: 18.26.05

COMPLETE RESULTS

II.A.--WALL DEFLECTIONS AND FORCES

	<------DEFLECTION----->		<--WALL INTERNAL FORCES-->		
ELEVATION (FT)	AXIAL (IN)	LATERAL (IN)	AXIAL (LB)	SHEAR (LB)	MOMENT (LB-FT)
666.00	-1.502E-02	3.104E-01	0.	0.	0.
665.50	-1.502E-02	3.125E-01	0.	13.	2.
665.00	-1.502E-02	3.145E-01	0.	51.	17.
664.50	-1.502E-02	3.165E-01	0.	115.	57.
664.00	-1.502E-02	3.186E-01	0.	204.	136.
663.50	-1.502E-02	3.206E-01	0.	319.	265.

663.00	-1.502E-02	3.227E-01	0.	460.	459.
662.50	-1.502E-02	3.247E-01	0.	628.	730.
662.00	-1.502E-02	3.268E-01	0.	822.	1092.
661.50	-1.502E-02	3.289E-01	0.	1043.	1557.
661.00	-1.502E-02	3.310E-01	0.	1290.	2139.
660.50	-1.502E-02	3.331E-01	0.	1563.	2851.
660.00	-1.502E-02	3.353E-01	0.	1863.	3707.
659.50	-1.502E-02	3.376E-01	0.	2189.	4719.
659.20+	-1.502E-02	3.390E-01	0.	2397.	5406.
659.20-	-1.502E-02	3.390E-01	0.	2397.	5406.
659.00	-1.502E-02	3.399E-01	0.	2540.	5900.
658.50	-1.502E-02	3.423E-01	0.	2916.	7263.
658.00	-1.502E-02	3.449E-01	0.	3316.	8820.
657.50	-1.502E-02	3.476E-01	0.	3741.	10583.
657.00	-1.502E-02	3.504E-01	0.	4189.	12564.
656.50	-1.502E-02	3.535E-01	0.	4662.	14776.
656.00	-1.502E-02	3.568E-01	0.	5159.	17231.
655.50	-1.502E-02	3.604E-01	0.	5679.	19939.
655.00+	-1.502E-02	3.644E-01	0.	6223.	22914.
655.00-	-1.502E-02	3.644E-01	-21988.	-15766.	22914.
654.50	-1.477E-02	3.686E-01	-21988.	-15199.	15171.
654.00	-1.452E-02	3.732E-01	-21988.	-14608.	7719.
653.50	-1.427E-02	3.778E-01	-21988.	-13995.	567.
653.00	-1.402E-02	3.825E-01	-21988.	-13359.	-6273.
652.50	-1.377E-02	3.870E-01	-21988.	-12700.	-12789.
652.00	-1.352E-02	3.914E-01	-21988.	-12018.	-18969.
651.50	-1.327E-02	3.954E-01	-21988.	-11314.	-24803.
651.00	-1.302E-02	3.991E-01	-21988.	-10586.	-30279.
650.50	-1.277E-02	4.022E-01	-21988.	-9836.	-35385.
650.00	-1.252E-02	4.048E-01	-21988.	-9062.	-40111.
649.50	-1.227E-02	4.067E-01	-21988.	-8266.	-44444.
649.00	-1.202E-02	4.078E-01	-21988.	-7446.	-48373.
648.50	-1.177E-02	4.082E-01	-21988.	-6604.	-51886.
648.00	-1.152E-02	4.077E-01	-21988.	-5738.	-54972.
647.60+	-1.132E-02	4.067E-01	-21988.	-5029.	-57126.
647.60-	-1.132E-02	4.067E-01	-21988.	-5029.	-57126.
647.50	-1.127E-02	4.063E-01	-21988.	-4850.	-57620.
647.00	-1.102E-02	4.040E-01	-21988.	-3942.	-59819.
646.50	-1.077E-02	4.007E-01	-21988.	-3012.	-61559.
646.00	-1.052E-02	3.964E-01	-21988.	-2059.	-62827.
645.50	-1.027E-02	3.910E-01	-21988.	-1083.	-63614.
645.00	-1.001E-02	3.846E-01	-21988.	-85.	-63907.
644.50	-9.765E-03	3.772E-01	-21988.	936.	-63695.
644.00	-9.514E-03	3.687E-01	-21988.	1981.	-62967.
643.90+	-9.464E-03	3.669E-01	-21988.	2192.	-62758.
643.90-	-9.464E-03	3.669E-01	-21988.	2192.	-62758.
643.50	-9.264E-03	3.592E-01	-21988.	2957.	-61729.
643.00	-9.013E-03	3.486E-01	-21988.	3932.	-60007.
642.50	-8.763E-03	3.371E-01	-21988.	4928.	-57793.
642.00	-8.513E-03	3.247E-01	-21988.	5944.	-55076.
641.50	-8.262E-03	3.113E-01	-21988.	6974.	-51846.
641.40+	-8.212E-03	3.085E-01	-21988.	7181.	-51139.
641.40-	-8.212E-03	3.085E-01	-21988.	7181.	-51139.
641.00	-8.012E-03	2.971E-01	-21988.	8126.	-48077.
640.50	-7.762E-03	2.821E-01	-21988.	9315.	-43717.
640.00	-7.511E-03	2.663E-01	-21988.	10513.	-38761.
639.50	-7.261E-03	2.500E-01	-21988.	11715.	-33204.
639.00	-7.010E-03	2.330E-01	-21988.	12916.	-27046.
638.50	-6.760E-03	2.157E-01	-21988.	14118.	-20288.
638.20+	-6.610E-03	2.051E-01	-21988.	14839.	-15944.
638.20-	-6.610E-03	2.051E-01	-21988.	14839.	-15944.
638.00	-6.510E-03	1.980E-01	-21988.	15285.	-12932.
637.50	-6.259E-03	1.801E-01	-21988.	16402.	-5010.
637.00	-6.009E-03	1.621E-01	-21988.	17520.	3470.

636.50	-5.759E-03	1.442E-01	-21988.	18642.	12511.
636.00	-5.508E-03	1.265E-01	-21988.	19767.	22113.
635.50	-5.258E-03	1.091E-01	-21988.	20895.	32278.
635.00	-5.007E-03	9.233E-02	-21988.	22027.	43009.
634.50	-4.757E-03	7.622E-02	-21988.	23164.	54306.
634.00	-4.507E-03	6.100E-02	-21988.	24304.	66173.
633.50	-4.256E-03	4.687E-02	-21988.	25449.	78611.
633.00	-4.006E-03	3.403E-02	-21988.	26598.	91623.
632.50	-3.756E-03	2.269E-02	-21988.	27751.	105210.
632.00	-3.505E-03	1.309E-02	-21988.	28907.	119374.
631.50	-3.255E-03	5.441E-03	-21988.	30067.	134117.
631.00+	-3.004E-03	0.000E+00	-21988.	31229.	149441.
631.00-	-3.004E-03	0.000E+00	-21988.	-64658.	149441.
630.50	-2.754E-03	-3.117E-03	-21988.	-63596.	117378.
630.00	-2.504E-03	-4.305E-03	-21988.	-62533.	85846.
629.50	-2.253E-03	-4.083E-03	-21988.	-61470.	54845.
629.00	-2.003E-03	-2.959E-03	-21988.	-60408.	24375.
628.50	-1.753E-03	-1.434E-03	-21988.	-59346.	-5563.
628.00+	-1.502E-03	0.000E+00	-21988.	-58283.	-34970.
628.00-	-1.502E-03	0.000E+00	-21988.	8471.	-34970.
627.50	-1.252E-03	9.520E-04	-21988.	9533.	-30469.
627.00	-1.001E-03	1.404E-03	-21988.	10595.	-25437.
626.50	-7.511E-04	1.439E-03	-21988.	11657.	-19875.
626.00	-5.007E-04	1.149E-03	-21988.	12719.	-13781.
625.50	-2.504E-04	6.329E-04	-21988.	13781.	-7156.
625.00	0.000E+00	0.000E+00	-21988.	14843.	0.

II.B.--SOIL PRESSURES

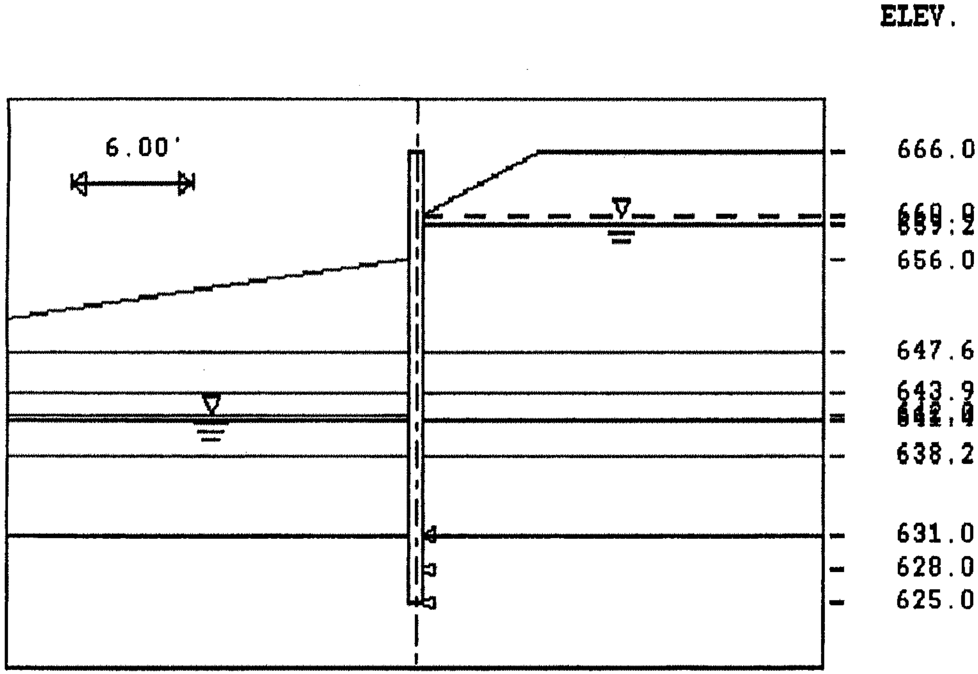
ELEVATION (FT)	<----------SOIL PRESSURES (PSF)---------> LEFTSIDE	RIGHTSIDE	NET
666.00	.00	.00	.00
665.50	.00	18.34	18.34
665.00	.00	36.66	36.66
664.50	.00	54.97	54.97
664.00	.00	73.27	73.27
663.50	.00	91.55	91.55
663.00	.00	109.81	109.81
662.50	.00	128.06	128.06
662.00	.00	146.30	146.30
661.50	.00	164.51	164.51
661.00	.00	182.71	182.71
660.50	.00	200.90	200.90
660.00	.00	219.06	219.06
659.50	.00	237.21	237.21
659.20+	.00	248.09	248.09
659.20-	.00	246.29	246.29
659.00	.00	252.79	252.79
658.50	.00	269.03	269.03
658.00	.00	285.23	285.23
657.50	.00	301.41	301.41
657.00	.00	317.56	317.56
656.50	.00	333.67	333.67
656.00	.00	349.74	349.74
655.50	.00	365.76	365.76
655.00+	.00	381.72	381.72
655.00-	.00	381.72	381.72
654.50	.00	397.62	397.62
654.00	.00	413.47	413.47
653.50	.00	429.28	429.28
653.00	.00	445.04	445.04
652.50	.00	460.79	460.79
652.00	.00	476.52	476.52

651.50	.00	492.26	492.26
651.00	.00	508.01	508.01
650.50	.00	523.80	523.80
650.00	.00	539.63	539.63
649.50	.00	555.53	555.53
649.00	.00	571.51	571.51
648.50	.00	587.59	587.59
648.00	.00	603.78	603.78
647.60+	.00	616.84	616.84
647.60-	.00	610.06	610.06
647.50	.00	612.97	612.97
647.00	.00	627.63	627.63
646.50	.00	642.47	642.47
646.00	.00	657.50	657.50
645.50	.00	672.75	672.75
645.00	.00	688.22	688.22
644.50	.00	703.92	703.92
644.00	.00	719.88	719.88
643.90+	.00	723.10	723.10
643.90-	.00	497.12	497.12
643.50	.00	506.25	506.25
643.00	.00	517.67	517.67
642.50	.00	529.08	529.08
642.00	.00	540.50	540.50
641.50	.00	551.92	551.92
641.40+	.00	554.20	554.20
641.40-	.00	843.69	843.69
641.00	.00	857.41	857.41
640.50	.00	874.72	874.72
640.00	.00	892.18	892.18
639.50	17.37	909.80	892.44
639.00	34.56	927.57	893.02
638.50	51.56	945.48	893.92
638.20+	61.67	956.29	894.61
638.20-	63.40	783.42	720.02
638.00	70.09	791.72	721.63
637.50	86.38	812.70	726.32
637.00	102.07	833.99	731.92
636.50	117.16	855.50	738.35
636.00	131.67	877.18	745.51
635.50	145.64	898.94	753.29
635.00	159.12	920.69	761.57
634.50	172.17	942.34	770.18
634.00	184.85	963.79	778.93
633.50	197.26	984.90	787.64
633.00	209.49	1005.56	796.07
632.50	221.67	1025.63	803.95
632.00	233.94	1044.95	811.01
631.50	246.44	1063.37	816.93
631.00+	259.34	1080.72	821.37
631.00-	197.07	821.23	624.16
630.50	208.10	832.95	624.85
630.00	219.20	844.34	625.14
629.50	230.36	855.47	625.11
629.00	241.57	866.43	624.86
628.50	252.81	877.32	624.51
628.00+	264.05	888.21	624.16
628.00-	264.05	888.21	624.16
627.50	275.27	899.19	623.92
627.00	286.46	910.26	623.80
626.50	297.63	921.41	623.78
626.00	308.78	932.63	623.85
625.50	319.91	943.89	623.99
625.00	331.03	955.19	624.16

```
1000   'ISLAND   CREEK   LPP,   LOGAN,   WV
1010   'APPALACHIAN      - L.C.  4  - CONSTRUCTION
1020   'WALL   HEIGHT    = 26',  W14  X 370 ·
1030   'NO  ANCHORS,    6'  C  TO  C  SPACING
1040   WALL       666.00       2.900E+07        9.07E+02        18.17E+00
1050   WALL       625.00
1065   ANCHOR        631.00   R   6.00E+04     0.00          0.00          0.00          0.00
1066   ANCHOR        628.00   R   6.00E+04     0.00          0.00          0.00          0.00
1067   ANCHOR        625.00   R   6.00E+04     0.00          0.00          0.00          0.00
1070   SURFACE    RIGHTSIDE          2
1080              .00      660.00     6.0    666.00
1090   SURFACE      LEFTSIDE         2
1100              .00      656.00    60.0     640.00
1110   SOIL   RIGHTSIDE       STRENGTH        7
1120     136.00     110.00    28.0        .00     .0      .00       1.8       1.8      659.20       0.00
1130     129.00     110.00    28.0        .00     .0      .00       1.8       1.8      647.60       0.00
1135     122.00     110.00    28.0        .00     .0      .00       1.8       1.8      643.90       0.00
1136     131.00     123.00    30.0        .00     .0      .00      52.2      52.2      641.40       0.00
1137     123.00     110.00    28.0        .00     .0      .00       1.1       1.1      638.20       0.00
1138     124.00     114.00    32.0        .00     .0      .00       3.5       3.5      631.00       0.00
1139     125.00     125.00    40.0      50.00      .0      .00       0.1       0.1
1140   SOIL    LEFTSIDE       STRENGTH        7
1151     129.00     110.00    28.0        .00     .0      .00       3.0       3.0      647.60       0.00
1152     122.00     110.00    28.0        .00     .0      .00       3.0       3.0      643.90       0.00
1153     131.00     123.00    30.0        .00     .0      .00      86.6      86.6      642.00       0.00
1154     131.00     123.00    30.0        .00     .0      .00      52.2      52.2      641.40       0.00
1155     123.00     110.00    28.0        .00     .0      .00       1.8       1.8      638.20       0.00
1156     124.00     114.00    32.0        .00     .0      .00       5.8       5.8      631.00       0.00
1160     125.00     125.00    40.0      50.00      .0      .00       0.1       0.1
1170   WATER   ELEVATIONS         62.50     660.00      642.00
1190   FINISH
```

A-I-113

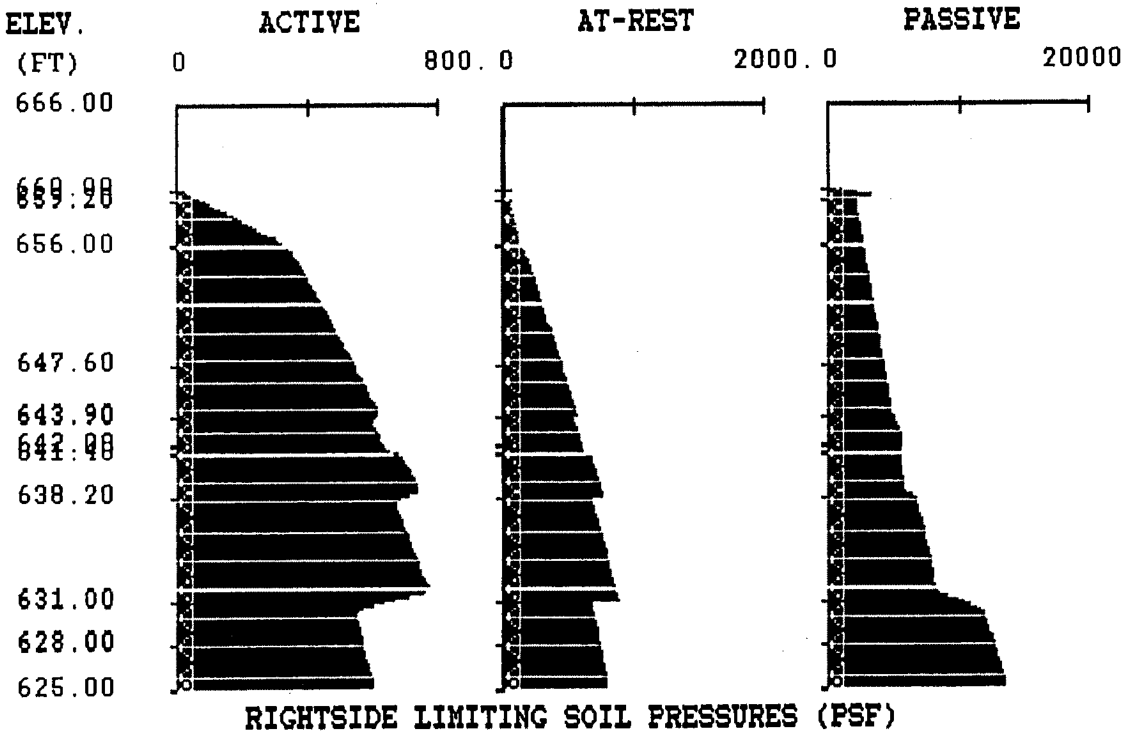
'ISLAND CREEK LPP, LOGAN, WV
'APPALACHIAN - L.C. 4 - CONSTRUCTION



***** INPUT GEOMETRY *****
DATE: 28-AUG-1993 TIME: 15.41.56

A-II-14

'ISLAND CREEK LPP, LOGAN, WV
'APPALACHIAN - L.C. 4 - CONSTRUCTION



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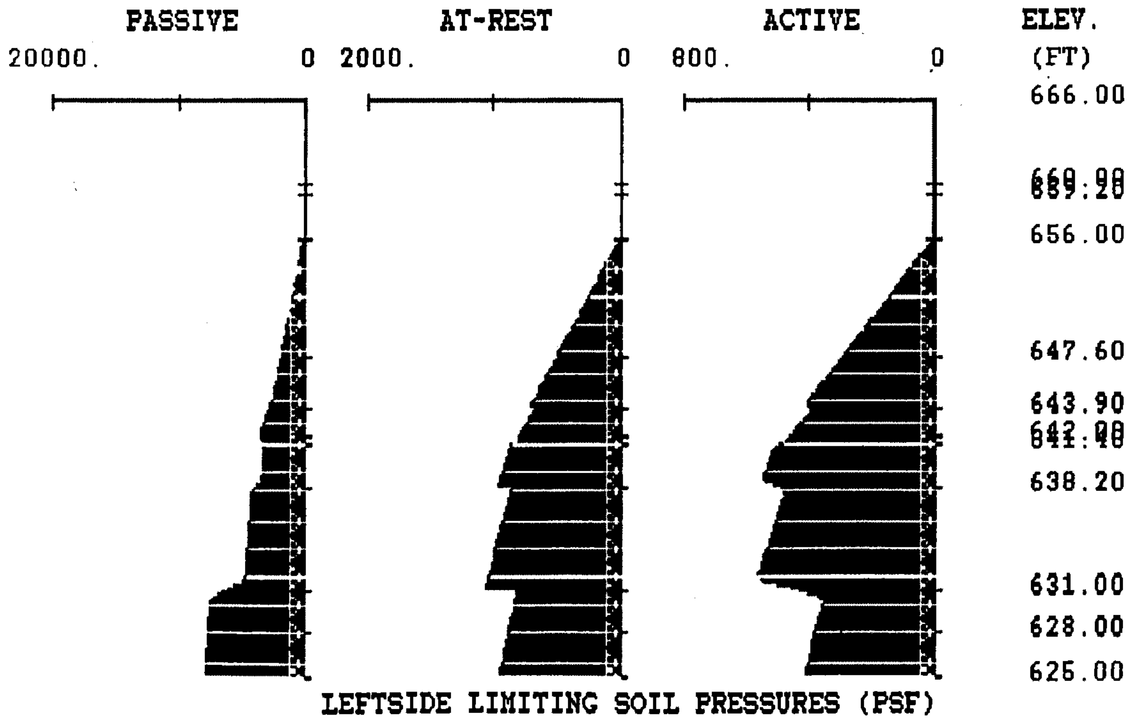
'APPALACHIAN - L.C. 4 - CONSTRUCTION



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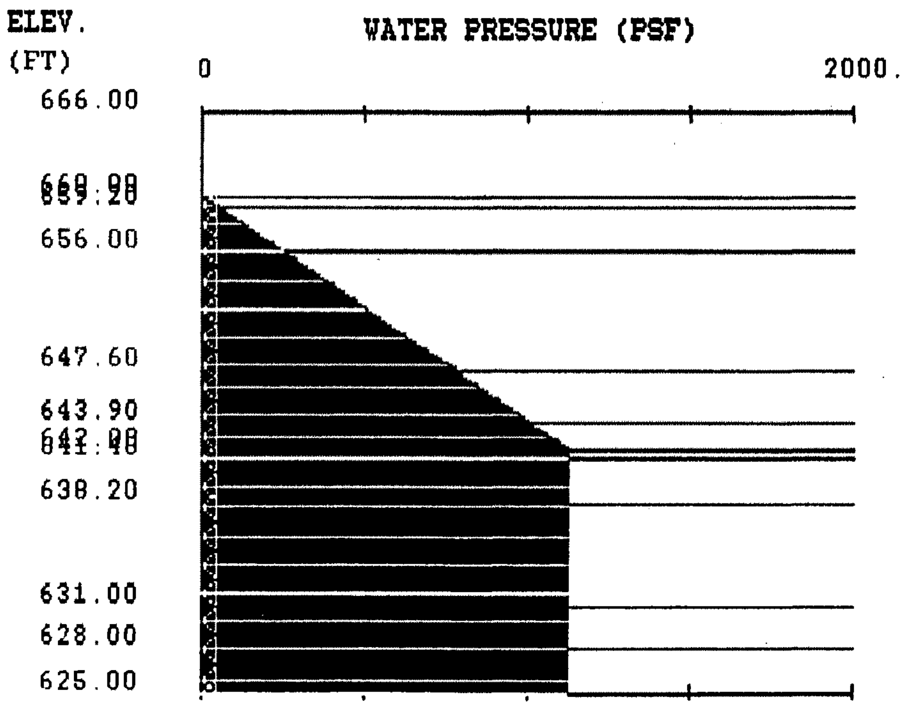

A-I-112

'ISLAND CREEK LPP, LOGAN, WV
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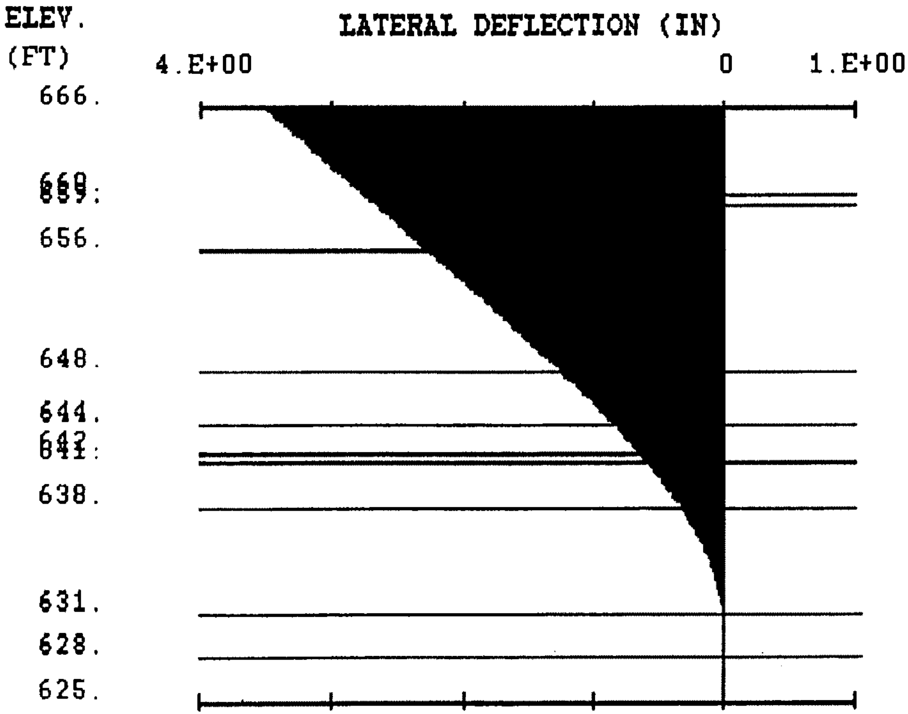
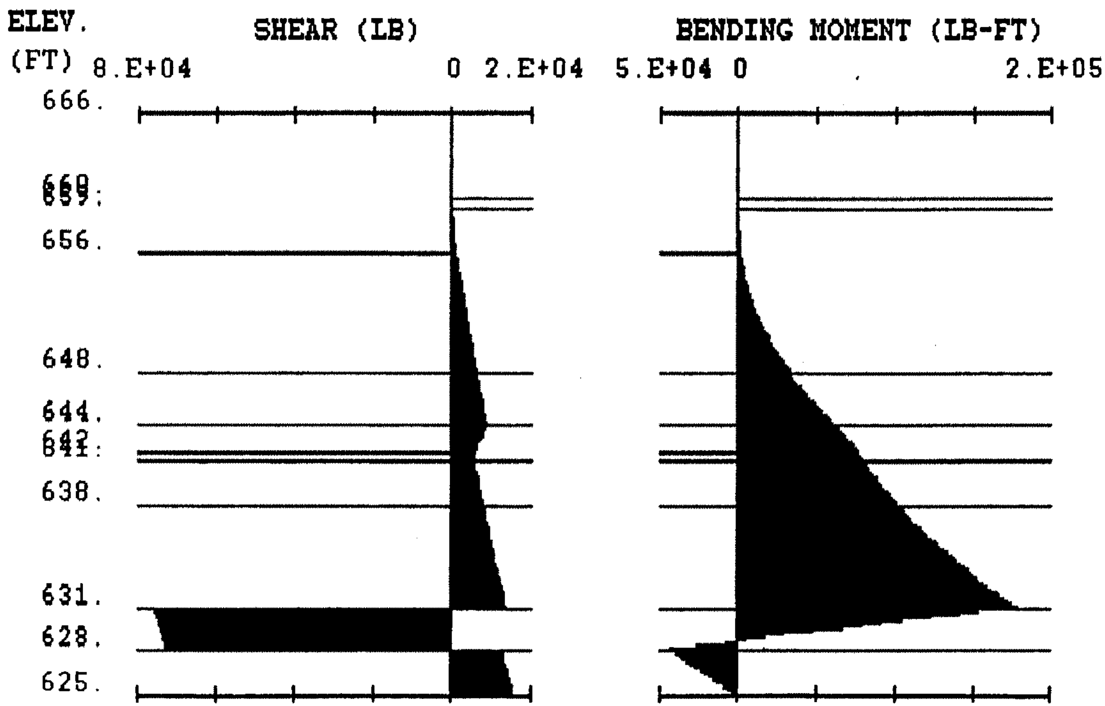


A-I-118

'ISLAND CREEK LPP, LOGAN, WV
'APPALACHIAN - L.C. 4 - CONSTRUCTION



A-I-119

'ISLAND CREEK LPP, LOGAN, WV
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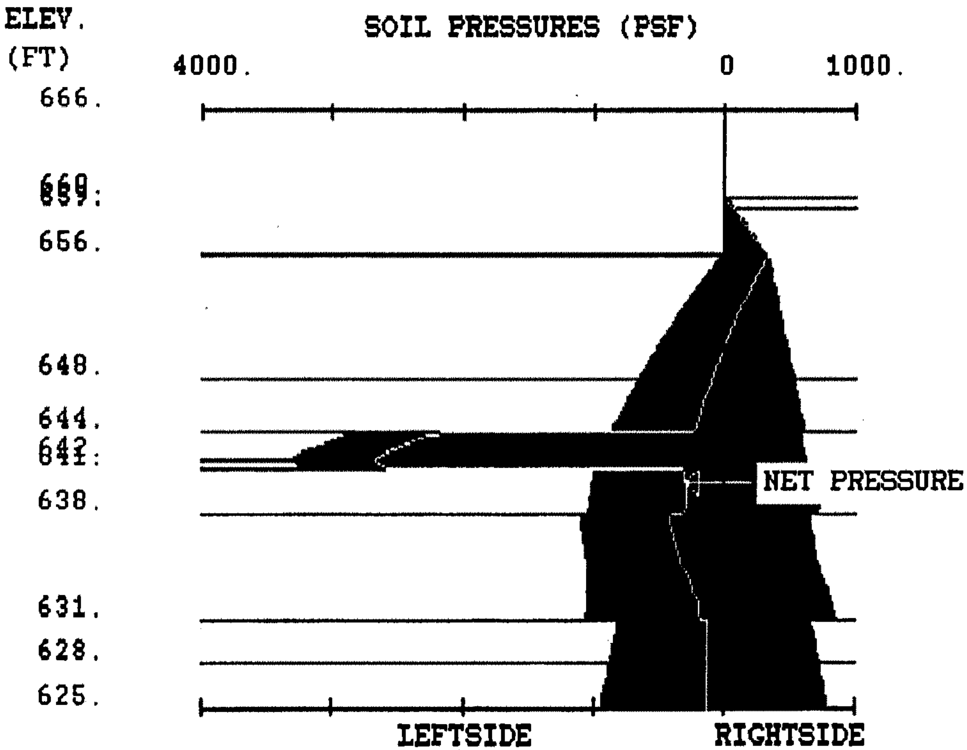

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 28-AUG-1993 TIME: 15.41.32

INPUT DATA

I.--HEADING:
'ISLAND CREEK LPP, LOGAN, WV

'APPALACHIAN - L.C. 4 - CONSTRUCTION

'WALL HEIGHT = 26', W14 X 370

'NO ANCHORS, 6' C TO C SPACING

II.--WALL SEGMENT DATA

ELEVATION AT TOP OF SEGMENT (FT)	MODULUS OF ELASTICICTY (PSI)	MOMENT OF INERTIA (IN**4)	CROSS SECTION AREA (SQIN)
666.00	2.900E+07	907.00	18.17

ELEVATION AT BOTTOM OF WALL = 625.00 (FT).

III.--ANCHOR DATA

ELEVATION AT WALL (FT)	ANCHOR TYPE ('R/F')	ULTIMATE TENSION FORCE (LB)	PRE-STRESS FORCE (LB)	ULTIMATE COMPRESSION FORCE (LB)	ANCHOR STIFFNESS (LB/IN)	ANCHOR SLOPE (FT)
631.00	RIGID					
628.00	RIGID					
625.00	RIGID					

IV.--SURFACE POINT DATA

IV.A.--RIGHTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	660.00
6.00	666.00

IV.B.-- LEFTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	656.00
60.00	640.00

V.--SOIL LAYER DATA

V.A.--RIGHTSIDE LAYER DATA

<UNIT WEIGHT> SAT. (PCF)	MOIST (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	WALL ADH-ESION (PSF)	<STIFF. COEF.> ACT. (PCI)	PASS. (PCI)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT)
136.00	110.00	28.00	.00	.00	.00	1.80	1.80	659.20	.00

129.00	110.00	28.00	.00	.00	.00	1.80	1.80	647.60	.00
122.00	110.00	28.00	.00	.00	.00	1.80	1.80	643.90	.00
131.00	123.00	30.00	.00	.00	.00	52.20	52.20	641.40	.00
123.00	110.00	28.00	.00	.00	.00	1.10	1.10	638.20	.00
124.00	114.00	32.00	.00	.00	.00	3.50	3.50	631.00	.00
125.00	125.00	40.00	50.00	.00	.00	.10	.10		

V.B.-- LEFTSIDE LAYER DATA

<UNIT WEIGHT> SAT. (PCF)	MOIST (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH- ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	WALL ADH- ESION (PSF)	<STIFF. ACT. (PCI)	COEF.> PASS. (PCI)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT)
129.00	110.00	28.00	.00	.00	.00	3.00	3.00	647.60	.00
122.00	110.00	28.00	.00	.00	.00	3.00	3.00	643.90	.00
131.00	123.00	30.00	.00	.00	.00	86.60	86.60	642.00	.00
131.00	123.00	30.00	.00	.00	.00	52.20	52.20	641.40	.00
123.00	110.00	28.00	.00	.00	.00	1.80	1.80	638.20	.00
124.00	114.00	32.00	.00	.00	.00	5.80	5.80	631.00	.00
125.00	125.00	40.00	50.00	.00	.00	.10	.10		

VI.--INTERACTION ZONE DATA
NONE

VII.--WATER DATA

UNIT WEIGHT = 62.50 (PCF)
RIGHTSIDE ELEVATION = 660.00 (FT)
LEFTSIDE ELEVATION = 642.00 (FT)
NO SEEPAGE

VIII.--SURFACE LOADS
NONE

IX.--HORIZONTAL LOADS
NONE

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 28-AUG-1993 TIME: 15.45.09

SUMMARY OF RESULTS

I.A.--MAXIMA

		MAXIMUM	MINIMUM
BENDING MOMENT (LB-FT)	:	1.787E+05	-4.357E+04
AT ELEVATION (FT)	:	631.00	628.00
DEFLECTION (IN)	:	3.511E+00	-5.192E-03

```
     AT ELEVATION (FT)          :        666.00          630.00
RIGHTSIDE SOIL PRESSURE (PSF):           873.41
     AT ELEVATION (FT)          :        631.00
LEFTSIDE SOIL PRESSURE (PSF) :          3292.70
     AT ELEVATION (FT)          :        642.00
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I.B.--ANCHOR FORCES

ELEVATION AT ANCHOR (FT)	ANCHOR TYPE	ANCHOR DEFORMATION (IN)	ANCHOR FORCE (LB)
631.00	RIGID	.00	89549.75
628.00	RIGID	.00	-85663.50
625.00	RIGID	.00	16005.30

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 28-AUG-1993 TIME: 15.45.09

COMPLETE RESULTS

II.A.--WALL DEFLECTIONS AND FORCES

	<------DEFLECTION----->		<--WALL INTERNAL FORCES->		
ELEVATION (FT)	AXIAL (IN)	LATERAL (IN)	AXIAL (LB)	SHEAR (LB)	MOMENT (LB-FT)
666.00	0.000E+00	3.511E+00	0.	0.	0.
665.50	0.000E+00	3.449E+00	0.	0.	0.
665.00	0.000E+00	3.387E+00	0.	0.	0.
664.50	0.000E+00	3.325E+00	0.	0.	0.
664.00	0.000E+00	3.263E+00	0.	0.	0.
663.50	0.000E+00	3.202E+00	0.	0.	0.
663.00	0.000E+00	3.140E+00	0.	0.	0.
662.50	0.000E+00	3.078E+00	0.	0.	0.
662.00	0.000E+00	3.016E+00	0.	0.	0.
661.50	0.000E+00	2.954E+00	0.	0.	0.
661.00	0.000E+00	2.893E+00	0.	0.	0.
660.50	0.000E+00	2.831E+00	0.	0.	0.
660.00	0.000E+00	2.769E+00	0.	0.	0.
659.50	0.000E+00	2.707E+00	0.	19.	3.
659.20	0.000E+00	2.670E+00	0.	48.	13.
659.00	0.000E+00	2.646E+00	0.	74.	25.
658.50	0.000E+00	2.584E+00	0.	167.	84.
658.00	0.000E+00	2.522E+00	0.	296.	198.
657.50	0.000E+00	2.460E+00	0.	461.	385.
657.00	0.000E+00	2.398E+00	0.	664.	665.
656.50	0.000E+00	2.337E+00	0.	902.	1055.
656.00	0.000E+00	2.275E+00	0.	1176.	1573.
655.50	0.000E+00	2.213E+00	0.	1467.	2234.
655.00	0.000E+00	2.151E+00	0.	1759.	3040.
654.50	0.000E+00	2.090E+00	0.	2051.	3993.
654.00	0.000E+00	2.028E+00	0.	2344.	5091.

653.50	0.000E+00	1.967E+00	0.	2638.	6337.
653.00	0.000E+00	1.905E+00	0.	2932.	7729.
652.50	0.000E+00	1.844E+00	0.	3229.	9269.
652.00	0.000E+00	1.783E+00	0.	3527.	10958.
651.50	0.000E+00	1.722E+00	0.	3829.	12797.
651.00	0.000E+00	1.661E+00	0.	4133.	14787.
650.50	0.000E+00	1.601E+00	0.	4440.	16930.
650.00	0.000E+00	1.541E+00	0.	4751.	19228.
649.50	0.000E+00	1.481E+00	0.	5067.	21682.
649.00	0.000E+00	1.421E+00	0.	5386.	24295.
648.50	0.000E+00	1.362E+00	0.	5711.	27069.
648.00	0.000E+00	1.304E+00	0.	6042.	30007.
647.60	0.000E+00	1.257E+00	0.	6310.	32478.
647.50	0.000E+00	1.245E+00	0.	6378.	33112.
647.00	0.000E+00	1.188E+00	0.	6719.	36386.
646.50	0.000E+00	1.131E+00	0.	7067.	39832.
646.00	0.000E+00	1.074E+00	0.	7421.	43454.
645.50	0.000E+00	1.019E+00	0.	7781.	47254.
645.00	0.000E+00	9.638E-01	0.	8148.	51236.
644.50	0.000E+00	9.097E-01	0.	8523.	55404.
644.00	0.000E+00	8.566E-01	0.	8902.	59760.
643.90+	0.000E+00	8.461E-01	0.	8978.	60654.
643.90-	0.000E+00	8.461E-01	0.	8978.	60654.
643.50	0.000E+00	8.044E-01	0.	8504.	64153.
643.00	0.000E+00	7.533E-01	0.	7835.	68240.
642.50	0.000E+00	7.034E-01	0.	7119.	71981.
642.00	0.000E+00	6.545E-01	0.	6363.	75353.
641.50	0.000E+00	6.070E-01	0.	5605.	78343.
641.40+	0.000E+00	5.976E-01	0.	5459.	78896.
641.40-	0.000E+00	5.976E-01	0.	5459.	78896.
641.00	0.000E+00	5.607E-01	0.	5782.	81144.
640.50	0.000E+00	5.158E-01	0.	6192.	84138.
640.00	0.000E+00	4.722E-01	0.	6604.	87337.
639.50	0.000E+00	4.301E-01	0.	7018.	90742.
639.00	0.000E+00	3.894E-01	0.	7433.	94355.
638.50	0.000E+00	3.503E-01	0.	7847.	98175.
638.20+	0.000E+00	3.276E-01	0.	8091.	100566.
638.20-	0.000E+00	3.276E-01	0.	8091.	100566.
638.00	0.000E+00	3.128E-01	0.	8233.	102198.
637.50	0.000E+00	2.770E-01	0.	8583.	106402.
637.00	0.000E+00	2.430E-01	0.	8937.	110782.
636.50	0.000E+00	2.108E-01	0.	9301.	115341.
636.00	0.000E+00	1.804E-01	0.	9673.	120084.
635.50	0.000E+00	1.521E-01	0.	10054.	125016.
635.00	0.000E+00	1.258E-01	0.	10443.	130140.
634.50	0.000E+00	1.016E-01	0.	10843.	135460.
634.00	0.000E+00	7.963E-02	0.	11257.	140985.
633.50	0.000E+00	6.000E-02	0.	11684.	146720.
633.00	0.000E+00	4.278E-02	0.	12122.	152671.
632.50	0.000E+00	2.806E-02	0.	12571.	158844.
632.00	0.000E+00	1.596E-02	0.	13028.	165244.
631.50	0.000E+00	6.568E-03	0.	13493.	171874.
631.00+	0.000E+00	0.000E+00	0.	13963.	178737.
631.00-	0.000E+00	0.000E+00	0.	-75587.	178737.
630.50	0.000E+00	-3.754E-03	0.	-75093.	141068.
630.00	0.000E+00	-5.192E-03	0.	-74598.	103645.
629.50	0.000E+00	-4.926E-03	0.	-74103.	66470.
629.00	0.000E+00	-3.569E-03	0.	-73609.	29542.
628.50	0.000E+00	-1.726E-03	0.	-73114.	-7139.
628.00+	0.000E+00	0.000E+00	0.	-72620.	-43573.
628.00-	0.000E+00	0.000E+00	0.	13043.	-43573.
627.50	0.000E+00	1.128E-03	0.	13537.	-36928.
627.00	0.000E+00	1.650E-03	0.	14031.	-30036.
626.50	0.000E+00	1.679E-03	0.	14524.	-22897.

626.00	0.000E+00	1.332E-03	0.	15018.	-15512.
625.50	0.000E+00	7.304E-04	0.	15511.	-7879.
625.00	0.000E+00	0.000E+00	0.	16005.	0.

II.B.--SOIL PRESSURES

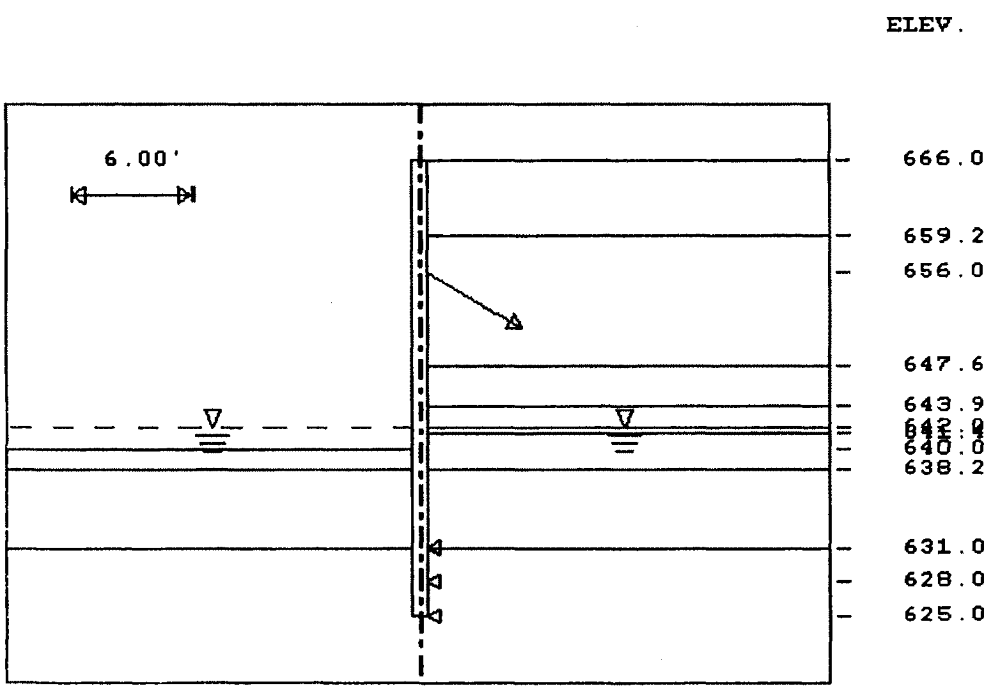
ELEVATION (FT)	<---------SOIL PRESSURES (PSF)--------> LEFTSIDE	RIGHTSIDE	NET
666.00	.00	.00	.00
665.50	.00	.00	.00
665.00	.00	.00	.00
664.50	.00	.00	.00
664.00	.00	.00	.00
663.50	.00	.00	.00
663.00	.00	.00	.00
662.50	.00	.00	.00
662.00	.00	.00	.00
661.50	.00	.00	.00
661.00	.00	.00	.00
660.50	.00	.00	.00
660.00	.00	.00	.00
659.50	.00	43.16	43.16
659.20	.00	68.89	68.89
659.00	.00	85.80	85.80
658.50	.00	127.71	127.71
658.00	.00	169.61	169.61
657.50	.00	211.51	211.51
657.00	.00	253.53	253.53
656.50	.00	295.22	295.22
656.00	.00	329.05	329.05
655.50	44.60	348.42	303.82
655.00	88.34	360.45	272.11
654.50	131.22	372.35	241.13
654.00	173.25	384.36	211.11
653.50	214.42	396.36	181.94
653.00	254.73	408.36	153.63
652.50	294.20	420.37	126.17
652.00	332.82	432.37	99.55
651.50	370.61	444.38	73.77
651.00	407.56	456.38	48.83
650.50	443.68	468.39	24.71
650.00	478.98	480.39	1.41
649.50	513.47	492.40	-21.07
649.00	547.16	504.40	-42.76
648.50	580.07	516.40	-63.66
648.00	612.19	528.41	-83.78
647.60	637.35	537.88	-99.47
647.50	643.57	540.12	-103.44
647.00	674.19	550.90	-123.29
646.50	704.10	561.64	-142.46
646.00	733.30	572.38	-160.92
645.50	761.82	583.12	-178.69
645.00	789.68	593.86	-195.82
644.50	816.91	604.95	-211.96
644.00	843.54	602.54	-241.01
643.90+	848.80	598.16	-250.64
643.90-	2687.24	598.16	-2089.08
643.50	2905.97	589.67	-2316.30
643.00	3051.24	598.57	-2452.66
642.50	3179.79	609.84	-2569.95
642.00	3292.70	620.43	-2672.27
641.50	3255.65	646.17	-2609.48
641.40+	3211.17	655.70	-2555.47

641.40-	984.55	655.70	-328.85
641.00	991.07	683.79	-307.28
640.50	999.15	697.04	-302.11
640.00	1007.18	707.66	-299.52
639.50	1015.18	718.58	-296.60
639.00	1023.19	730.59	-292.60
638.50	1031.24	729.55	-301.69
638.20+	1036.11	716.12	-319.99
638.20-	1104.14	699.67	-404.47
638.00	1099.94	675.71	-424.23
637.50	1089.72	663.53	-426.18
637.00	1079.96	673.37	-406.59
636.50	1070.81	682.03	-388.77
636.00	1062.39	690.70	-371.69
635.50	1054.85	699.36	-355.50
635.00	1048.35	710.31	-338.04
634.50	1043.03	733.15	-309.88
634.00	1039.07	755.48	-283.59
633.50	1036.64	777.19	-259.44
633.00	1035.91	798.21	-237.70
632.50	1037.08	818.44	-218.64
632.00	1040.35	837.79	-202.56
631.50	1045.92	856.15	-189.78
631.00+	1054.02	873.41	-180.61
631.00-	800.94	663.70	-137.24
630.50	811.45	675.41	-136.04
630.00	822.35	686.79	-135.56
629.50	833.55	697.93	-135.62
629.00	844.94	708.90	-136.05
628.50	856.44	719.78	-136.66
628.00+	867.92	730.68	-137.24
628.00-	867.92	730.68	-137.24
627.50	879.30	741.66	-137.63
627.00	890.56	752.74	-137.82
626.50	901.73	763.89	-137.84
626.00	912.83	775.11	-137.72
625.50	923.88	786.37	-137.51
625.00	934.90	797.66	-137.24

```
1000  'ISLAND   CREEK   LPP,   LOGAN,   WV
1010  'LOAD   CASE   3-NORMAL   OPERATING   CONDITION
1020  'WALL   HEIGHT   = 26',   W14  X 370
1030  'ONE   ANCHOR,   6'  C TO  C SPACING
1040  WALL     666.00     2.900E+07     9.07E+02     18.17E+00
1050  WALL     625.00
1060  ANCHOR      656.00   F   6.67E+04    4.00E+04    4.00E+04    3.15E+04    1.000E+00
1065  ANCHOR      631.00   R   6.00E+04    0.00        0.00        0.00        0.00
1066  ANCHOR      628.00   R   6.00E+04    0.00        0.00        0.00        0.00
1067  ANCHOR      625.00   R   6.00E+04    0.00        0.00        0.00        0.00
1070  SURFACE    RIGHTSIDE       1
1080        .00      666.00
1090  SURFACE     LEFTSIDE       1
1100        .00      640.00
1110  SOIL   RIGHTSIDE       STRENGTH        8
1120    136.00    110.00   28.0       .00     .0      .00      3.0      3.0     659.20     0.00
1130    129.00    110.00   28.0       .00     .0      .00      3.0      3.0     647.60     0.00
1131    122.00    110.00   28.0       .00     .0      .00      3.0      3.0     643.90     0.00
1132    131.00    123.00   30.0       .00     .0      .00     86.6     86.6     642.00     0.00
1133    131.00    123.00   30.0       .00     .0      .00     52.2     52.2     641.40     0.00
1137    123.00    110.00   28.0       .00     .0      .00      1.1      1.1     638.20     0.00
1138    124.00    114.00   32.0       .00     .0      .00      3.5      3.5     631.00     0.00
1139     125.00    125.00   40.0    50.00      .0      .00      0.1      0.1
1140  SOIL    LEFTSIDE       STRENGTH        3
1150    123.00    110.00   28.0       .00     .0      .00      1.1      1.1     638.20     0.00
1155    124.00    114.00   32.0       .00     .0      .00      3.5      3.5     631.00     0.00
1160     125.00    125.00   40.0    50.00      .0      .00      0.1      0.1
1170  WATER   ELEVATIONS        62.50    642.00    642.00
1190  FINISH
```

'ISLAND CREEK LPP, LOGAN, WV

'LOAD CASE 3-NORMAL OPERATING CONDITION



***** INPUT GEOMETRY *****

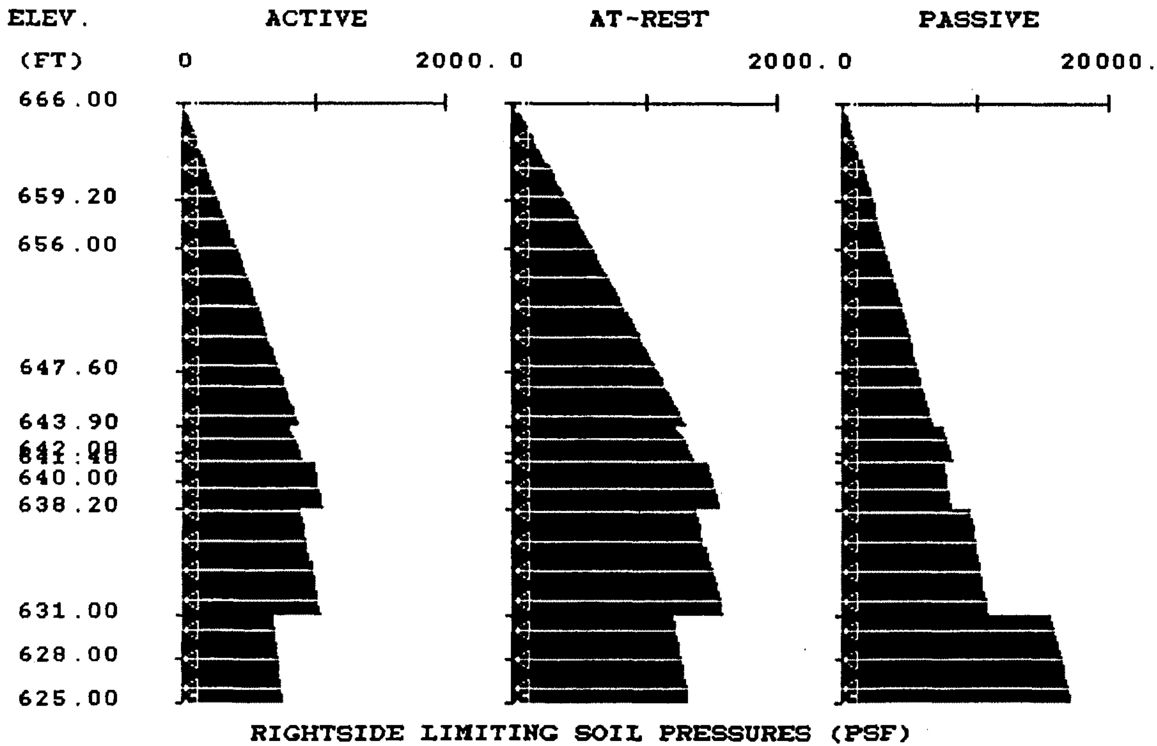
DATE: 27-AUG-1993 TIME: 17.39.25

A-II-127

A-I-128

'ISLAND CREEK LPP, LOGAN, WV

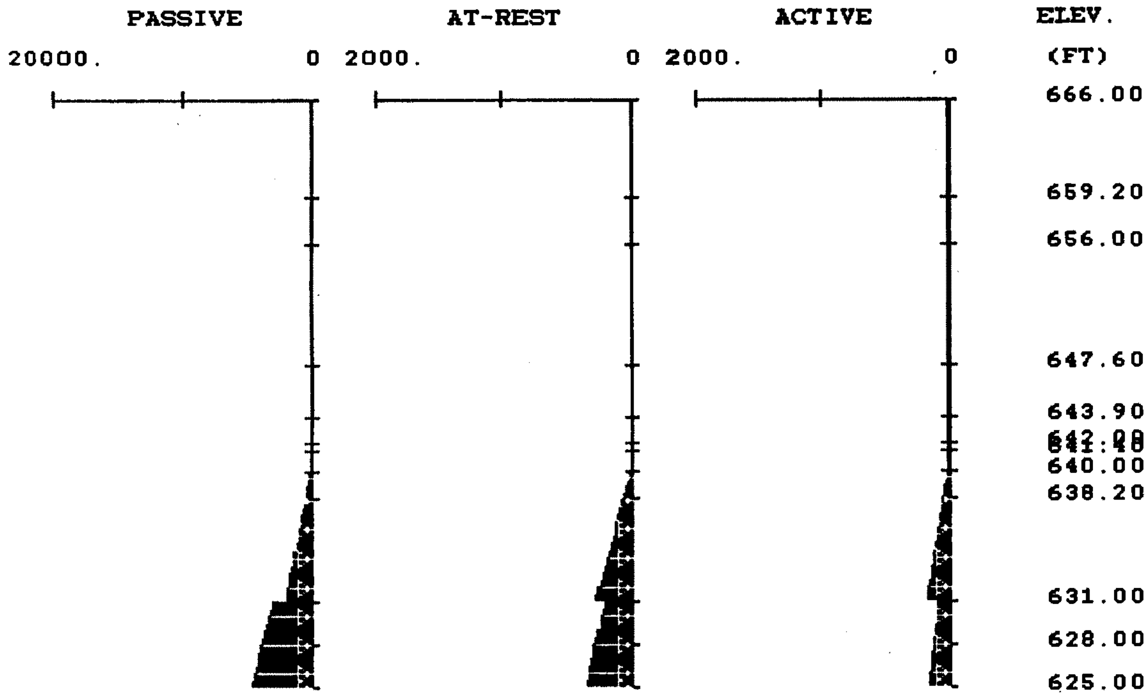
'LOAD CASE 3-NORMAL OPERATING CONDITION



A-I-129

'ISLAND CREEK LPP, LOGAN, WV

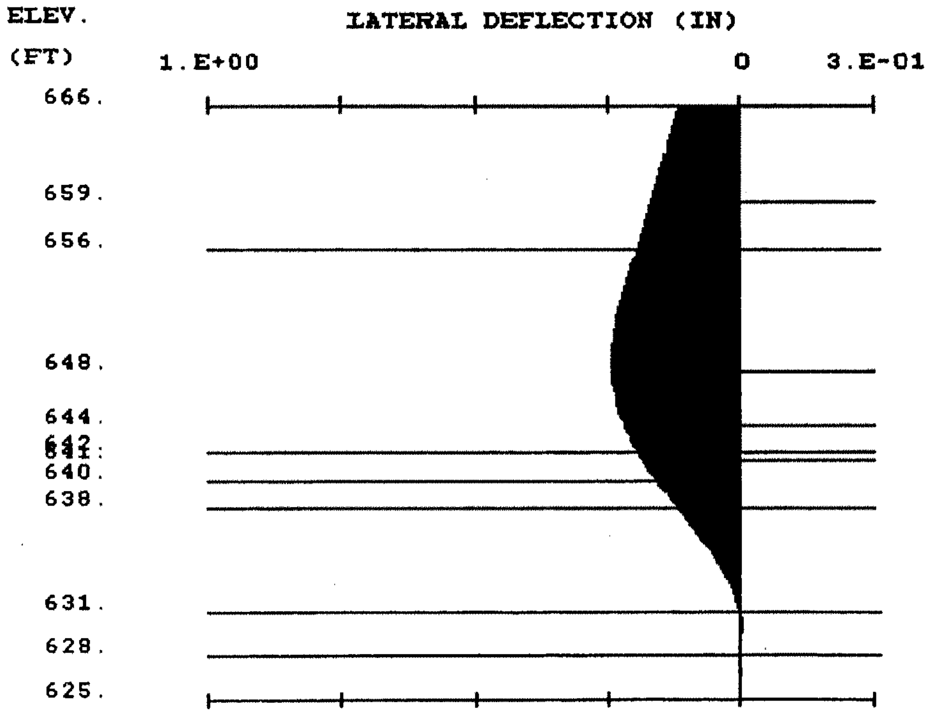
'LOAD CASE 3-NORMAL OPERATING CONDITION



LEFTSIDE LIMITING SOIL PRESSURES (PSF)

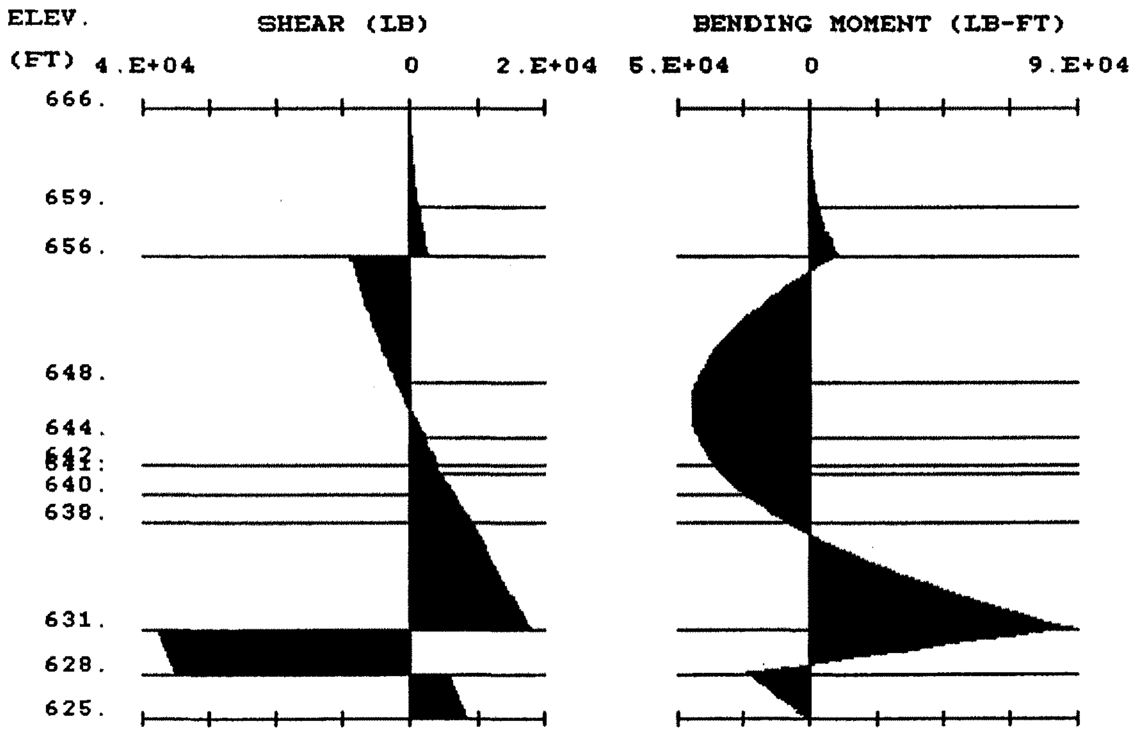
'ISLAND CREEK LPP, LOGAN, WV

'LOAD CASE 3-NORMAL OPERATING CONDITION



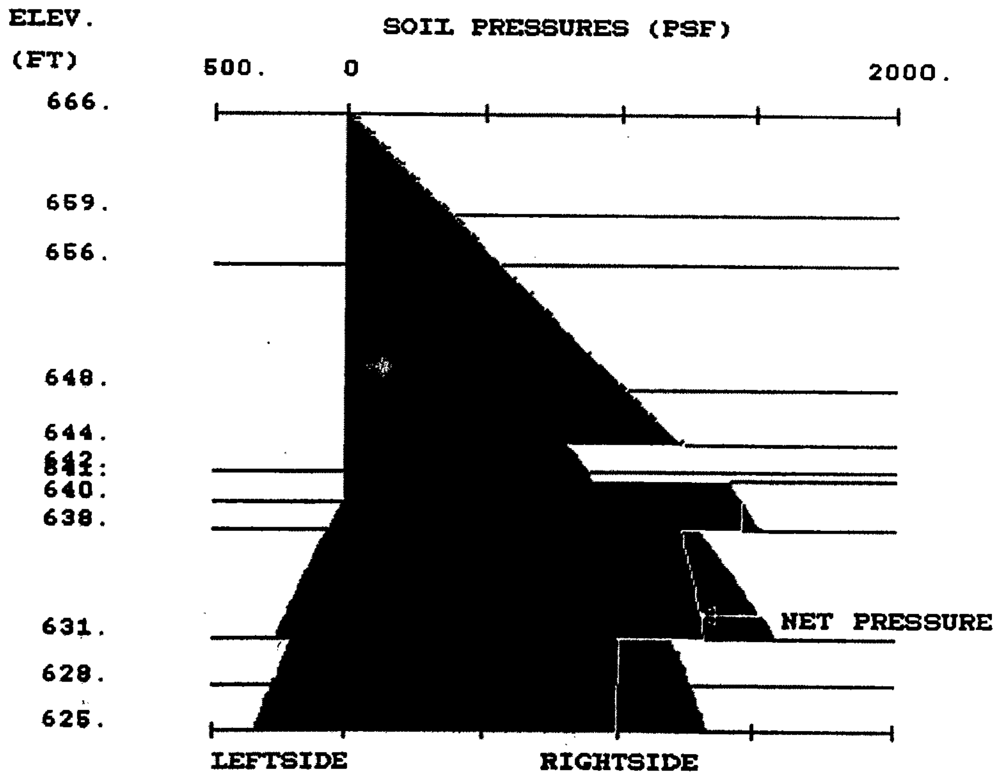
'ISLAND CREEK LPP, LOGAN, WV

'LOAD CASE 3-NORMAL OPERATING CONDITION



'ISLAND CREEK LPP, LOGAN, WV

'LOAD CASE 3-NORMAL OPERATING CONDITION



PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 27-AUG-1993 TIME: 17.39.05

INPUT DATA

I.--HEADING:
'ISLAND CREEK LPP, LOGAN, WV

'LOAD CASE 3-NORMAL OPERATING CONDITION

'WALL HEIGHT = 26', W14 X 370

'ONE ANCHOR, 6' C TO C SPACING

II.--WALL SEGMENT DATA

ELEVATION AT TOP OF SEGMENT (FT)	MODULUS OF ELASTICICTY (PSI)	MOMENT OF INERTIA (IN**4)	CROSS SECTION AREA (SQIN)
666.00	2.900E+07	907.00	18.17

ELEVATION AT BOTTOM OF WALL = 625.00 (FT).

III.--ANCHOR DATA

ELEVATION AT WALL (FT)	ANCHOR TYPE ('R/F')	ULTIMATE TENSION FORCE (LB)	PRE-STRESS FORCE (LB)	ULTIMATE COMPRESSION FORCE (LB)	ANCHOR STIFFNESS (LB/IN)	ANCHOR SLOPE (FT)
656.00	FLEXIBLE	6.67E+04	4.00E+04	4.00E+04	3.150E+04	1.00
631.00	RIGID					
628.00	RIGID					
625.00	RIGID					

IV.--SURFACE POINT DATA

IV.A.--RIGHTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	666.00

IV.B.-- LEFTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	640.00

V.--SOIL LAYER DATA

V.A.--RIGHTSIDE LAYER DATA

<UNIT WEIGHT> SAT.. (PCF)	MOIST (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	WALL ADH-ESION (PSF)	<STIFF. COEF.> ACT. (PCI)	PASS. (PCI)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT)

136.00	110.00	28.00	.00	.00	.00	3.00	3.00	659.20	.00
129.00	110.00	28.00	.00	.00	.00	3.00	3.00	647.60	.00
122.00	110.00	28.00	.00	.00	.00	3.00	3.00	643.90	.00
131.00	123.00	30.00	.00	.00	.00	86.60	86.60	642.00	.00
131.00	123.00	30.00	.00	.00	.00	52.20	52.20	641.40	.00
123.00	110.00	28.00	.00	.00	.00	1.10	1.10	638.20	.00
124.00	114.00	32.00	.00	.00	.00	3.50	3.50	631.00	.00
125.00	125.00	40.00	50.00	.00	.00	.10	.10		

V.B.-- LEFTSIDE LAYER DATA

<UNIT WEIGHT> SAT. (PCF)	MOIST (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH- ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	WALL ADH- ESION (PSF)	<STIFF. ACT. (PCI)	COEF.> PASS. (PCI)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT)
123.00	110.00	28.00	.00	.00	.00	1.10	1.10	638.20	.00
124.00	114.00	32.00	.00	.00	.00	3.50	3.50	631.00	.00
125.00	125.00	40.00	50.00	.00	.00	.10	.10		

VI.--INTERACTION ZONE DATA
NONE

VII.--WATER DATA

UNIT WEIGHT = 62.50 (PCF)
RIGHTSIDE ELEVATION = 642.00 (FT)
LEFTSIDE ELEVATION = 642.00 (FT)
NO SEEPAGE

VIII.--SURFACE LOADS
NONE

IX.--HORIZONTAL LOADS
NONE

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 27-AUG-1993 TIME: 17.43.01

SUMMARY OF RESULTS

I.A.--MAXIMA

		MAXIMUM	MINIMUM
BENDING MOMENT (LB-FT)	:	8.761E+04	-3.991E+04
AT ELEVATION (FT)	:	631.00	645.50

DEFLECTION (IN)	:	2.408E-01	-2.531E-03
AT ELEVATION (FT)	:	648.00	630.00
RIGHTSIDE SOIL PRESSURE (PSF)	:	1571.10	
AT ELEVATION (FT)	:	631.00	
LEFTSIDE SOIL PRESSURE (PSF)	:	331.03	
AT ELEVATION (FT)	:	625.00	

I.B.--ANCHOR FORCES

ELEVATION AT ANCHOR (FT)	ANCHOR TYPE	ANCHOR DEFORMATION (IN)	ANCHOR FORCE (LB)
656.00	FLEXIBLE	.14	17644.10
631.00	RIGID	.00	55658.34
628.00	RIGID	.00	-40064.75
625.00	RIGID	.00	8421.61

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 27-AUG-1993 TIME: 17.43.01

COMPLETE RESULTS

II.A.--WALL DEFLECTIONS AND FORCES

	<-------DEFLECTION----->		<--WALL INTERNAL FORCES->		
ELEVATION (FT)	AXIAL (IN)	LATERAL (IN)	AXIAL (LB)	SHEAR (LB)	MOMENT (LB-FT)
666.00	-8.089E-03	1.125E-01	0.	0.	0.
665.50	-8.089E-03	1.162E-01	0.	7.	1.
665.00	-8.089E-03	1.200E-01	0.	28.	9.
664.50	-8.089E-03	1.237E-01	0.	64.	32.
664.00	-8.089E-03	1.274E-01	0.	114.	76.
663.50	-8.089E-03	1.312E-01	0.	178.	148.
663.00	-8.089E-03	1.349E-01	0.	256.	256.
662.50	-8.089E-03	1.386E-01	0.	348.	406.
662.00	-8.089E-03	1.424E-01	0.	454.	606.
661.50	-8.089E-03	1.461E-01	0.	574.	862.
661.00	-8.089E-03	1.499E-01	0.	708.	1182.
660.50	-8.089E-03	1.537E-01	0.	857.	1573.
660.00	-8.089E-03	1.575E-01	0.	1019.	2041.
659.50	-8.089E-03	1.613E-01	0.	1195.	2594.
659.20	-8.089E-03	1.636E-01	0.	1307.	2969.
659.00	-8.089E-03	1.652E-01	0.	1385.	3238.
658.50	-8.089E-03	1.691E-01	0.	1589.	3981.
658.00	-8.089E-03	1.731E-01	0.	1807.	4830.
657.50	-8.089E-03	1.772E-01	0.	2039.	5791.
657.00	-8.089E-03	1.814E-01	0.	2285.	6871.
656.50	-8.089E-03	1.857E-01	0.	2544.	8078.
656.00+	-8.089E-03	1.901E-01	0.	2817.	9418.
656.00-	-8.089E-03	1.901E-01	-11458.	-8641.	9418.
655.50	-7.959E-03	1.947E-01	-11458.	-8354.	5168.

655.00	-7.828E-03	1.993E-01	-11458.	-8053.	1066.
654.50	-7.698E-03	2.040E-01	-11458.	-7739.	-2883.
654.00	-7.567E-03	2.086E-01	-11458.	-7411.	-6671.
653.50	-7.437E-03	2.132E-01	-11458.	-7070.	-10291.
653.00	-7.306E-03	2.175E-01	-11458.	-6714.	-13738.
652.50	-7.176E-03	2.216E-01	-11458.	-6346.	-17004.
652.00	-7.045E-03	2.255E-01	-11458.	-5964.	-20082.
651.50	-6.915E-03	2.290E-01	-11458.	-5568.	-22965.
651.00	-6.784E-03	2.321E-01	-11458.	-5158.	-25647.
650.50	-6.654E-03	2.348E-01	-11458.	-4735.	-28121.
650.00	-6.523E-03	2.371E-01	-11458.	-4299.	-30380.
649.50	-6.393E-03	2.388E-01	-11458.	-3848.	-32417.
649.00	-6.263E-03	2.400E-01	-11458.	-3384.	-34226.
648.50	-6.132E-03	2.407E-01	-11458.	-2907.	-35800.
648.00	-6.002E-03	2.408E-01	-11458.	-2415.	-37131.
647.60	-5.897E-03	2.404E-01	-11458.	-2012.	-38016.
647.50	-5.871E-03	2.402E-01	-11458.	-1910.	-38212.
647.00	-5.741E-03	2.390E-01	-11458.	-1390.	-39038.
646.50	-5.610E-03	2.372E-01	-11458.	-857.	-39600.
646.00	-5.480E-03	2.348E-01	-11458.	-309.	-39893.
645.50	-5.349E-03	2.317E-01	-11458.	252.	-39907.
645.00	-5.219E-03	2.279E-01	-11458.	828.	-39638.
644.50	-5.088E-03	2.235E-01	-11458.	1419.	-39077.
644.00	-4.958E-03	2.184E-01	-11458.	2024.	-38217.
643.90+	-4.932E-03	2.173E-01	-11458.	2147.	-38008.
643.90-	-4.932E-03	2.173E-01	-11458.	2147.	-38008.
643.50	-4.827E-03	2.127E-01	-11458.	2474.	-37084.
643.00	-4.697E-03	2.064E-01	-11458.	2892.	-35743.
642.50	-4.566E-03	1.996E-01	-11458.	3321.	-34190.
642.00	-4.436E-03	1.921E-01	-11458.	3760.	-32420.
641.50	-4.305E-03	1.841E-01	-11458.	4207.	-30429.
641.40+	-4.279E-03	1.825E-01	-11458.	4297.	-30003.
641.40-	-4.279E-03	1.825E-01	-11458.	4297.	-30003.
641.00	-4.175E-03	1.757E-01	-11458.	4859.	-28172.
640.50	-4.045E-03	1.667E-01	-11458.	5570.	-25565.
640.00	-3.914E-03	1.574E-01	-11458.	6289.	-22601.
639.50	-3.784E-03	1.476E-01	-11458.	7013.	-19275.
639.00	-3.653E-03	1.376E-01	-11458.	7738.	-15587.
638.50	-3.523E-03	1.273E-01	-11458.	8463.	-11537.
638.20+	-3.444E-03	1.210E-01	-11458.	8899.	-8933.
638.20-	-3.444E-03	1.210E-01	-11458.	8899.	-8933.
638.00	-3.392E-03	1.168E-01	-11458.	9143.	-7129.
637.50	-3.262E-03	1.062E-01	-11458.	9757.	-2404.
637.00	-3.131E-03	9.555E-02	-11458.	10373.	2629.
636.50	-3.001E-03	8.495E-02	-11458.	10993.	7970.
636.00	-2.870E-03	7.448E-02	-11458.	11615.	13622.
635.50	-2.740E-03	6.424E-02	-11458.	12241.	19586.
635.00	-2.609E-03	5.432E-02	-11458.	12871.	25864.
634.50	-2.479E-03	4.482E-02	-11458.	13505.	32458.
634.00	-2.348E-03	3.586E-02	-11458.	14142.	39369.
633.50	-2.218E-03	2.754E-02	-11458.	14783.	46600.
633.00	-2.088E-03	1.999E-02	-11458.	15427.	54153.
632.50	-1.957E-03	1.333E-02	-11458.	16075.	62028.
632.00	-1.827E-03	7.683E-03	-11458.	16725.	70228.
631.50	-1.696E-03	3.195E-03	-11458.	17378.	78754.
631.00+	-1.566E-03	0.000E+00	-11458.	18033.	87607.
631.00-	-1.566E-03	0.000E+00	-11458.	-37625.	87607.
630.50	-1.435E-03	-1.831E-03	-11458.	-37126.	68919.
630.00	-1.305E-03	-2.531E-03	-11458.	-36628.	50480.
629.50	-1.174E-03	-2.400E-03	-11458.	-36129.	32291.
629.00	-1.044E-03	-1.739E-03	-11458.	-35630.	14351.
628.50	-9.133E-04	-8.425E-04	-11458.	-35131.	-3339.
628.00+	-7.828E-04	0.000E+00	-11458.	-34633.	-20780.
628.00-	-7.828E-04	0.000E+00	-11458.	5432.	-20780.

627.50	-6.523E-04	5.564E-04	-11458.	5930.	-17940.
627.00	-5.219E-04	8.184E-04	-11458.	6428.	-14850.
626.50	-3.914E-04	8.370E-04	-11458.	6927.	-11511.
626.00	-2.609E-04	6.668E-04	-11458.	7425.	-7923.
625.50	-1.305E-04	3.668E-04	-11458.	7923.	-4086.
625.00	0.000E+00	0.000E+00	-11458.	8422.	0.

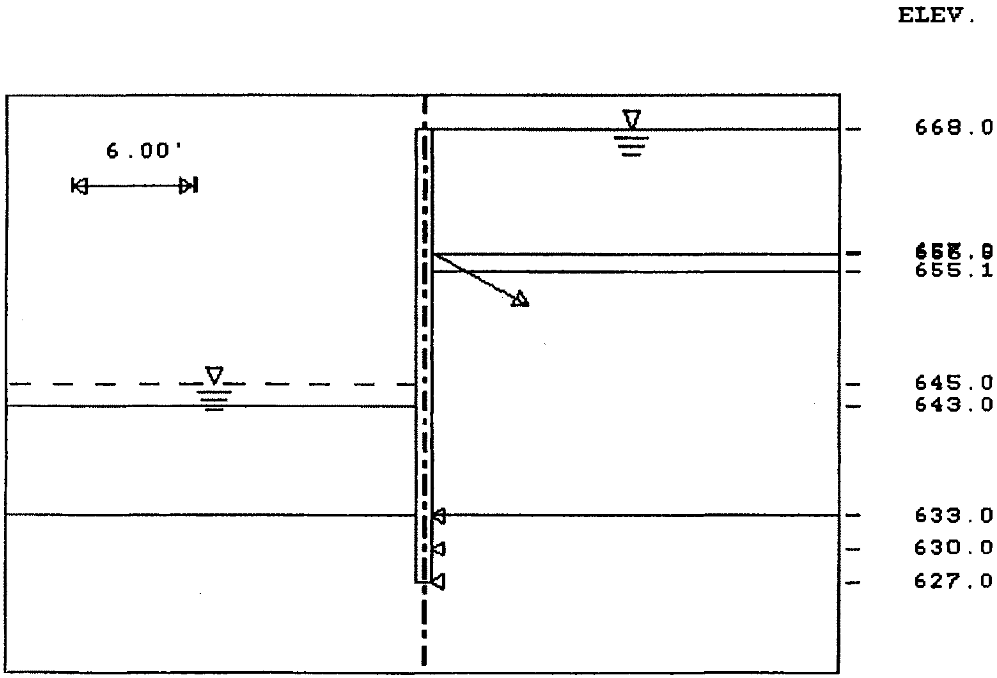
II.B.--SOIL PRESSURES

ELEVATION (FT)	<---------SOIL PRESSURES (PSF)--------> LEFTSIDE	RIGHTSIDE	NET
666.00	.00	.00	.00
665.50	.00	28.46	28.46
665.00	.00	56.88	56.88
664.50	.00	85.25	85.25
664.00	.00	113.57	113.57
663.50	.00	141.85	141.85
663.00	.00	170.08	170.08
662.50	.00	198.27	198.27
662.00	.00	226.40	226.40
661.50	.00	254.50	254.50
661.00	.00	282.54	282.54
660.50	.00	310.54	310.54
660.00	.00	338.49	338.49
659.50	.00	366.39	366.39
659.20	.00	383.10	383.10
659.00	.00	394.23	394.23
658.50	.00	422.03	422.03
658.00	.00	449.77	449.77
657.50	.00	477.45	477.45
657.00	.00	505.07	505.07
656.50	.00	532.63	532.63
656.00+	.00	560.11	560.11
656.00-	.00	560.11	560.11
655.50	.00	587.53	587.53
655.00	.00	614.87	614.87
654.50	.00	642.16	642.16
654.00	.00	669.40	669.40
653.50	.00	696.59	696.59
653.00	.00	723.76	723.76
652.50	.00	750.91	750.91
652.00	.00	778.06	778.06
651.50	.00	805.22	805.22
651.00	.00	832.40	832.40
650.50	.00	859.63	859.63
650.00	.00	886.92	886.92
649.50	.00	914.27	914.27
649.00	.00	941.72	941.72
648.50	.00	969.28	969.28
648.00	.00	996.96	996.96
647.60	.00	1019.20	1019.20
647.50	.00	1024.78	1024.78
647.00	.00	1052.75	1052.75
646.50	.00	1080.88	1080.88
646.00	.00	1109.21	1109.21
645.50	.00	1137.72	1137.72
645.00	.00	1166.45	1166.45
644.50	.00	1195.40	1195.40
644.00	.00	1224.57	1224.57
643.90+	.00	1230.43	1230.43
643.90-	.00	810.33	810.33
643.50	.00	826.73	826.73
643.00	.00	847.23	847.23

642.50	.00	867.73	867.73
642.00	.00	888.23	888.23
641.50	.00	899.65	899.65
641.40+	.00	901.93	901.93
641.40-	.00	1398.57	1398.57
641.00	.00	1412.47	1412.47
640.50	.00	1429.97	1429.97
640.00	.00	1447.59	1447.59
639.50	16.83	1465.34	1448.51
639.00	33.55	1483.19	1449.64
638.50	50.16	1501.15	1450.99
638.20+	60.07	1511.97	1451.89
638.20-	58.39	1280.80	1222.40
638.00	64.71	1289.10	1224.39
637.50	80.24	1310.02	1229.78
637.00	95.42	1331.12	1235.70
636.50	110.25	1352.35	1242.10
636.00	124.73	1373.63	1248.90
635.50	138.90	1394.90	1256.00
635.00	152.78	1416.09	1263.31
634.50	166.40	1437.10	1270.71
634.00	179.81	1457.86	1278.06
633.50	193.06	1478.27	1285.21
633.00	206.20	1498.22	1292.01
632.50	219.32	1517.60	1298.28
632.00	232.49	1536.29	1303.80
631.50	245.80	1554.17	1308.37
631.00+	259.34	1571.10	1311.76
631.00-	197.07	1193.88	996.80
630.50	208.15	1205.51	997.36
630.00	219.28	1216.86	997.58
629.50	230.44	1228.00	997.55
629.00	241.64	1238.99	997.35
628.50	252.84	1249.92	997.07
628.00+	264.05	1260.85	996.80
628.00-	264.05	1260.85	996.80
627.50	275.25	1271.86	996.62
627.00	286.43	1282.95	996.52
626.50	297.59	1294.11	996.51
626.00	308.75	1305.32	996.57
625.50	319.89	1316.56	996.67
625.00	331.03	1327.83	996.80

```
1000 'ISLAND CREEK LPP, LOGAN, WV
1010 'BAISDEN - LC 1 - CRITICAL
1020 'WALL HEIGHT = 26', W14 X 370 POST
1030 'ONE ANCHOR, 6' C TO C SPACING
1040 WALL    668.00   2.900E+07   9.070E+02  18.17E+00
1050 WALL    627.00
1060 ANCHOR    657.00    F    6.67E+04    4.00E+04    4.00E+04     3.15E+04  1.0
1062 ANCHOR    633.00    R
1063 ANCHOR    630.00    R
1064 ANCHOR    627.00    R
1070 SURFACE RIGHTSIDE    1
1080        .00     668.00
1090 SURFACE  LEFTSIDE    1
1100        .00     643.00
1110 SOIL RIGHTSIDE  STRENGTH    4
1130   129.00  114.00 32.0     .00   .0    .00    34.8    34.8   656.80    0.00
1135   136.00  110.00 28.0     .00   .0    .00     3.5     3.5   655.10    0.00
1138   124.00  114.00 32.0     .00   .0    .00     3.5     3.5   633.00    0.00
1139   125.00  125.00 40.0   50.00   .0     .00     0.1     0.1
1140 SOIL  LEFTSIDE  STRENGTH    2
1155   124.00  114.00 32.0     .00   .0    .00     3.5     3.5   633.00    0.00
1160   125.00  125.00 40.0   50.00   .0     .00     0.1     0.1
1170 WATER ELEVATIONS     62.50  668.00  645.00
1180 H D 12 666. 0. 664. 5.48 660. 31.64
1181 658.5 38.46 657.5 41.08
1182 656. 42.32 654.5 41.04
1183 646. 20.74 642.5 14.46
1184 639. 10.1 635. 6.82 631. 4.68
1190 FINISH
```

'ISLAND CREEK LPP, LOGAN, WV
'BAISDEN - LC 1 - CRITICAL



***** INPUT GEOMETRY *****
DATE: 28-AUG-1993 TIME: 10.46.46

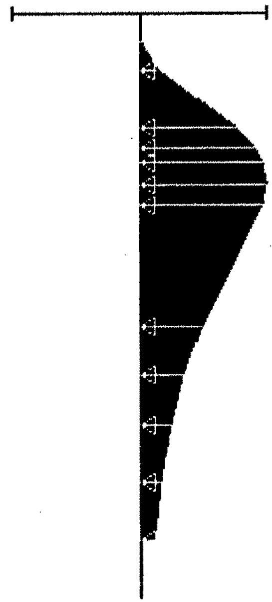
'ISLAND CREEK LPP, LOGAN, WV
'BAISDEN - LC 1 - CRITICAL

ELEV. (FT)

DIST. LOADS (PSF)

42 42

668.0

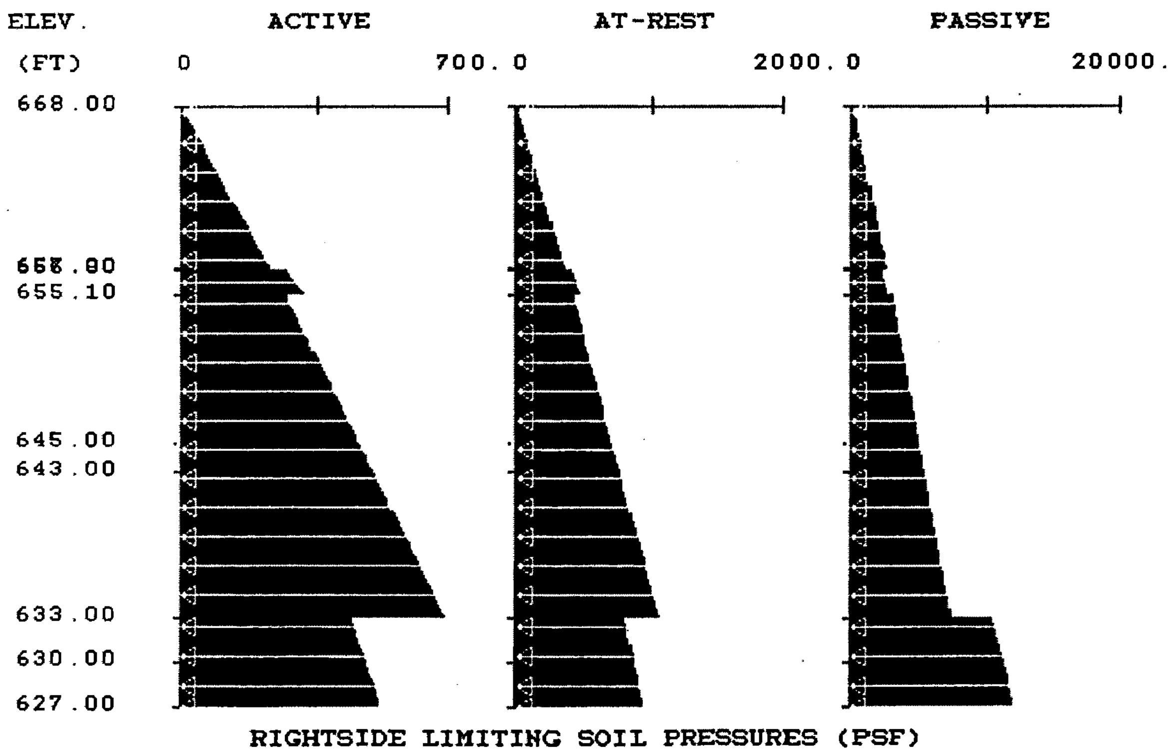


627.0

***** INPUT HORIZONTAL LOADS *****

DATE: 28-AUG-1993 TIME: 10.48.03

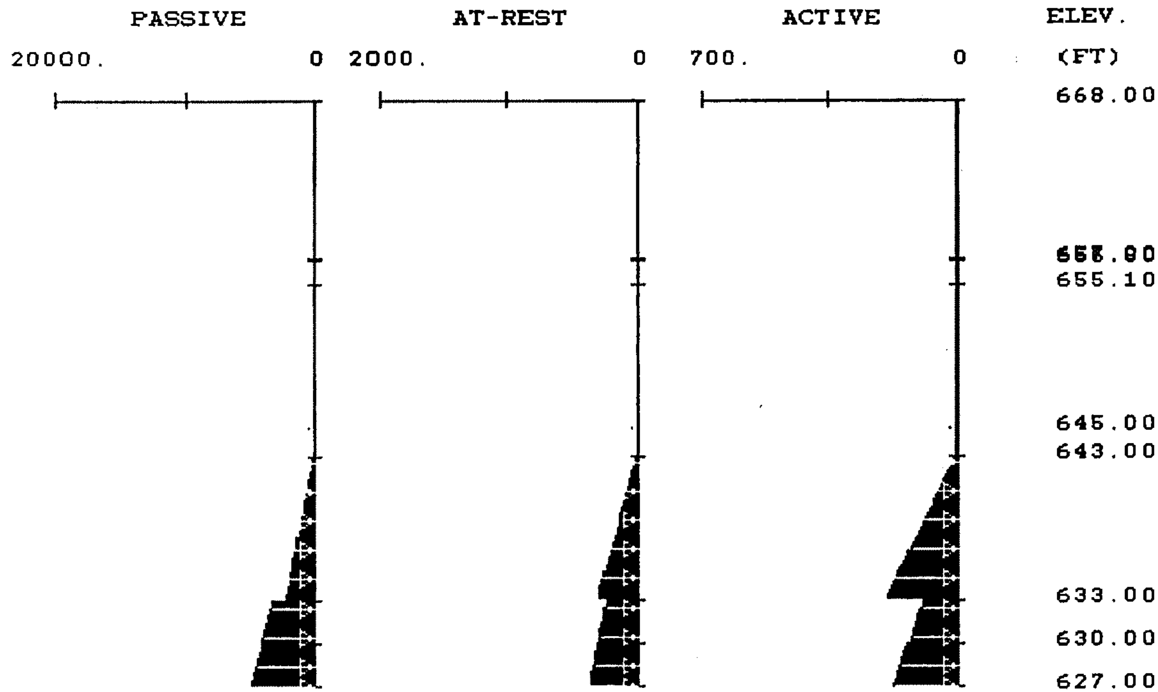
'ISLAND CREEK LPP, LOGAN, WV
'BAISDEN - LC 1 - CRITICAL



A-I-143

'ISLAND CREEK LPP, LOGAN, WV

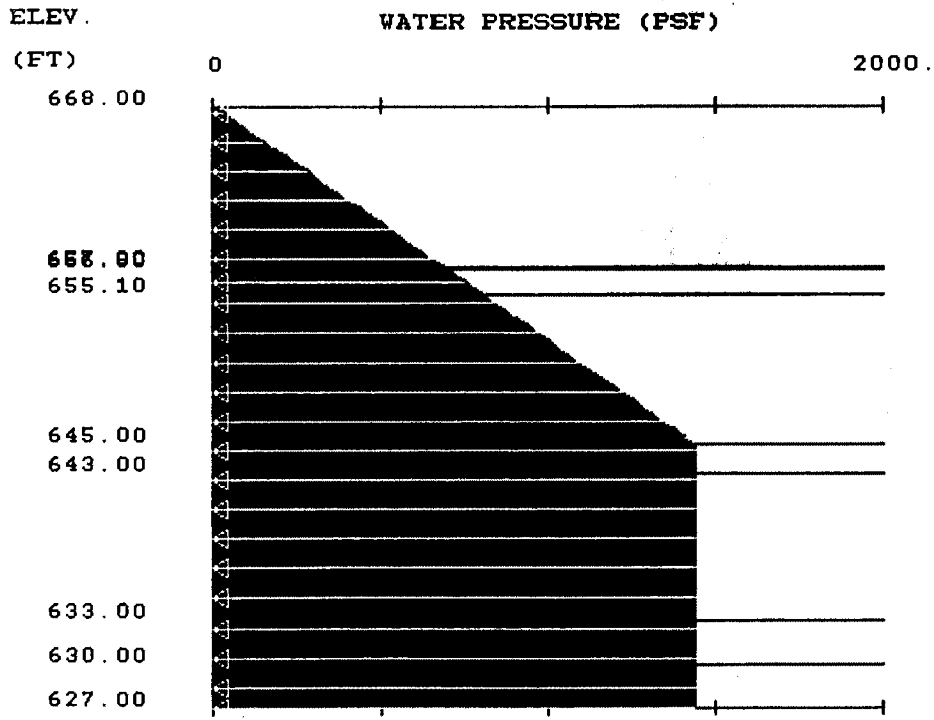
'BAISDEN - LC 1 - CRITICAL



LEFTSIDE LIMITING SOIL PRESSURES (PSF)

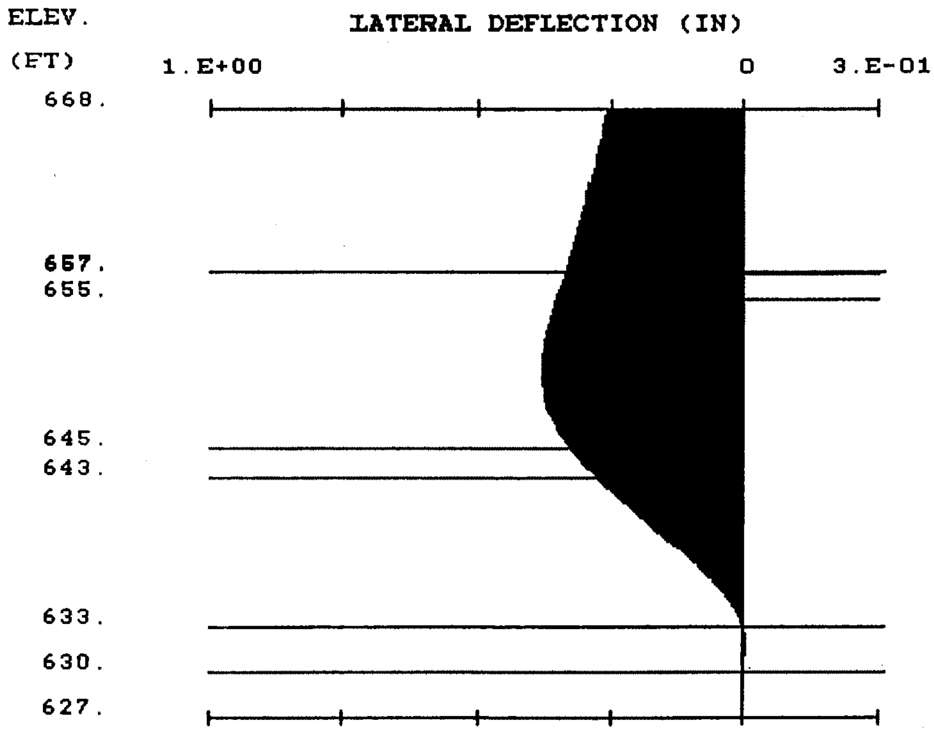
A-I-144

'ISLAND CREEK LPP, LOGAN, WV
'BAISDEN - LC 1 - CRITICAL



'ISLAND CREEK LPP, LOGAN, WV

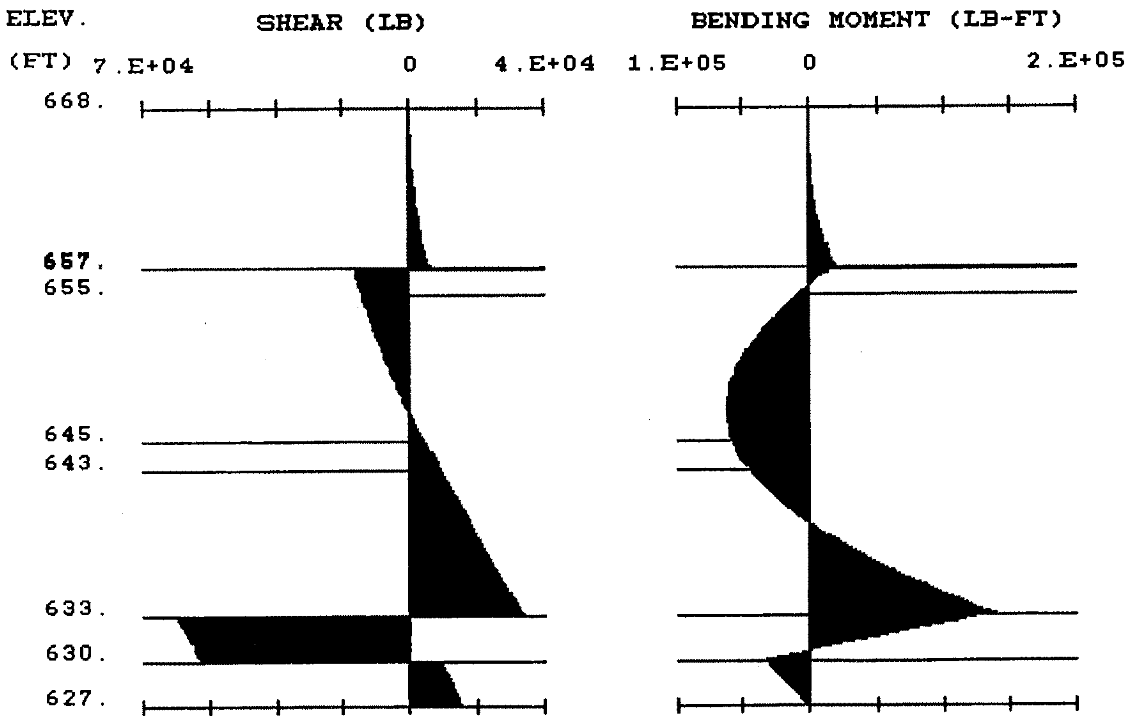
'BAISDEN - LC 1 - CRITICAL



A-T-146

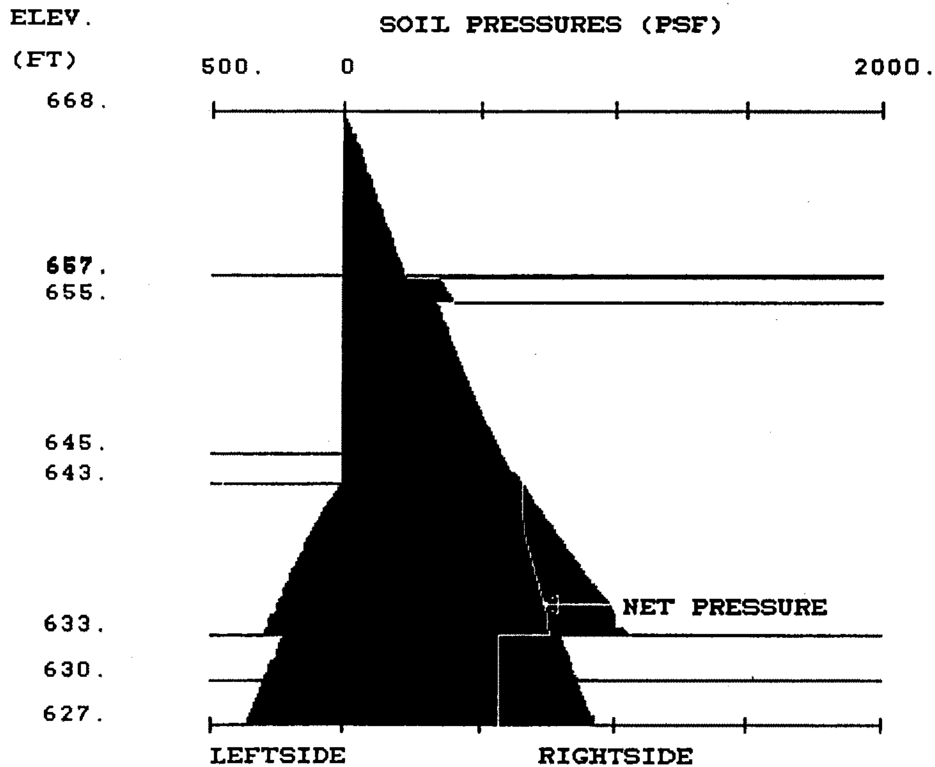
'ISLAND CREEK LPP, LOGAN, WV

'BAISDEN - LC 1 - CRITICAL



A-T 147

'ISLAND CREEK LPP, LOGAN, WV
'BAISDEN - LC 1 - CRITICAL



PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 28-AUG-1993 TIME: 10.46.23

INPUT DATA

I.--HEADING:
'ISLAND CREEK LPP, LOGAN, WV

'BAISDEN - LC 1 - CRITICAL

'WALL HEIGHT = 26', W14 X 370 POST

'ONE ANCHOR, 6' C TO C SPACING

II.--WALL SEGMENT DATA

ELEVATION AT TOP OF SEGMENT (FT)	MODULUS OF ELASTICICTY (PSI)	MOMENT OF INERTIA (IN**4)	CROSS SECTION AREA (SQIN)
668.00	2.900E+07	907.00	18.17

ELEVATION AT BOTTOM OF WALL = 627.00 (FT).

III.--ANCHOR DATA

ELEVATION AT WALL (FT)	ANCHOR TYPE ('R/F')	ULTIMATE TENSION FORCE (LB)	PRE-STRESS FORCE (LB)	ULTIMATE COMPRESSION FORCE (LB)	ANCHOR STIFFNESS (LB/IN)	ANCHOR SLOPE (FT)
657.00	FLEXIBLE	6.67E+04	4.00E+04	4.00E+04	3.150E+04	1.00
633.00	RIGID					
630.00	RIGID					
627.00	RIGID					

IV.--SURFACE POINT DATA

IV.A.--RIGHTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	668.00

IV.B.-- LEFTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	643.00

V.--SOIL LAYER DATA

V.A.--RIGHTSIDE LAYER DATA

<UNIT WEIGHT> SAT. (PCF)	MOIST (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	WALL ADH-ESION (PSF)	<STIFF. COEF.> ACT. (PCI)	PASS. (PCI)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT)
129.00	114.00	32.00	.00	.00	.00	34.80	34.80	656.80	.00
136.00	110.00	28.00	.00	.00	.00	3.50	3.50	655.10	.00
124.00	114.00	32.00	.00	.00	.00	3.50	3.50	633.00	.00
125.00	125.00	40.00	50.00	.00	.00	.10	.10		

V.B.-- LEFTSIDE LAYER DATA

<UNIT WEIGHT>	ANGLE OF INTERNAL	COH-	ANGLE OF WALL	WALL ADH-	<STIFF. COEF.>	<--BOTTOM-->

SAT . (PCF)	MOIST (PCF)	FRICTION (DEG)	ESION (PSF)	FRICTION (DEG)	ESION (PSF)	ACT. (PCI)	PASS. (PCI)	ELEV. (FT)	SLOPE (FT)
124.00	114.00	32.00	.00	.00	.00	3.50	3.50	633.00	.00
125.00	125.00	40.00	50.00	.00	.00	.10	.10		

VI.--INTERACTION ZONE DATA
NONE

VII.--WATER DATA

UNIT WEIGHT = 62.50 (PCF)
RIGHTSIDE ELEVATION = 668.00 (FT)
LEFTSIDE ELEVATION = 645.00 (FT)
NO SEEPAGE

VIII.--SURFACE LOADS
NONE

IX.--HORIZONTAL LOADS
IX.A.--EARTHQUAKE ACCELERATION = .00 (G'S)
IX.B.--HORIZONTAL LINE LOADS
NONE
X.C.--HORIZONTAL DISTRIBUTED LOADS

ELEVATION (FT)	DIST. LOAD (PSF)
666.00	.00
664.00	5.48
660.00	31.64
658.50	38.46
657.50	41.08
656.00	42.32
654.50	41.04
646.00	20.74
642.50	14.46
639.00	10.10
635.00	6.82
631.00	4.68

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 28-AUG-1993 TIME: 10.52.05

SUMMARY OF RESULTS

I.A.--MAXIMA

		MAXIMUM	MINIMUM
BENDING MOMENT (LB-FT)	:	1.399E+05	-6.120E+04
AT ELEVATION (FT)	:	633.00	647.00
DEFLECTION (IN)	:	3.774E-01	-4.030E-03
AT ELEVATION (FT)	:	650.50	632.00
RIGHTSIDE SOIL PRESSURE (PSF)	:	1047.76	
AT ELEVATION (FT)	:	633.00	
LEFTSIDE SOIL PRESSURE (PSF)	:	353.64	
AT ELEVATION (FT)	:	627.00	

I.B.--ANCHOR FORCES

ELEVATION AT ANCHOR (FT)	ANCHOR TYPE	ANCHOR DEFORMATION (IN)	ANCHOR FORCE (LB)
657.00	FLEXIBLE	.24	30428.34

633.00	RIGID	.00	89949.41
630.00	RIGID	.00	-62405.34
627.00	RIGID	.00	13925.21

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 28-AUG-1993 TIME: 10.52.05

COMPLETE RESULTS

II.A.--WALL DEFLECTIONS AND FORCES

	<------DEFLECTION----->		<--WALL	INTERNAL	FORCES->
ELEVATION (FT)	AXIAL (IN)	LATERAL (IN)	AXIAL (LB)	SHEAR (LB)	MOMENT (LB-FT)
668.00	-1.354E-02	2.549E-01	0.	0.	0.
667.50	-1.354E-02	2.579E-01	0.	10.	2.
667.00	-1.354E-02	2.609E-01	0.	41.	14.
666.50	-1.354E-02	2.639E-01	0.	93.	47.
666.00	-1.354E-02	2.669E-01	0.	166.	111.
665.50	-1.354E-02	2.699E-01	0.	260.	216.
665.00	-1.354E-02	2.729E-01	0.	375.	374.
664.50	-1.354E-02	2.759E-01	0.	511.	594.
664.00	-1.354E-02	2.789E-01	0.	669.	888.
663.50	-1.354E-02	2.820E-01	0.	849.	1267.
663.00	-1.354E-02	2.850E-01	0.	1051.	1741.
662.50	-1.354E-02	2.881E-01	0.	1275.	2321.
662.00	-1.354E-02	2.912E-01	0.	1522.	3020.
661.50	-1.354E-02	2.944E-01	0.	1792.	3847.
661.00	-1.354E-02	2.977E-01	0.	2083.	4815.
660.50	-1.354E-02	3.010E-01	0.	2397.	5934.
660.00	-1.354E-02	3.044E-01	0.	2734.	7216.
659.50	-1.354E-02	3.079E-01	0.	3092.	8672.
659.00	-1.354E-02	3.116E-01	0.	3472.	10312.
658.50	-1.354E-02	3.154E-01	0.	3875.	12148.
658.00	-1.354E-02	3.195E-01	0.	4298.	14190.
657.50	-1.354E-02	3.238E-01	0.	4744.	16450.
657.00+	-1.354E-02	3.283E-01	0.	5210.	18937.
657.00-	-1.354E-02	3.283E-01	-19812.	-14602.	18937.
656.80+	-1.345E-02	3.302E-01	-19812.	-14410.	16036.
656.80-	-1.345E-02	3.302E-01	-19812.	-14410.	16036.
656.50	-1.331E-02	3.331E-01	-19812.	-14079.	11763.
656.00	-1.308E-02	3.382E-01	-19812.	-13508.	4865.
655.50	-1.286E-02	3.433E-01	-19812.	-12914.	-1741.
655.10+	-1.268E-02	3.473E-01	-19812.	-12421.	-6809.
655.10-	-1.268E-02	3.473E-01	-19812.	-12421.	-6809.
655.00	-1.263E-02	3.484E-01	-19812.	-12302.	-8045.
654.50	-1.241E-02	3.533E-01	-19812.	-11694.	-14045.
654.00	-1.218E-02	3.580E-01	-19812.	-11066.	-19736.
653.50	-1.196E-02	3.624E-01	-19812.	-10418.	-25108.
653.00	-1.173E-02	3.664E-01	-19812.	-9748.	-30150.
652.50	-1.151E-02	3.699E-01	-19812.	-9059.	-34853.
652.00	-1.128E-02	3.728E-01	-19812.	-8348.	-39205.
651.50	-1.105E-02	3.751E-01	-19812.	-7618.	-43198.
651.00	-1.083E-02	3.766E-01	-19812.	-6866.	-46820.
650.50	-1.060E-02	3.774E-01	-19812.	-6094.	-50061.
650.00	-1.038E-02	3.774E-01	-19812.	-5301.	-52910.
649.50	-1.015E-02	3.765E-01	-19812.	-4487.	-55358.
649.00	-9.926E-03	3.747E-01	-19812.	-3652.	-57394.
648.50	-9.701E-03	3.719E-01	-19812.	-2796.	-59006.
648.00	-9.475E-03	3.682E-01	-19812.	-1918.	-60186.
647.50	-9.249E-03	3.635E-01	-19812.	-1018.	-60921.
647.00	-9.024E-03	3.578E-01	-19812.	-97.	-61201.

646.50	-8.798E-03	3.511E-01	-19812.	846.	-61014.
646.00	-8.573E-03	3.434E-01	-19812.	1811.	-60351.
645.50	-8.347E-03	3.347E-01	-19812.	2799.	-59200.
645.00	-8.121E-03	3.250E-01	-19812.	3809.	-57549.
644.50	-7.896E-03	3.144E-01	-19812.	4835.	-55388.
644.00	-7.670E-03	3.029E-01	-19812.	5868.	-52713.
643.50	-7.445E-03	2.905E-01	-19812.	6909.	-49519.
643.00	-7.219E-03	2.773E-01	-19812.	7958.	-45803.
642.50	-6.993E-03	2.634E-01	-19812.	9011.	-41560.
642.00	-6.768E-03	2.487E-01	-19812.	10064.	-36792.
641.50	-6.542E-03	2.335E-01	-19812.	11116.	-31497.
641.00	-6.317E-03	2.177E-01	-19812.	12169.	-25676.
640.50	-6.091E-03	2.015E-01	-19812.	13223.	-19328.
640.00	-5.865E-03	1.851E-01	-19812.	14278.	-12453.
639.50	-5.640E-03	1.684E-01	-19812.	15335.	-5050.
639.00	-5.414E-03	1.516E-01	-19812.	16394.	2882.
638.50	-5.189E-03	1.348E-01	-19812.	17456.	11345.
638.00	-4.963E-03	1.183E-01	-19812.	18521.	20339.
637.50	-4.738E-03	1.021E-01	-19812.	19590.	29866.
637.00	-4.512E-03	8.637E-02	-19812.	20662.	39929.
636.50	-4.286E-03	7.131E-02	-19812.	21738.	50529.
636.00	-4.061E-03	5.708E-02	-19812.	22818.	61668.
635.50	-3.835E-03	4.386E-02	-19812.	23902.	73348.
635.00	-3.610E-03	3.185E-02	-19812.	24990.	85570.
634.50	-3.384E-03	2.124E-02	-19812.	26081.	98338.
634.00	-3.158E-03	1.225E-02	-19812.	27176.	111652.
633.50	-2.933E-03	5.094E-03	-19812.	28274.	125514.
633.00+	-2.707E-03	0.000E+00	-19812.	29374.	139926.
633.00-	-2.707E-03	0.000E+00	-19812.	-60576.	139926.
632.50	-2.482E-03	-2.918E-03	-19812.	-59566.	109891.
632.00	-2.256E-03	-4.030E-03	-19812.	-58556.	80361.
631.50	-2.030E-03	-3.822E-03	-19812.	-57546.	51335.
631.00	-1.805E-03	-2.770E-03	-19812.	-56536.	22815.
630.50	-1.579E-03	-1.343E-03	-19812.	-55529.	-5201.
630.00+	-1.354E-03	0.000E+00	-19812.	-54521.	-32714.
630.00-	-1.354E-03	0.000E+00	-19812.	7884.	-32714.
629.50	-1.128E-03	8.915E-04	-19812.	8891.	-28520.
629.00	-9.024E-04	1.315E-03	-19812.	9898.	-23823.
628.50	-6.768E-04	1.348E-03	-19812.	10905.	-18622.
628.00	-4.512E-04	1.076E-03	-19812.	11911.	-12918.
627.50	-2.256E-04	5.930E-04	-19812.	12918.	-6711.
627.00	0.000E+00	0.000E+00	-19812.	13925.	0.

II.B.--SOIL PRESSURES

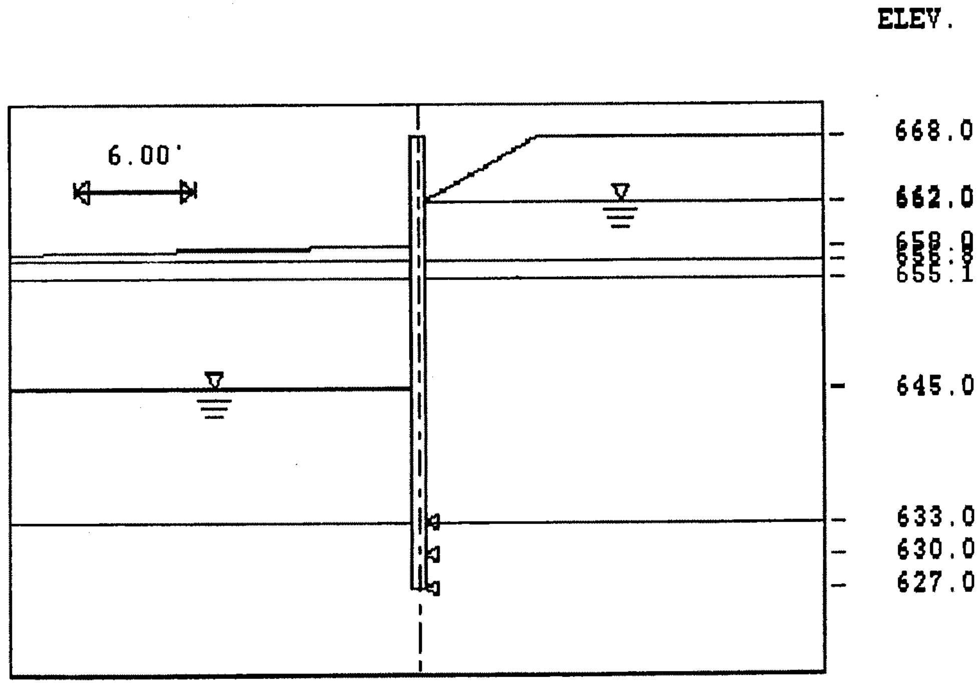
ELEVATION (FT)	<---------SOIL PRESSURES (PSF)--------> LEFTSIDE	RIGHTSIDE	NET
668.00	.00	.00	.00
667.50	.00	10.22	10.22
667.00	.00	20.43	20.43
666.50	.00	30.65	30.65
666.00	.00	40.87	40.87
665.50	.00	51.08	51.08
665.00	.00	61.30	61.30
664.50	.00	71.51	71.51
664.00	.00	81.73	81.73
663.50	.00	91.95	91.95
663.00	.00	102.16	102.16
662.50	.00	112.38	112.38
662.00	.00	122.60	122.60
661.50	.00	132.81	132.81
661.00	.00	143.03	143.03
660.50	.00	153.25	153.25
660.00	.00	163.46	163.46

659.50	.00	173.68	173.68
659.00	.00	183.89	183.89
658.50	.00	194.11	194.11
658.00	.00	204.33	204.33
657.50	.00	214.54	214.54
657.00+	.00	224.76	224.76
657.00-	.00	224.76	224.76
656.80+	.00	228.85	228.85
656.80-	.00	346.95	346.95
656.50	.00	356.78	356.78
656.00	.00	373.09	373.09
655.50	.00	389.31	389.31
655.10+	.00	402.24	402.24
655.10-	.00	338.12	338.12
655.00	.00	340.30	340.30
654.50	.00	351.20	351.20
654.00	.00	362.07	362.07
653.50	.00	372.95	372.95
653.00	.00	383.87	383.87
652.50	.00	394.84	394.84
652.00	.00	405.91	405.91
651.50	.00	417.10	417.10
651.00	.00	428.45	428.45
650.50	.00	439.98	439.98
650.00	.00	451.72	451.72
649.50	.00	463.71	463.71
649.00	.00	475.98	475.98
648.50	.00	488.56	488.56
648.00	.00	501.47	501.47
647.50	.00	514.75	514.75
647.00	.00	528.42	528.42
646.50	.00	542.49	542.49
646.00	.00	557.00	557.00
645.50	.00	571.95	571.95
645.00	.00	587.38	587.38
644.50	.00	603.27	603.27
644.00	.00	619.65	619.65
643.50	.00	636.52	636.52
643.00	.00	653.87	653.87
642.50	18.60	671.70	653.10
642.00	36.74	690.00	653.26
641.50	54.40	708.76	654.36
641.00	71.54	727.94	656.40
640.50	88.15	747.52	659.37
640.00	104.22	767.47	663.25
639.50	119.75	787.74	668.00
639.00	134.74	808.29	673.56
638.50	149.21	829.06	679.86
638.00	163.18	849.99	686.81
637.50	176.69	871.00	694.31
637.00	189.78	892.02	702.24
636.50	202.52	912.96	710.44
636.00	214.96	933.71	718.76
635.50	227.19	954.18	726.99
635.00	239.30	974.24	734.94
634.50	251.42	993.77	742.35
634.00	263.66	1012.64	748.97
633.50	276.17	1030.69	754.52
633.00+	289.10	1047.76	758.66
633.00-	219.69	796.19	576.51
632.50	230.70	807.86	577.16
632.00	241.80	819.23	577.42
631.50	252.97	830.36	577.39
631.00	264.18	841.34	577.16

630.50	275.42	852.25	576.83
630.00+	286.66	863.17	576.51
630.00-	286.66	863.17	576.51
629.50	297.88	874.16	576.28
629.00	309.08	885.24	576.17
628.50	320.24	896.40	576.15
628.00	331.39	907.61	576.22
627.50	342.52	918.87	576.34
627.00	353.64	930.15	576.51

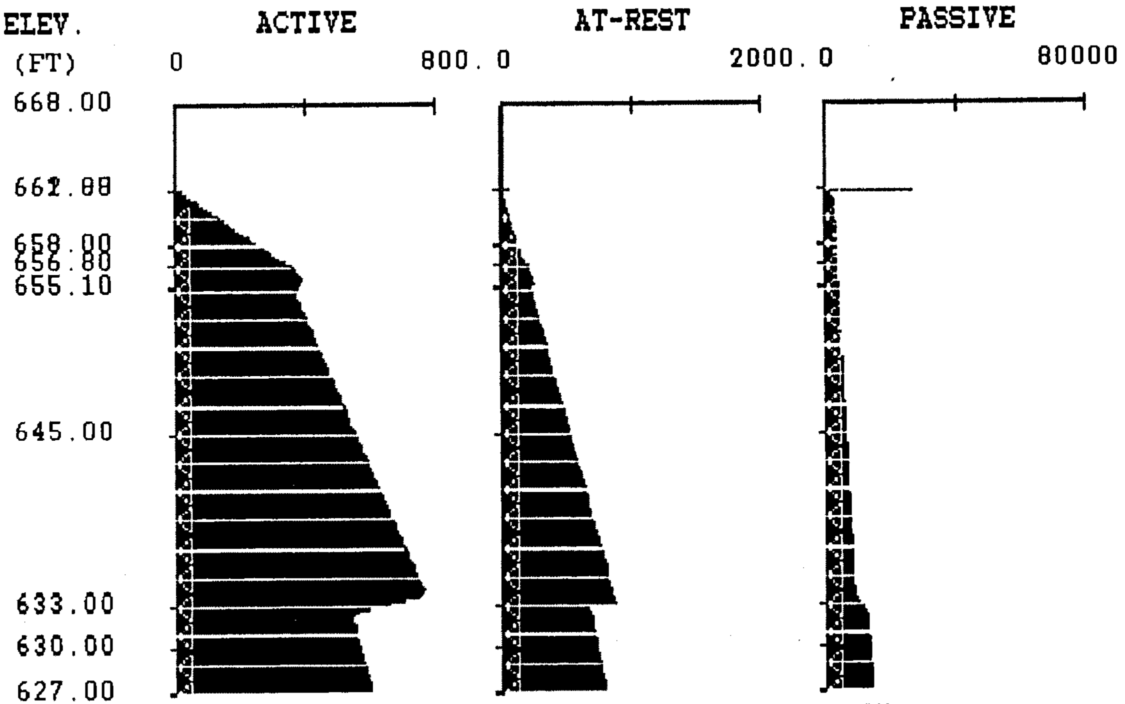
```
1000  'ISLAND   CREEK  LPP,  LOGAN,   WV
1010  'BAISDEN-    L.C.4   -  CONSTRUCTION
1020  'WALL   HEIGHT   =  26',  W14  X  370  POST
1030  'ONE   ANCHOR,   6'  C  TO  C  SPACING
1040  WALL      668.00       2.900E+07        9.070E+02        18.17E+00
1050  WALL     627.00
1062  ANCHOR       633.00       R
1063  ANCHOR       630.00       R
1064  ANCHOR       627.00       R
1070  SURFACE   RIGHTSIDE        2
1080            .00       662.00     6.0    668.00
1090  SURFACE     LEFTSIDE       2
1100            .00      658.00     25.0    657.00
1110  SOIL   RIGHTSIDE       STRENGTH        5
1130     129.00     114.00    32.0        .00      .0       .00      58.0     58.0     661.95       0.00
1131     129.00     114.00    32.0        .00      .0       .00      34.8     34.8     656.80       0.00
1135     136.00     110.00    28.0        .00      .0       .00       3.5      3.5     655.10       0.00
1138     124.00     114.00    32.0        .00      .0       .00       3.5      3.5     633.00       0.00
1139     125.00     125.00    40.0     50.00      .0       .00       0.1      0.1
1140  SOIL    LEFTSIDE       STRENGTH        5
1145     129.00     114.00    32.0        .00      .0       .00      58.0     58.0     656.80       0.00
1150     136.00     110.00    28.0        .00      .0       .00       5.8      5.8     655.10       0.00
1153     124.00     114.00    32.0        .00      .0       .00       5.8      5.8     645.00       0.00
1155     124.00     114.00    32.0        .00      .0       .00       3.5      3.5     633.00       0.00
1160     125.00     125.00    40.0     50.00      .0       .00       0.1      0.1
1170  WATER   ELEVATIONS          62.50     662.00     645.00
1190  FINISH
```

'ISLAND CREEK LPP, LOGAN, WV
'BAISDEN- L.C.4 - CONSTRUCTION



***** INPUT GEOMETRY *****
DATE: 28-AUG-1993 TIME: 13.32.11

'ISLAND CREEK LPP, LOGAN, WV
'BAISDEN- L.C.4 - CONSTRUCTION

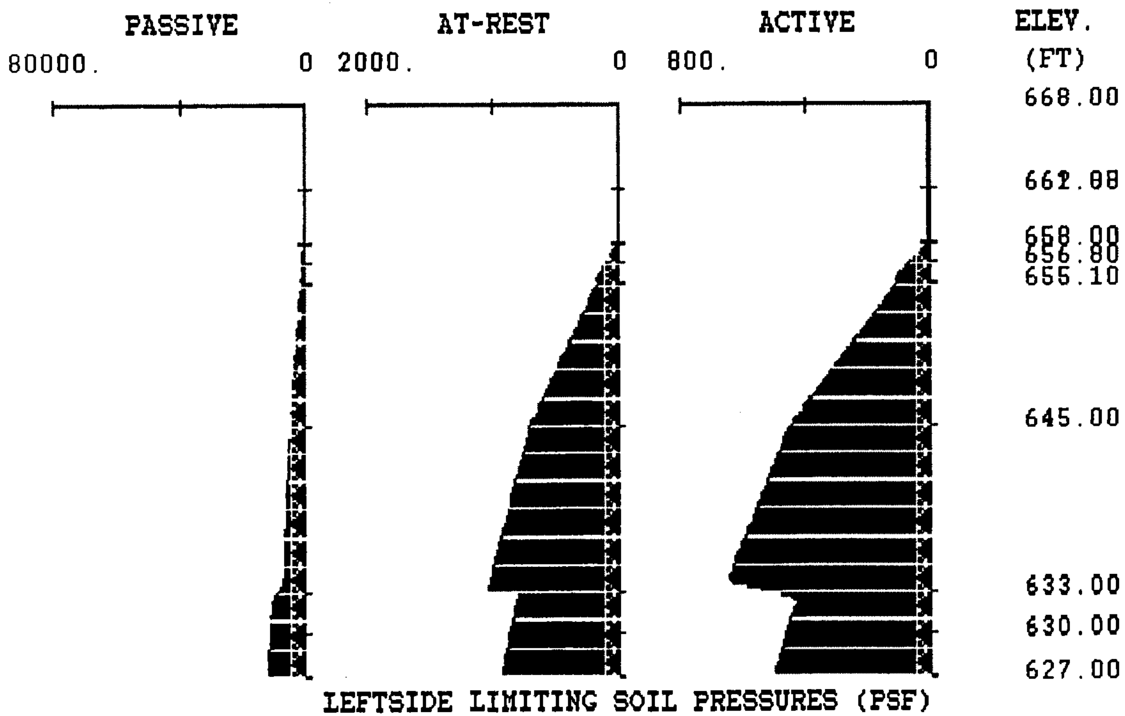


RIGHTSIDE LIMITING SOIL PRESSURES (PSF)

A-I-156

A-T-157

'ISLAND CREEK LPP, LOGAN, WV
'BAISDEN- L.C.4 - CONSTRUCTION



A-I-158

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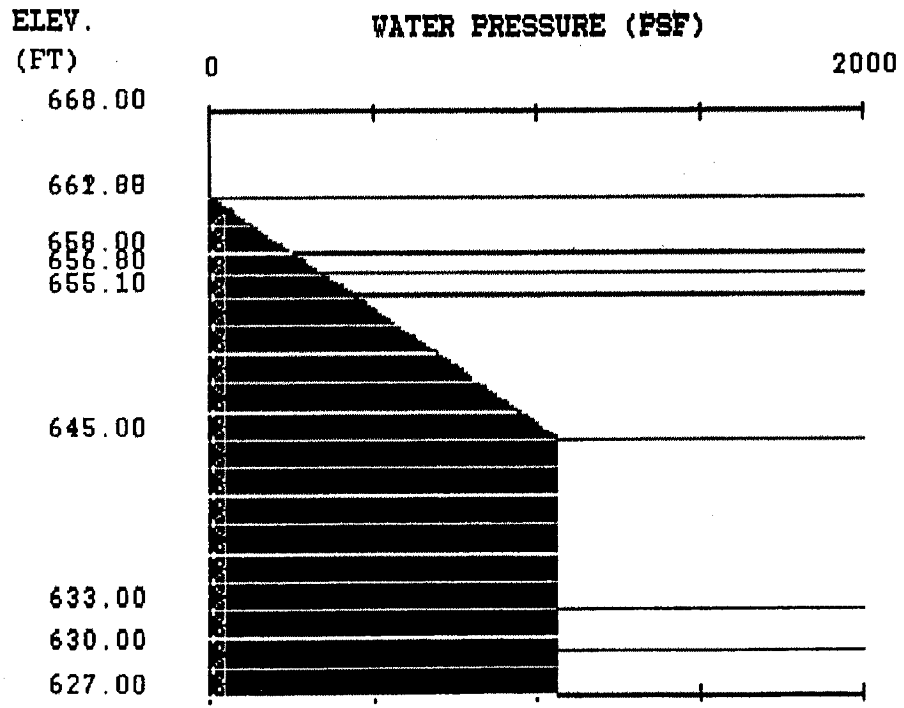

A-I- 159

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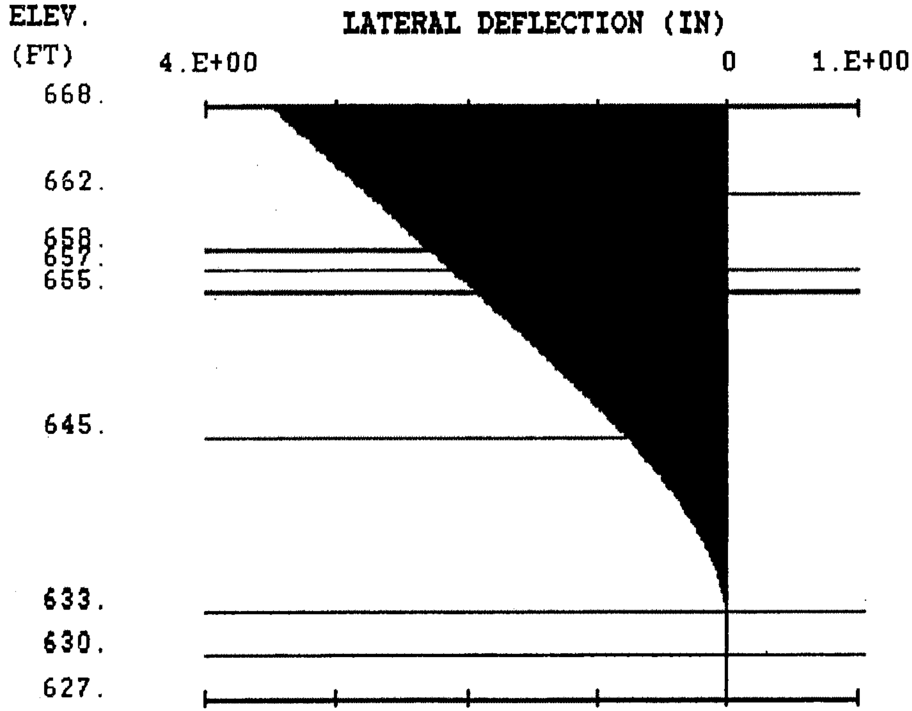
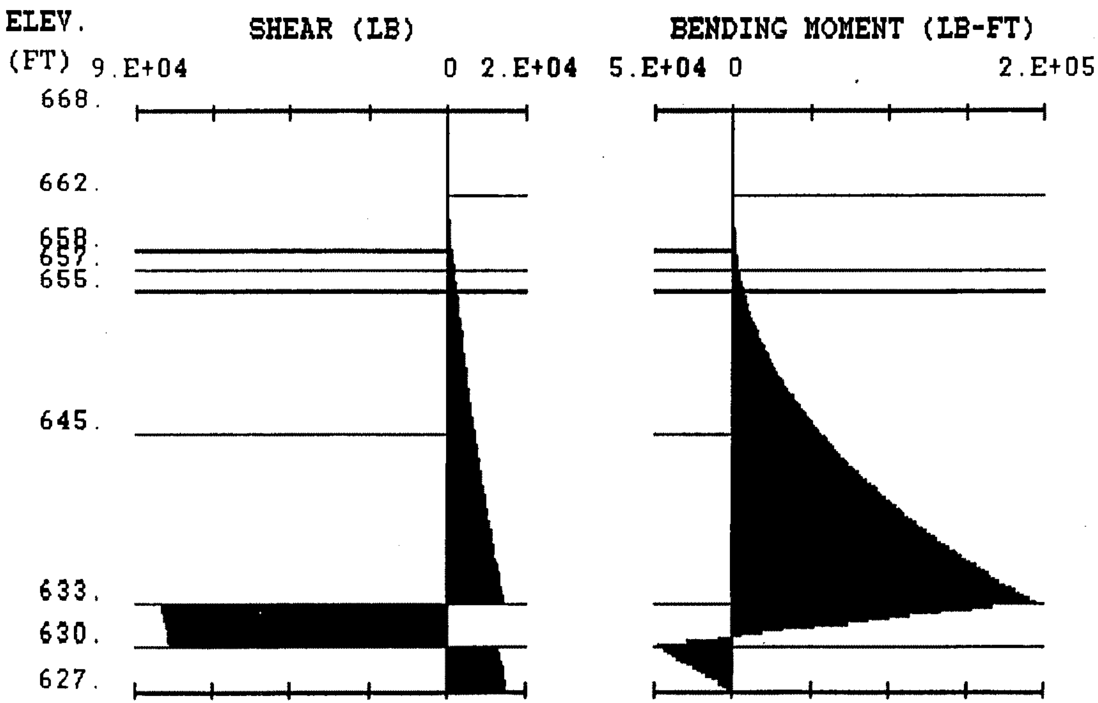


A-I-160

'ISLAND CREEK LPP, LOGAN, WV
'BAISDEN- L.C.4 - CONSTRUCTION



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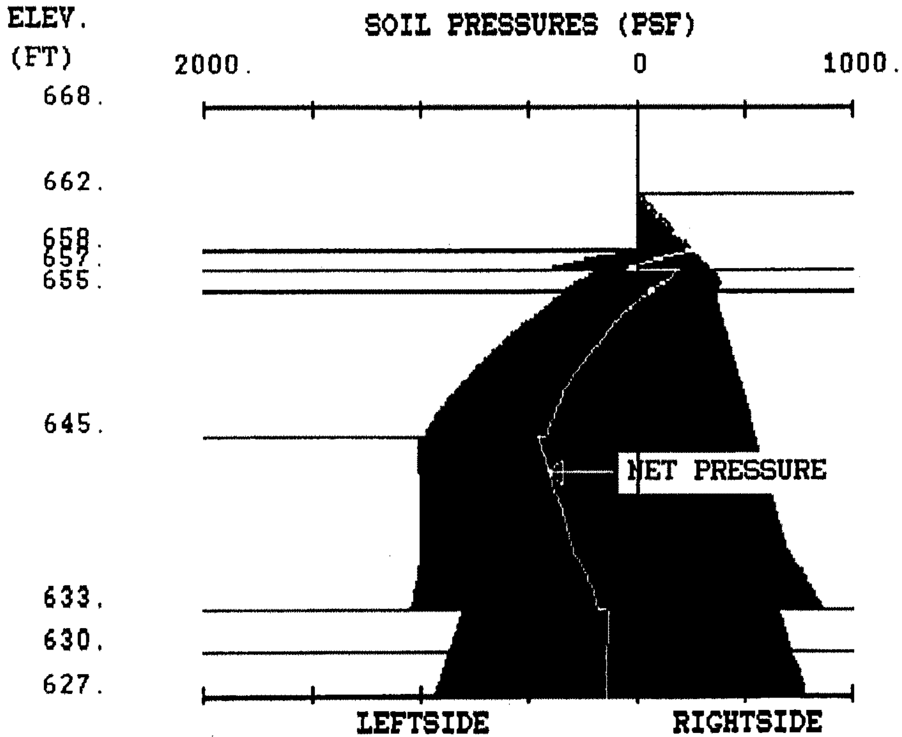
'BAISDEN- L.C.4 - CONSTRUCTION



A-H 161

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 28-AUG-1993 TIME: 13.31.50

INPUT DATA

I.--HEADING:

'ISLAND CREEK LPP, LOGAN, WV

'BAISDEN- L.C.4 - CONSTRUCTION

'WALL HEIGHT = 26', W14 X 370 POST

'ONE ANCHOR, 6' C TO C SPACING

II.--WALL SEGMENT DATA

ELEVATION AT TOP OF SEGMENT (FT)	MODULUS OF ELASTICICTY (PSI)	MOMENT OF INERTIA (IN**4)	CROSS SECTION AREA (SQIN)
668.00	2.900E+07	907.00	18.17

ELEVATION AT BOTTOM OF WALL = 627.00 (FT).

III.--ANCHOR DATA

ELEVATION AT WALL (FT)	ANCHOR TYPE ('R/F')	ULTIMATE TENSION FORCE (LB)	PRE-STRESS FORCE (LB)	ULTIMATE COMPRESSION FORCE (LB)	ANCHOR STIFFNESS (LB/IN)	ANCHOR SLOPE (FT)
633.00	RIGID					
630.00	RIGID					
627.00	RIGID					

IV.--SURFACE POINT DATA

IV.A.--RIGHTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	662.00
6.00	668.00

IV.B.-- LEFTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	658.00
25.00	657.00

V.--SOIL LAYER DATA

V.A.--RIGHTSIDE LAYER DATA

<UNIT WEIGHT> SAT. (PCF)	MOIST (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	WALL ADH-ESION (PSF)	<STIFF. COEF.> ACT. (PCI)	PASS. (PCI)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT)
129.00	114.00	32.00	.00	.00	.00	58.00	58.00	661.95	.00
129.00	114.00	32.00	.00	.00	.00	34.80	34.80	656.80	.00
136.00	110.00	28.00	.00	.00	.00	3.50	3.50	655.10	.00
124.00	114.00	32.00	.00	.00	.00	3.50	3.50	633.00	.00
125.00	125.00	40.00	50.00	.00	.00	.10	.10		

V.B.-- LEFTSIDE LAYER DATA

<UNIT WEIGHT>		ANGLE OF INTERNAL	COH-	ANGLE OF WALL	WALL ADH-	<STIFF. COEF.>		<--BOTTOM-->	

SAT. (PCF)	MOIST (PCF)	FRICTION (DEG)	ESION (PSF)	FRICTION (DEG)	ESION (PSF)	ACT. (PCI)	PASS. (PCI)	ELEV. (FT)	SLOPE (FT)
129.00	114.00	32.00	.00	.00	.00	58.00	58.00	656.80	.00
136.00	110.00	28.00	.00	.00	.00	5.80	5.80	655.10	.00
124.00	114.00	32.00	.00	.00	.00	5.80	5.80	645.00	.00
124.00	114.00	32.00	.00	.00	.00	3.50	3.50	633.00	.00
125.00	125.00	40.00	50.00	.00	.00	.10	.10		

VI.--INTERACTION ZONE DATA
NONE

VII.--WATER DATA

UNIT WEIGHT = 62.50 (PCF)
RIGHTSIDE ELEVATION = 662.00 (FT)
LEFTSIDE ELEVATION = 645.00 (FT)
NO SEEPAGE

VIII.--SURFACE LOADS
NONE

IX.--HORIZONTAL LOADS
NONE

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 28-AUG-1993 TIME: 13.34.38

SUMMARY OF RESULTS

I.A.--MAXIMA

		MAXIMUM	MINIMUM
BENDING MOMENT (LB-FT)	:	1.949E+05	-4.767E+04
AT ELEVATION (FT)	:	633.00	630.00
DEFLECTION (IN)	:	3.500E+00	-5.664E-03
AT ELEVATION (FT)	:	668.00	632.00
RIGHTSIDE SOIL PRESSURE (PSF)	:	860.20	
AT ELEVATION (FT)	:	633.00	
LEFTSIDE SOIL PRESSURE (PSF)	:	1040.38	
AT ELEVATION (FT)	:	633.00	

I.B.--ANCHOR FORCES

ELEVATION AT ANCHOR (FT)	ANCHOR TYPE	ANCHOR DEFORMATION (IN)	ANCHOR FORCE (LB)
633.00	RIGID	.00	98594.07
630.00	RIGID	.00	-93954.33
627.00	RIGID	.00	17278.26

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 28-AUG-1993 TIME: 13.34.38

COMPLETE RESULTS

II.A.--WALL DEFLECTIONS AND FORCES

	<------DEFLECTION----->		<--WALL INTERNAL FORCES-->		
ELEVATION (FT)	AXIAL (IN)	LATERAL (IN)	AXIAL (LB)	SHEAR (LB)	MOMENT (LB-FT)

668.00	0.000E+00	3.500E+00	0.	0.	0.
667.50	0.000E+00	3.440E+00	0.	0.	0.
667.00	0.000E+00	3.380E+00	0.	0.	0.
666.50	0.000E+00	3.319E+00	0.	0.	0.
666.00	0.000E+00	3.259E+00	0.	0.	0.
665.50	0.000E+00	3.199E+00	0.	0.	0.
665.00	0.000E+00	3.138E+00	0.	0.	0.
664.50	0.000E+00	3.078E+00	0.	0.	0.
664.00	0.000E+00	3.017E+00	0.	0.	0.
663.50	0.000E+00	2.957E+00	0.	0.	0.
663.00	0.000E+00	2.897E+00	0.	0.	0.
662.50	0.000E+00	2.836E+00	0.	0.	0.
662.00+	0.000E+00	2.776E+00	0.	0.	0.
662.00-	0.000E+00	2.776E+00	0.	0.	0.
661.95+	0.000E+00	2.770E+00	0.	0.	0.
661.95-	0.000E+00	2.770E+00	0.	0.	0.
661.50	0.000E+00	2.716E+00	0.	16.	3.
661.00	0.000E+00	2.655E+00	0.	63.	21.
660.50	0.000E+00	2.595E+00	0.	142.	71.
660.00	0.000E+00	2.535E+00	0.	253.	169.
659.50	0.000E+00	2.474E+00	0.	395.	329.
659.00	0.000E+00	2.414E+00	0.	569.	569.
658.50	0.000E+00	2.354E+00	0.	775.	904.
658.00	0.000E+00	2.293E+00	0.	1012.	1349.
657.50	0.000E+00	2.233E+00	0.	1237.	1914.
657.00	0.000E+00	2.173E+00	0.	1410.	2578.
656.80+	0.000E+00	2.149E+00	0.	1468.	2866.
656.80-	0.000E+00	2.149E+00	0.	1468.	2866.
656.50	0.000E+00	2.112E+00	0.	1624.	3330.
656.00	0.000E+00	2.052E+00	0.	1885.	4207.
655.50	0.000E+00	1.992E+00	0.	2141.	5214.
655.10+	0.000E+00	1.944E+00	0.	2340.	6110.
655.10-	0.000E+00	1.944E+00	0.	2340.	6110.
655.00	0.000E+00	1.932E+00	0.	2391.	6347.
654.50	0.000E+00	1.872E+00	0.	2636.	7604.
654.00	0.000E+00	1.812E+00	0.	2874.	8981.
653.50	0.000E+00	1.753E+00	0.	3111.	10478.
653.00	0.000E+00	1.693E+00	0.	3346.	12092.
652.50	0.000E+00	1.634E+00	0.	3581.	13824.
652.00	0.000E+00	1.575E+00	0.	3816.	15673.
651.50	0.000E+00	1.516E+00	0.	4052.	17640.
651.00	0.000E+00	1.458E+00	0.	4290.	19725.
650.50	0.000E+00	1.399E+00	0.	4531.	21931.
650.00	0.000E+00	1.342E+00	0.	4775.	24257.
649.50	0.000E+00	1.284E+00	0.	5023.	26706.
649.00	0.000E+00	1.227E+00	0.	5275.	29280.
648.50	0.000E+00	1.171E+00	0.	5534.	31982.
648.00	0.000E+00	1.115E+00	0.	5798.	34815.
647.50	0.000E+00	1.059E+00	0.	6070.	37782.
647.00	0.000E+00	1.005E+00	0.	6349.	40886.
646.50	0.000E+00	9.505E-01	0.	6636.	44132.
646.00	0.000E+00	8.971E-01	0.	6932.	47523.
645.50	0.000E+00	8.445E-01	0.	7237.	51065.
645.00+	0.000E+00	7.928E-01	0.	7552.	54762.
645.00-	0.000E+00	7.928E-01	0.	7552.	54762.
644.50	0.000E+00	7.419E-01	0.	7857.	58614.
644.00	0.000E+00	6.920E-01	0.	8167.	62620.
643.50	0.000E+00	6.431E-01	0.	8481.	66781.
643.00	0.000E+00	5.954E-01	0.	8800.	71101.
642.50	0.000E+00	5.488E-01	0.	9124.	75582.
642.00	0.000E+00	5.034E-01	0.	9453.	80226.
641.50	0.000E+00	4.594E-01	0.	9788.	85036.
641.00	0.000E+00	4.167E-01	0.	10128.	90015.
640.50	0.000E+00	3.755E-01	0.	10473.	95165.

640.00	0.000E+00	3.359E-01	0.	10823.	100489.
639.50	0.000E+00	2.980E-01	0.	11179.	105989.
639.00	0.000E+00	2.618E-01	0.	11540.	111669.
638.50	0.000E+00	2.274E-01	0.	11906.	117530.
638.00	0.000E+00	1.949E-01	0.	12277.	123575.
637.50	0.000E+00	1.645E-01	0.	12652.	129808.
637.00	0.000E+00	1.362E-01	0.	13032.	136229.
636.50	0.000E+00	1.102E-01	0.	13418.	142841.
636.00	0.000E+00	8.646E-02	0.	13814.	149648.
635.50	0.000E+00	6.521E-02	0.	14220.	156657.
635.00	0.000E+00	4.654E-02	0.	14635.	163870.
634.50	0.000E+00	3.056E-02	0.	15058.	171293.
634.00	0.000E+00	1.739E-02	0.	15488.	178929.
633.50	0.000E+00	7.161E-03	0.	15923.	186782.
633.00+	0.000E+00	0.000E+00	0.	16362.	194853.
633.00-	0.000E+00	0.000E+00	0.	-82232.	194853.
632.50	0.000E+00	-4.096E-03	0.	-81769.	153853.
632.00	0.000E+00	-5.664E-03	0.	-81305.	113084.
631.50	0.000E+00	-5.375E-03	0.	-80841.	72548.
631.00	0.000E+00	-3.894E-03	0.	-80378.	32243.
630.50	0.000E+00	-1.883E-03	0.	-79914.	-7830.
630.00+	0.000E+00	0.000E+00	0.	-79452.	-47671.
630.00-	0.000E+00	0.000E+00	0.	14503.	-47671.
629.50	0.000E+00	1.229E-03	0.	14965.	-40304.
629.00	0.000E+00	1.796E-03	0.	15428.	-32706.
628.50	0.000E+00	1.826E-03	0.	15890.	-24876.
628.00	0.000E+00	1.448E-03	0.	16353.	-16816.
627.50	0.000E+00	7.937E-04	0.	16816.	-8523.
627.00	0.000E+00	0.000E+00	0.	17278.	0.

II.B.--SOIL PRESSURES

ELEVATION (FT)	<---------SOIL PRESSURES (PSF)--------> LEFTSIDE	RIGHTSIDE	NET
668.00	.00	.00	.00
667.50	.00	.00	.00
667.00	.00	.00	.00
666.50	.00	.00	.00
666.00	.00	.00	.00
665.50	.00	.00	.00
665.00	.00	.00	.00
664.50	.00	.00	.00
664.00	.00	.00	.00
663.50	.00	.00	.00
663.00	.00	.00	.00
662.50	.00	.00	.00
662.00+	.00	.00	.00
662.00-	.00	.00	.00
661.95+	.00	3.20	3.20
661.95-	.00	3.20	3.20
661.50	.00	32.00	32.00
661.00	.00	64.00	64.00
660.50	.00	95.99	95.99
660.00	.00	127.99	127.99
659.50	.00	159.99	159.99
659.00	.00	191.99	191.99
658.50	.00	223.99	223.99
658.00	.00	256.16	256.16
657.50	173.88	286.68	112.79
657.00	332.45	319.02	-13.42
656.80+	379.23	335.64	-43.59
656.80-	144.56	335.64	191.08
656.50	177.94	357.03	179.09

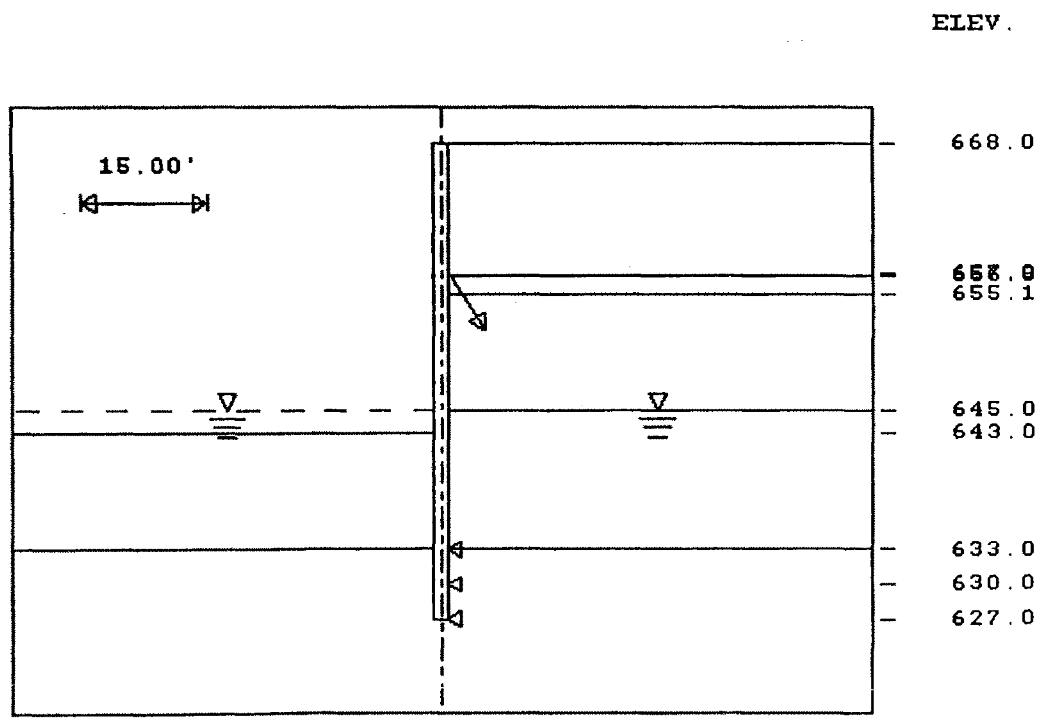
656.00	232.26	376.15	143.89
655.50	284.96	387.62	102.66
655.10+	325.97	379.08	53.11
655.10-	300.98	379.08	78.10
655.00	310.63	373.98	63.35
654.50	357.90	368.77	10.87
654.00	403.56	378.60	-24.97
653.50	447.64	388.05	-59.59
653.00	490.13	397.49	-92.63
652.50	531.04	406.94	-124.10
652.00	570.40	416.39	-154.01
651.50	608.21	425.84	-182.37
651.00	644.49	435.29	-209.20
650.50	679.26	444.74	-234.52
650.00	712.54	454.18	-258.35
649.50	744.35	463.63	-280.72
649.00	774.72	473.08	-301.64
648.50	803.68	482.53	-321.15
648.00	831.25	491.98	-339.28
647.50	857.48	501.42	-356.06
647.00	882.40	510.88	-371.52
646.50	906.05	520.30	-385.76
646.00	928.48	529.45	-399.03
645.50	949.73	538.22	-411.51
645.00+	969.86	546.83	-423.03
645.00-	1002.63	546.83	-455.80
644.50	1003.28	555.55	-447.74
644.00	1003.50	564.61	-438.89
643.50	1003.33	573.99	-429.33
643.00	1002.83	583.45	-419.37
642.50	1002.05	592.90	-409.15
642.00	1001.06	602.35	-398.72
641.50	999.93	611.80	-388.13
641.00	998.71	621.25	-377.47
640.50	997.49	630.69	-366.79
640.00	996.33	640.14	-356.19
639.50	995.32	649.59	-345.73
639.00	994.54	659.04	-335.50
638.50	994.08	668.49	-325.59
638.00	994.03	677.94	-316.10
637.50	994.50	687.38	-307.12
637.00	995.58	696.83	-298.75
636.50	997.38	717.37	-280.02
636.00	1000.02	740.16	-259.86
635.50	1003.61	762.33	-241.28
635.00	1008.28	783.78	-224.50
634.50	1014.15	804.40	-209.75
634.00	1021.36	824.09	-197.27
633.50	1030.06	842.73	-187.33
633.00+	1040.38	860.20	-180.18
633.00-	790.58	653.66	-136.92
632.50	801.04	665.41	-135.63
632.00	811.92	676.81	-135.11
631.50	823.12	687.95	-135.17
631.00	834.53	698.90	-135.64
630.50	846.05	709.76	-136.29
630.00+	857.56	720.64	-136.92
630.00-	857.56	720.64	-136.92
629.50	868.95	731.61	-137.34
629.00	880.23	742.68	-137.55
628.50	891.40	753.83	-137.57
628.00	902.49	765.05	-137.44
627.50	913.53	776.32	-137.21
627.00	924.54	787.62	-136.92

```
1000 'ISLAND CREEK LPP, LOGAN, WV
1010 'BAISDEN- L.C. 3-NORMAL OPERATING CONDITION
1020 'WALL HEIGHT = 26', W14 X 370 POST
1030 'ONE ANCHOR, 6' C TO C SPACING
1040 WALL   668.00   2.900E+07   9.070E+02   18.17E+00
1050 WALL   627.00
1060 ANCHOR   657.00   F  6.67E+04    4.00E+04    4.00E+04    3.15E+04    1.0
1062 ANCHOR   633.00   R
1063 ANCHOR   630.00   R
1064 ANCHOR   627.00   R
1070 SURFACE RIGHTSIDE   1
1080        .00    668.00
1090 SURFACE  LEFTSIDE   1
1100        .00    643.00
1110 SOIL RIGHTSIDE  STRENGTH    5
1130   129.00  114.00 32.0     .00   .0     .00    58.0    58.0   656.80    0.00
1135   136.00  110.00 28.0     .00   .0     .00     5.8     5.8   655.10    0.00
1136   124.00  114.00 32.0     .00   .0     .00     5.8     5.8   645.00    0.00
1138   124.00  114.00 32.0     .00   .0     .00     3.5     3.5   633.00    0.00
1139    125.00  125.00 40.0   50.00   .0     .00     0.1     0.1
1140 SOIL  LEFTSIDE  STRENGTH    2
1155   124.00  114.00 32.0     .00   .0     .00     3.5     3.5   633.00    0.00
1160    125.00  125.00 40.0   50.00   .0     .00     0.1     0.1
1170 WATER ELEVATIONS    62.50  645.00  645.00
1190 FINISH
```

A-I-167

'ISLAND CREEK LPP, LOGAN, WV

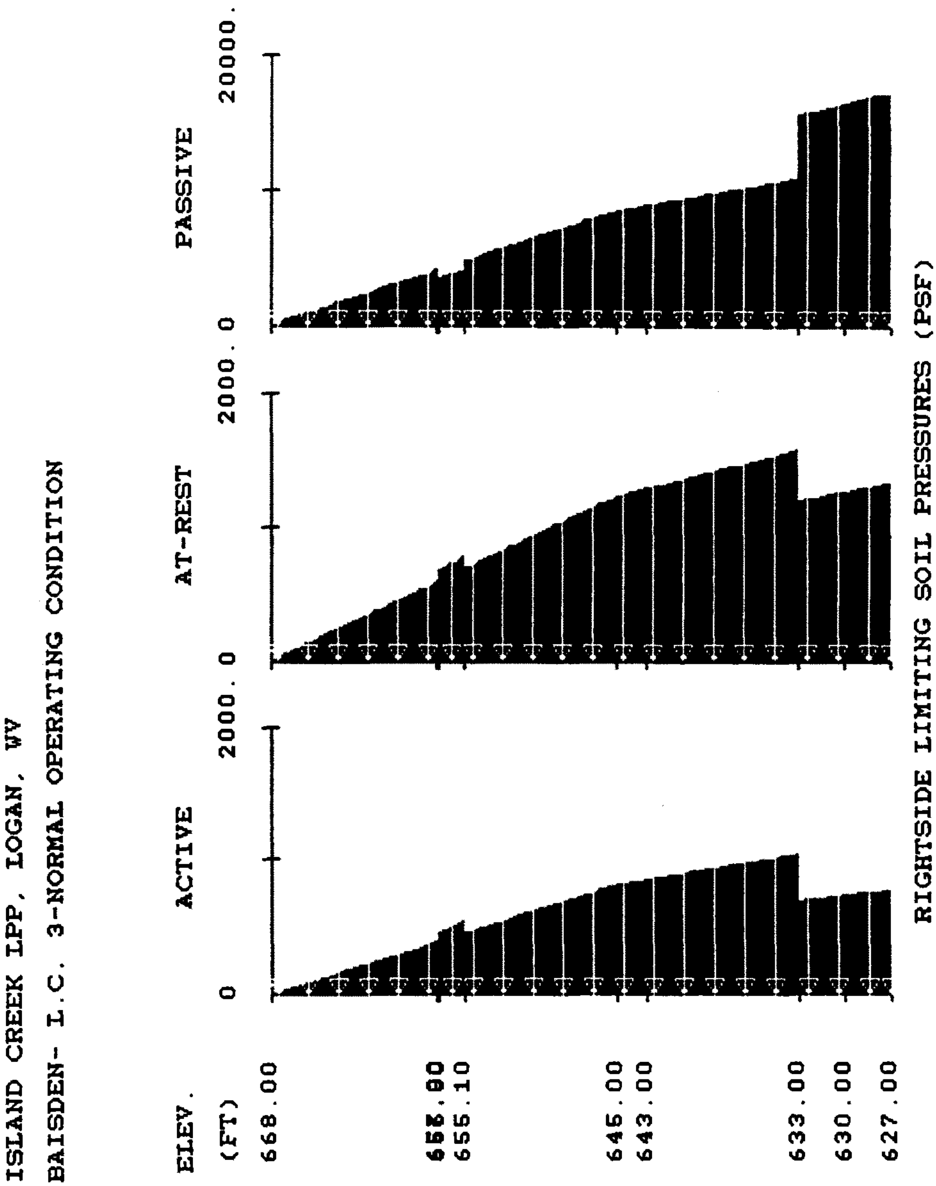
'BAISDEN- L.C. 3-NORMAL OPERATING CONDITION



***** INPUT GEOMETRY *****

DATE: 01-NOV-1993 TIME: 14.15.33

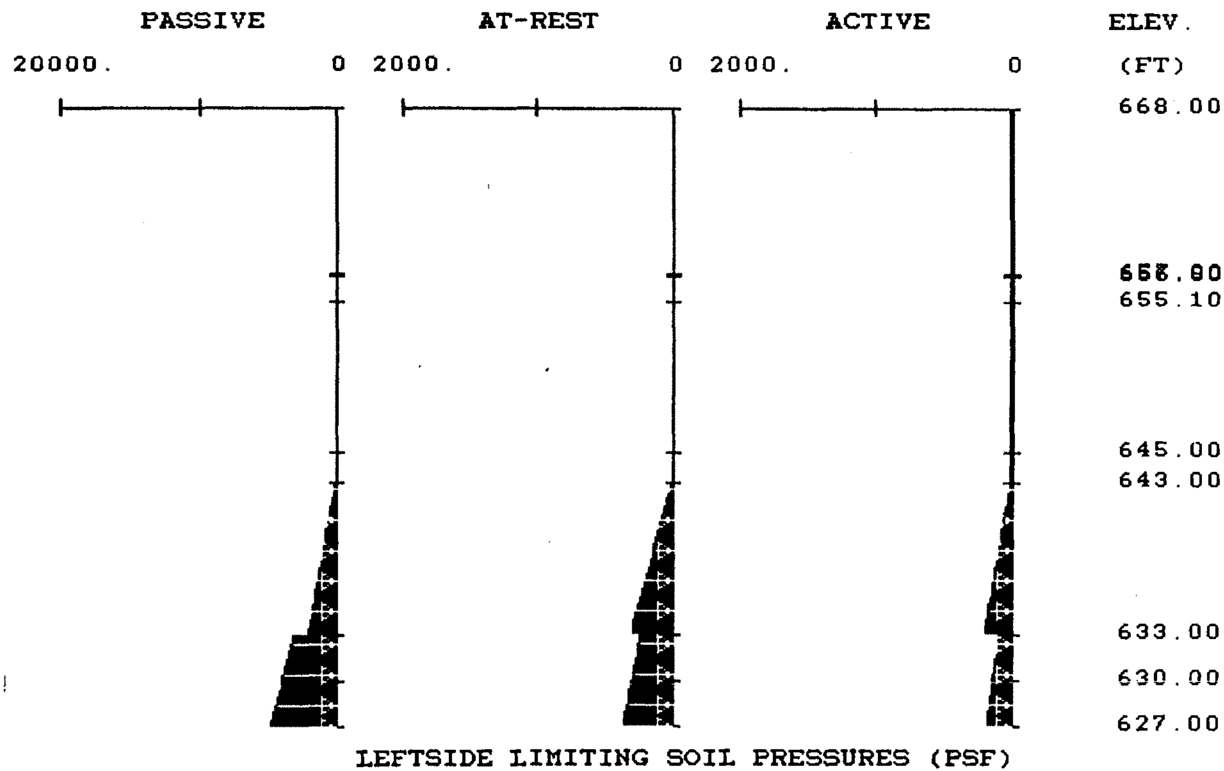
A-T-168


'ISLAND CREEK LPP, LOGAN, WV
'BAISDEN- L.C. 3-NORMAL OPERATING CONDITION
ELEV.
(FT)
668.00
655.10
645.00
643.00
633.00
630.00
627.00
ACTIVE
AT-REST
PASSIVE
0
2000.0
2000.
0
20000.
RIGHTSIDE LIMITING SOIL PRESSURES (PSF)

A-I-169

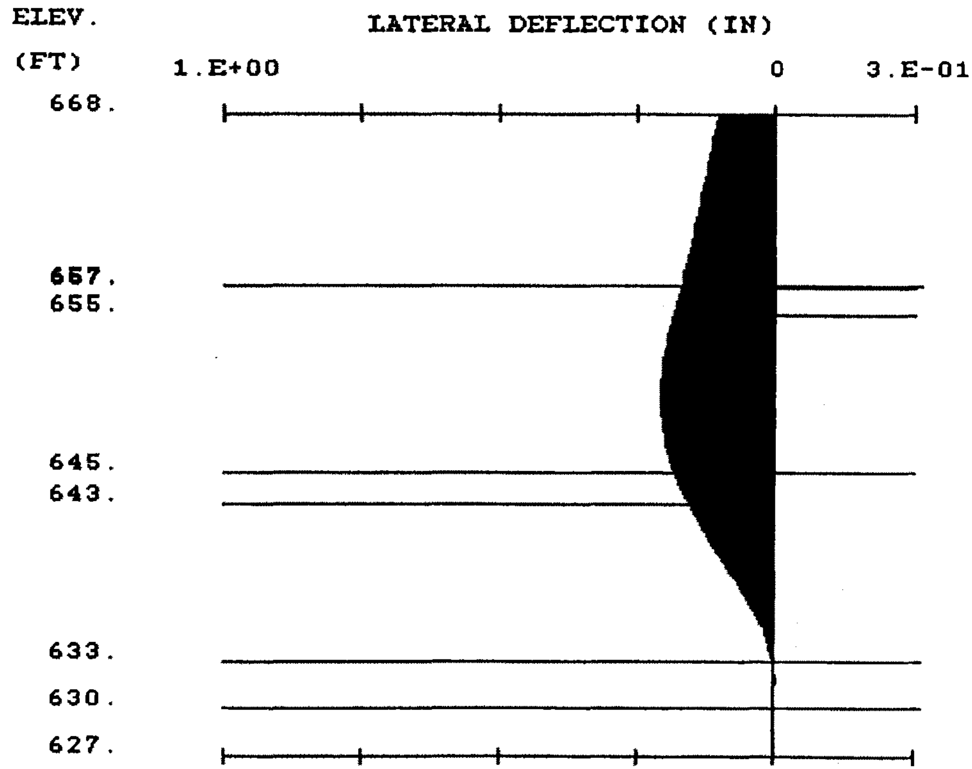
'ISLAND CREEK LPP, LOGAN, WV

'BAISDEN- L.C. 3-NORMAL OPERATING CONDITION



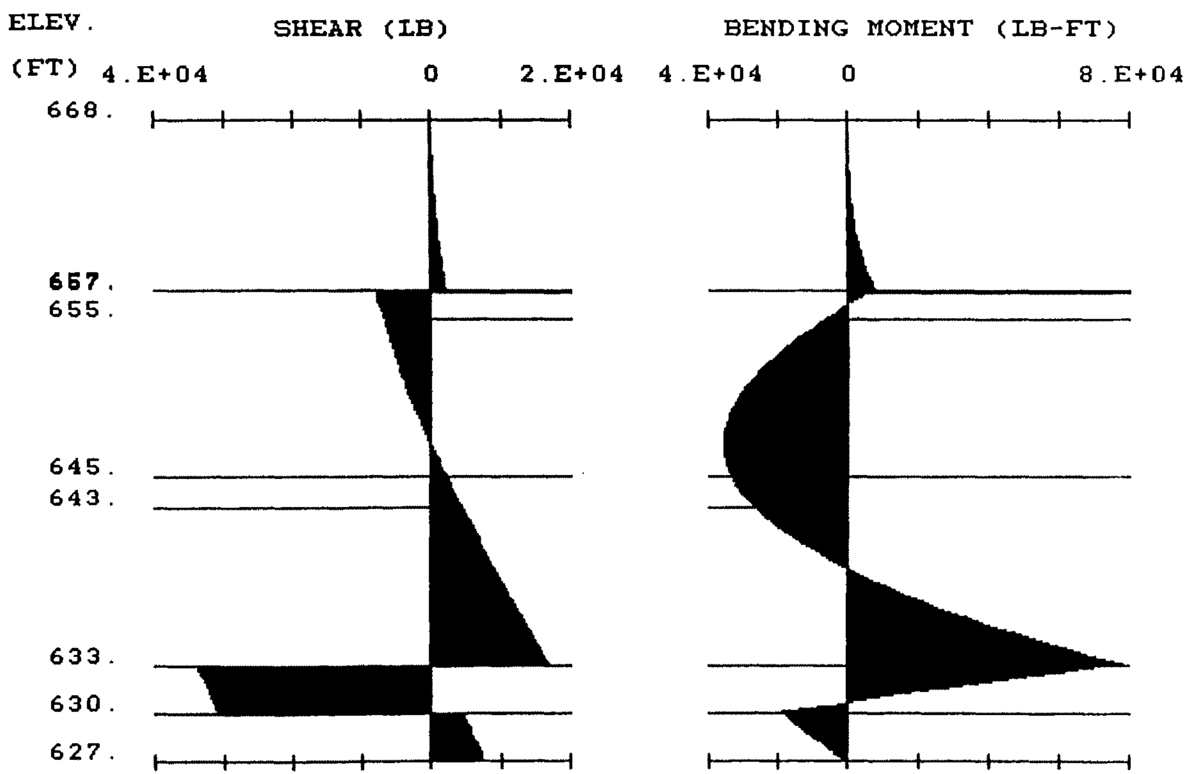
'ISLAND CREEK LPP, LOGAN, WV

'BAISDEN- L.C. 3-NORMAL OPERATING CONDITION



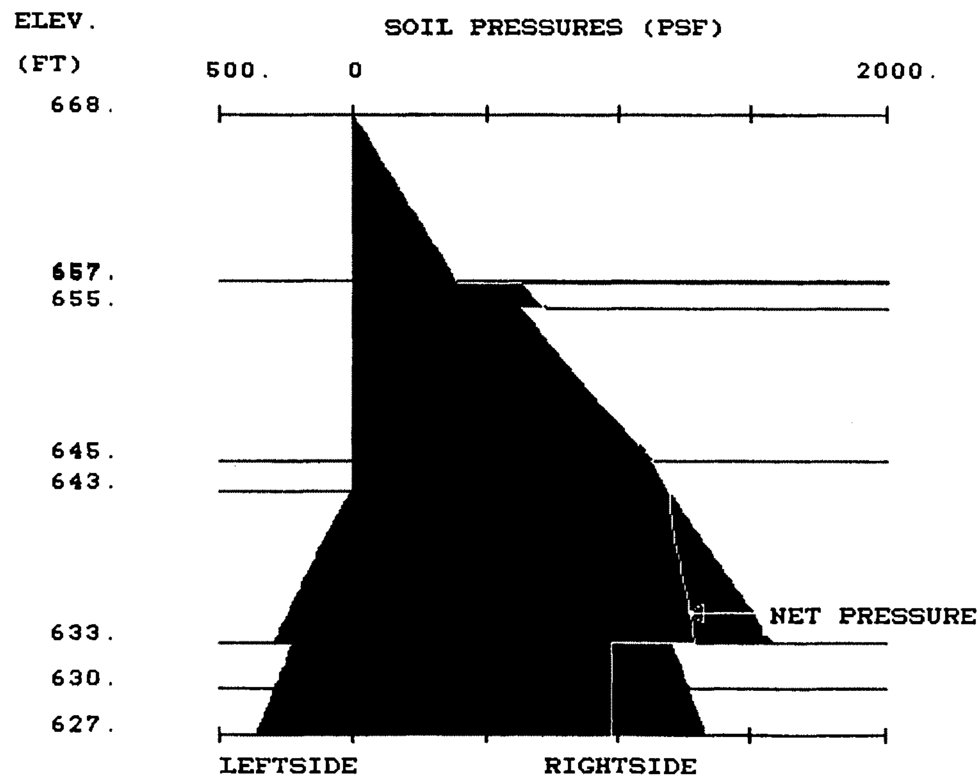
'ISLAND CREEK LPP, LOGAN, WV

'BAISDEN- L.C. 3-NORMAL OPERATING CONDITION



'ISLAND CREEK LPP, LOGAN, WV

'BAISDEN- L.C. 3-NORMAL OPERATING CONDITION



PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 01-NOV-1993 TIME: 14.15.05

INPUT DATA

I.--HEADING:
'ISLAND CREEK LPP, LOGAN, WV

'BAISDEN- L.C. 3-NORMAL OPERATING CONDITION

'WALL HEIGHT = 26', W14 X 370 POST

'ONE ANCHOR, 6' C TO C SPACING

II.--WALL SEGMENT DATA

ELEVATION AT TOP OF SEGMENT (FT)	MODULUS OF ELASTICICTY (PSI)	MOMENT OF INERTIA (IN**4)	CROSS SECTION AREA (SQIN)
668.00	2.900E+07	907.00	18.17

ELEVATION AT BOTTOM OF WALL = 627.00 (FT).

III.--ANCHOR DATA

ELEVATION AT WALL (FT)	ANCHOR TYPE ('R/F')	ULTIMATE TENSION FORCE (LB)	PRE-STRESS FORCE (LB)	ULTIMATE COMPRESSION FORCE (LB)	ANCHOR STIFFNESS (LB/IN)	ANCHOR SLOPE (FT)
657.00	FLEXIBLE	6.67E+04	4.00E+04	4.00E+04	3.150E+04	1.00
633.00	RIGID					
630.00	RIGID					
627.00	RIGID					

IV.--SURFACE POINT DATA

IV.A.--RIGHTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	668.00

IV.B.-- LEFTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	643.00

V.--SOIL LAYER DATA

V.A.--RIGHTSIDE LAYER DATA

<UNIT WEIGHT> SAT. (PCF)	MOIST (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	WALL ADH-ESION (PSF)	<STIFF. COEF.> ACT. (PCI)	PASS. (PCI)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT)

129.00	114.00	32.00	.00	.00	.00	58.00	58.00	656.80	.00
136.00	110.00	28.00	.00	.00	.00	5.80	5.80	655.10	.00
124.00	114.00	32.00	.00	.00	.00	5.80	5.80	645.00	.00
124.00	114.00	32.00	.00	.00	.00	3.50	3.50	633.00	.00
125.00	125.00	40.00	50.00	.00	.00	.10	.10		

V.B.-- LEFTSIDE LAYER DATA

<UNIT	WEIGHT>	ANGLE OF INTERNAL	COH-	ANGLE OF WALL	WALL ADH-	<STIFF.	COEF.>	<--BOTTOM	-->
SAT.	MOIST	FRICTION	ESION	FRICTION	ESION	ACT.	PASS.	ELEV.	SLOPE
(PCF)	(PCF)	(DEG)	(PSF)	(DEG)	(PSF)	(PCI)	(PCI)	(FT)	(FT)
124.00	114.00	32.00	.00	.00	.00	3.50	3.50	633.00	.00
125.00	125.00	40.00	50.00	.00	.00	.10	.10		

VI.--INTERACTION ZONE DATA
NONE

VII.--WATER DATA

UNIT WEIGHT = 62.50 (PCF)
RIGHTSIDE ELEVATION = 645.00 (FT)
LEFTSIDE ELEVATION = 645.00 (FT)
NO SEEPAGE

VIII.--SURFACE LOADS
NONE

IX.--HORIZONTAL LOADS
NONE

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 01-NOV-1993 TIME: 14.17.52

SUMMARY OF RESULTS

I.A.--MAXIMA

		MAXIMUM	MINIMUM
BENDING MOMENT (LB-FT)	:	7.848E+04	-3.546E+04
AT ELEVATION (FT)	:	633.00	647.00
DEFLECTION (IN)	:	2.041E-01	-2.265E-03
AT ELEVATION (FT)	:	649.50	632.00
RIGHTSIDE SOIL PRESSURE (PSF)	:	1576.27	
AT ELEVATION (FT)	:	633.00	

LEFTSIDE SOIL PRESSURE (PSF) : 353.64
AT ELEVATION (FT) : 627.00

I.B.--ANCHOR FORCES

ELEVATION AT ANCHOR (FT)	ANCHOR TYPE	ANCHOR DEFORMATION (IN)	ANCHOR FORCE (LB)
657.00	FLEXIBLE	.12	15416.75
633.00	RIGID	.00	50586.49
630.00	RIGID	.00	-35573.22
627.00	RIGID	.00	7640.35

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 01-NOV-1993 TIME: 14.17.52

COMPLETE RESULTS

II.A.--WALL DEFLECTIONS AND FORCES

	<------DEFLECTION----->		<--WALL INTERNAL FORCES->		
ELEVATION (FT)	AXIAL (IN)	LATERAL (IN)	AXIAL (LB)	SHEAR (LB)	MOMENT (LB-FT)
668.00	-6.858E-03	9.886E-02	0.	0.	0.
667.50	-6.858E-03	1.018E-01	0.	4.	1.
667.00	-6.858E-03	1.047E-01	0.	18.	6.
666.50	-6.858E-03	1.076E-01	0.	39.	20.
666.00	-6.858E-03	1.106E-01	0.	70.	47.
665.50	-6.858E-03	1.135E-01	0.	109.	91.
665.00	-6.858E-03	1.164E-01	0.	158.	158.
664.50	-6.858E-03	1.194E-01	0.	215.	250.
664.00	-6.858E-03	1.223E-01	0.	280.	374.
663.50	-6.858E-03	1.252E-01	0.	355.	532.
663.00	-6.858E-03	1.282E-01	0.	438.	730.
662.50	-6.858E-03	1.312E-01	0.	530.	971.
662.00	-6.858E-03	1.341E-01	0.	630.	1261.
661.50	-6.858E-03	1.371E-01	0.	740.	1603.
661.00	-6.858E-03	1.402E-01	0.	858.	2002.
660.50	-6.858E-03	1.432E-01	0.	985.	2463.
660.00	-6.858E-03	1.463E-01	0.	1121.	2989.
659.50	-6.858E-03	1.495E-01	0.	1265.	3585.
659.00	-6.858E-03	1.527E-01	0.	1419.	4256.
658.50	-6.858E-03	1.560E-01	0.	1581.	5005.
658.00	-6.858E-03	1.593E-01	0.	1751.	5838.
657.50	-6.858E-03	1.628E-01	0.	1931.	6758.
657.00+	-6.858E-03	1.663E-01	0.	2119.	7770.
657.00-	-6.858E-03	1.663E-01	-10038.	-7919.	7770.
656.80+	-6.812E-03	1.678E-01	-10038.	-7841.	6194.
656.80-	-6.812E-03	1.678E-01	-10038.	-7841.	6194.
656.50	-6.744E-03	1.700E-01	-10038.	-7649.	3871.
656.00	-6.629E-03	1.738E-01	-10038.	-7320.	128.

655.50	-6.515E-03	1.775E-01	-10038.	-6977.	-3447.
655.10+	-6.424E-03	1.805E-01	-10038.	-6693.	-6181.
655.10-	-6.424E-03	1.805E-01	-10038.	-6693.	-6181.
655.00	-6.401E-03	1.812E-01	-10038.	-6630.	-6847.
654.50	-6.286E-03	1.848E-01	-10038.	-6305.	-10082.
654.00	-6.172E-03	1.882E-01	-10038.	-5969.	-13151.
653.50	-6.058E-03	1.914E-01	-10038.	-5621.	-16048.
653.00	-5.944E-03	1.943E-01	-10038.	-5261.	-18769.
652.50	-5.829E-03	1.970E-01	-10038.	-4889.	-21307.
652.00	-5.715E-03	1.992E-01	-10038.	-4506.	-23657.
651.50	-5.601E-03	2.011E-01	-10038.	-4111.	-25811.
651.00	-5.486E-03	2.026E-01	-10038.	-3704.	-27766.
650.50	-5.372E-03	2.036E-01	-10038.	-3285.	-29513.
650.00	-5.258E-03	2.041E-01	-10038.	-2854.	-31048.
649.50	-5.143E-03	2.041E-01	-10038.	-2411.	-32365.
649.00	-5.029E-03	2.036E-01	-10038.	-1956.	-33457.
648.50	-4.915E-03	2.026E-01	-10038.	-1488.	-34319.
648.00	-4.801E-03	2.009E-01	-10038.	-1008.	-34943.
647.50	-4.686E-03	1.987E-01	-10038.	-515.	-35324.
647.00	-4.572E-03	1.959E-01	-10038.	-9.	-35456.
646.50	-4.458E-03	1.926E-01	-10038.	510.	-35331.
646.00	-4.343E-03	1.886E-01	-10038.	1041.	-34944.
645.50	-4.229E-03	1.841E-01	-10038.	1587.	-34288.
645.00+	-4.115E-03	1.790E-01	-10038.	2145.	-33355.
645.00-	-4.115E-03	1.790E-01	-10038.	2145.	-33355.
644.50	-4.000E-03	1.734E-01	-10038.	2709.	-32142.
644.00	-3.886E-03	1.673E-01	-10038.	3282.	-30644.
643.50	-3.772E-03	1.606E-01	-10038.	3863.	-28859.
643.00	-3.658E-03	1.535E-01	-10038.	4453.	-26780.
642.50	-3.543E-03	1.459E-01	-10038.	5048.	-24405.
642.00	-3.429E-03	1.379E-01	-10038.	5643.	-21732.
641.50	-3.315E-03	1.296E-01	-10038.	6240.	-18762.
641.00	-3.200E-03	1.210E-01	-10038.	6838.	-15492.
640.50	-3.086E-03	1.121E-01	-10038.	7439.	-11923.
640.00	-2.972E-03	1.030E-01	-10038.	8041.	-8053.
639.50	-2.857E-03	9.377E-02	-10038.	8646.	-3881.
639.00	-2.743E-03	8.449E-02	-10038.	9253.	593.
638.50	-2.629E-03	7.522E-02	-10038.	9863.	5372.
638.00	-2.515E-03	6.604E-02	-10038.	10477.	10457.
637.50	-2.400E-03	5.703E-02	-10038.	11093.	15849.
637.00	-2.286E-03	4.829E-02	-10038.	11713.	21551.
636.50	-2.172E-03	3.989E-02	-10038.	12336.	27563.
636.00	-2.057E-03	3.195E-02	-10038.	12962.	33887.
635.50	-1.943E-03	2.457E-02	-10038.	13592.	40526.
635.00	-1.829E-03	1.785E-02	-10038.	14225.	47480.
634.50	-1.714E-03	1.191E-02	-10038.	14861.	54751.
634.00	-1.600E-03	6.873E-03	-10038.	15500.	62342.
633.50	-1.486E-03	2.859E-03	-10038.	16141.	70252.
633.00+	-1.372E-03	0.000E+00	-10038.	16784.	78483.
633.00-	-1.372E-03	0.000E+00	-10038.	-33802.	78483.
632.50	-1.257E-03	-1.639E-03	-10038.	-33313.	61704.
632.00	-1.143E-03	-2.265E-03	-10038.	-32824.	45170.
631.50	-1.029E-03	-2.148E-03	-10038.	-32334.	28880.
631.00	-9.144E-04	-1.557E-03	-10038.	-31845.	12836.
630.50	-8.001E-04	-7.542E-04	-10038.	-31356.	-2965.
630.00+	-6.858E-04	0.000E+00	-10038.	-30867.	-18520.
630.00-	-6.858E-04	0.000E+00	-10038.	4707.	-18520.
629.50	-5.715E-04	4.990E-04	-10038.	5196.	-16045.
629.00	-4.572E-04	7.348E-04	-10038.	5684.	-13325.
628.50	-3.429E-04	7.522E-04	-10038.	6173.	-10360.
628.00	-2.286E-04	5.996E-04	-10038.	6662.	-7151.
627.50	-1.143E-04	3.300E-04	-10038.	7151.	-3698.
627.00	0.000E+00	0.000E+00	-10038.	7640.	0.

II.B.--SOIL PRESSURES

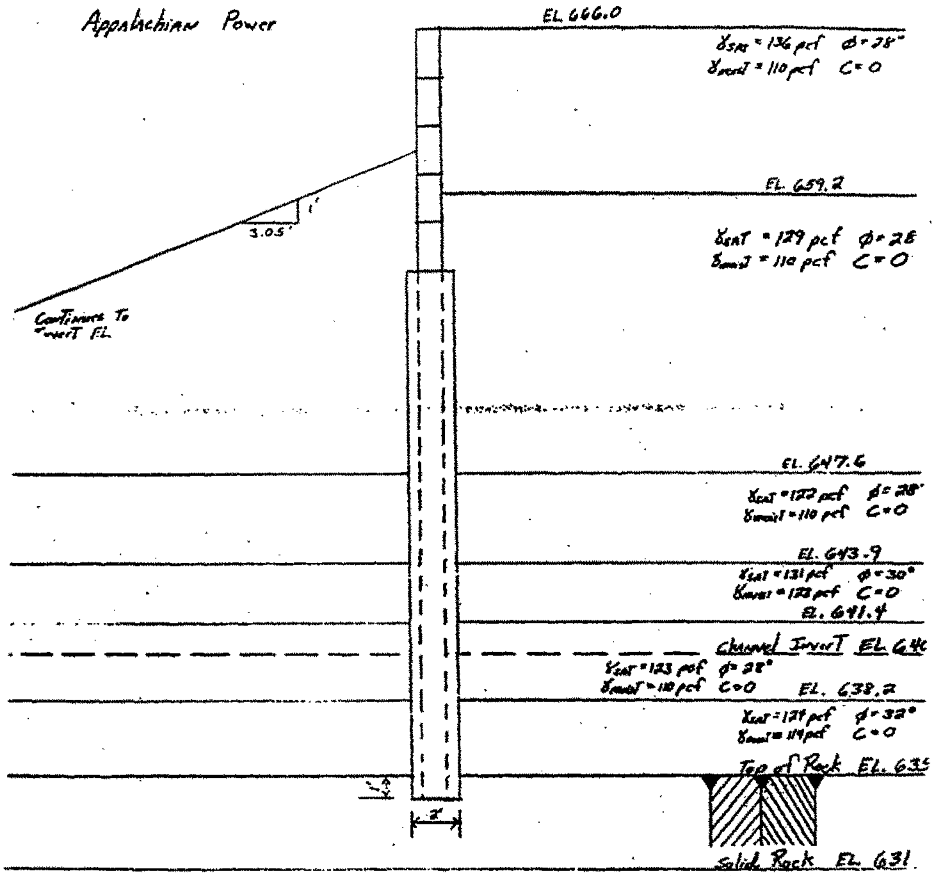
ELEVATION (FT)	<---------SOIL PRESSURES (PSF)--------> LEFTSIDE	RIGHTSIDE	NET
668.00	.00	.00	.00
667.50	.00	17.51	17.51
667.00	.00	35.03	35.03
666.50	.00	52.54	52.54
666.00	.00	70.05	70.05
665.50	.00	87.57	87.57
665.00	.00	105.08	105.08
664.50	.00	122.60	122.60
664.00	.00	140.11	140.11
663.50	.00	157.62	157.62
663.00	.00	175.14	175.14
662.50	.00	192.65	192.65
662.00	.00	210.16	210.16
661.50	.00	227.68	227.68
661.00	.00	245.19	245.19
660.50	.00	262.71	262.71
660.00	.00	280.22	280.22
659.50	.00	297.73	297.73
659.00	.00	315.25	315.25
658.50	.00	332.76	332.76
658.00	.00	350.27	350.27
657.50	.00	367.79	367.79
657.00+	.00	385.30	385.30
657.00-	.00	385.30	385.30
656.80+	.00	392.31	392.31
656.80-	.00	630.90	630.90
656.50	.00	646.58	646.58
656.00	.00	672.62	672.62
655.50	.00	698.57	698.57
655.10+	.00	719.28	719.28
655.10-	.00	632.80	632.80
655.00	.00	637.51	637.51
654.50	.00	660.99	660.99
654.00	.00	684.45	684.45
653.50	.00	707.89	707.89
653.00	.00	731.36	731.36
652.50	.00	754.87	754.87
652.00	.00	778.44	778.44
651.50	.00	802.12	802.12
651.00	.00	825.92	825.92
650.50	.00	849.88	849.88
650.00	.00	874.02	874.02
649.50	.00	898.37	898.37
649.00	.00	922.97	922.97
648.50	.00	947.82	947.82
648.00	.00	972.98	972.98
647.50	.00	998.45	998.45
647.00	.00	1024.26	1024.26
646.50	.00	1050.44	1050.44
646.00	.00	1077.00	1077.00
645.50	.00	1103.96	1103.96
645.00+	.00	1131.34	1131.34
645.00-	.00	1119.72	1119.72
644.50	.00	1136.37	1136.37
644.00	.00	1153.44	1153.44
643.50	.00	1170.91	1170.91
643.00	.00	1188.78	1188.78
642.50	16.75	1207.04	1190.28
642.00	33.25	1225.67	1192.41
641.50	49.49	1244.65	1195.16

641.00	65.44	1263.96	1198.51
640.50	81.10	1283.56	1202.46
640.00	96.46	1303.42	1206.96
639.50	111.52	1323.51	1211.99
639.00	126.29	1343.78	1217.49
638.50	140.76	1364.17	1223.41
638.00	154.95	1384.63	1229.68
637.50	168.89	1405.10	1236.21
637.00	182.59	1425.51	1242.92
636.50	196.08	1445.78	1249.70
636.00	209.41	1465.84	1256.42
635.50	222.63	1485.60	1262.97
635.00	235.78	1504.96	1269.18
634.50	248.92	1523.82	1274.89
634.00	262.14	1542.07	1279.93
633.50	275.50	1559.60	1284.09
633.00+	289.10	1576.27	1287.18
633.00-	219.69	1197.80	978.12
632.50	230.77	1209.39	978.63
632.00	241.89	1220.72	978.83
631.50	253.06	1231.86	978.80
631.00	264.25	1242.87	978.62
630.50	275.46	1253.82	978.37
630.00+	286.66	1264.78	978.12
630.00-	286.66	1264.78	978.12
629.50	297.86	1275.81	977.95
629.00	309.04	1286.90	977.87
628.50	320.20	1298.06	977.86
628.00	331.36	1309.26	977.91
627.50	342.50	1320.50	978.00
627.00	353.64	1331.76	978.12

US Army Corps of Engineers Ohio River Division	Subject Island Creek, WV, LPP Post & Panel Wall	Page Of Pages Computed by DAK Date 9-9-93 Checked by Date

5' Wall

The 5' wall is used at the transitions from the wall to the sloped channel. It is a cantilever wall with the post placed on top of the weathered Rock. It is use at both sections of post & panel wall. The program "CWALSHT" was used for the cantilever wall stiffness coefficients not need



Form 427

US Army Corps of Engineers Ohio River Division	Subject Island Creek, WV, LPP Post & Panel Wall	Page Of Pages
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5' Cantilever Wall Con'T

Four Load cases where examined. They where

1) High Water (EL. 666 & 661) & Truck (HS-20)
2) High Water (EL. 666 & 661) & No Truck
3) Normal Water (EL. 642 & 642) & Truck (HS-20)
4) Normal Water (EL. 642 & 642) & No Truck

For Each Load Case The program "CWALSHT" was ran. The Program "CSLide" was then Ran To examine the possiblety of A sliding failure.

For Simplicity The wall was examined in 3' Sections. Both programs investigate a 1' width of wall. Therefore, additional Horizontal Loads where added To account for The additional 2' of wall. The Horizontal Loads accounted for the soil and when called for, the Truck

The properties of the pile where divided by 2 since a 3' wall Section was half of The effective span for a single pile

The Program "CWALSHT" used both The sweep search and Fixed surface wedge methods To examine The problem. The results for each method are provided for each Load Case.

The allowable Factors of Safety for The sliding analysis were obtained From EM 1110-2-2502.

Summary of Results

Max bending Moment = 2.579×10^5 lb-ft

Max deflection = 3.919" @ Top of wall

Sliding F.S = 1.303 ≈ 1.33 ok

US Army Corps of Engineers Ohio River Division	Subject Island Creek, WV, LPP Post & Panel Wall	Page Of Pages Computed by RAK Date 10/7/93 Checked by Date

Wheel Load Distribution

For the 5' wall the max Horizontal pressure is 272.82 psf @ 2.2' From the Top of the wall. This pressure was the sum of the pressures for Two 16 kip Loads located 3' and 9' from the wall. These pressure values where obtained using the equation on page 3-48 of EM 1110-2-2502, "Engineering and Design Retaining and Flood Walls". See pages for Graph and Values.

$\Delta P_{HZ} = 272.82$ psf @ 2.2'

@ $x = 3'$ $\qquad A = 3/5 = 0.60$

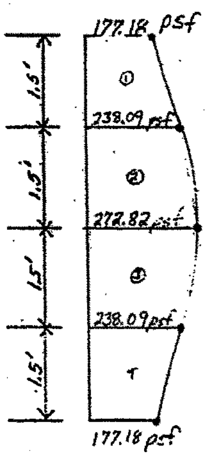
$\alpha = \tan^{-1}\left(\frac{x}{AH}\right) = \tan^{-1}\left(\frac{3}{0.60\,(5)}\right) = 45^\circ$

$\Delta P_{HX} = 272.82 \cos(1.1(45)) = 177.18$ psf

@ $x = 1.5'$

$\alpha = \tan^{-1}\left(\frac{1.5}{.333(6)}\right) = 26.57^\circ$

$\Delta P_{HX} = 272.82 \cos(1.1(26.57)) = 238.09$ psf



Total Load $= 2\left(\frac{1.5(177.18+238.09)}{2}\right) + 2\left(\frac{1.5(238.09+272.82)}{2}\right)$

$= 1389.27$ psf over 6'

Use Uniform Load of 231.55 psf / ' of wall.

$\frac{231.55}{272.82} = 0.849$

Multiply Horizontal Pressures by 0.849 To obtain the pressures To input into "CWALSSI"

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Wheel Load Distribution (con'T)

$\Delta P_{HZ} = 17.47$ psf @ 0.30'

@ $X = 3'$

$\Delta P_{HX} = 17.47 \cos(1.1(45)) = 11.35$ psf

@ $X = 1.5'$

$\Delta P_{HX} = 17.47 \cos(1.1(26.57)) = 15.25$ psf

$$\text{Total Load} = 2\left(\frac{1.5(11.35 + 15.25)}{2}\right) + 2\left(\frac{1.5(15.25 + 17.47)}{2}\right)$$

$= 88.98$ psf over 6'

Use uniform Load of 14.83 psf

$\frac{14.83}{17.47} = 0.849$ multiply Horizontal Pressu by 0.849 To obtain The pressures To input into "CWALSSI"

$\Delta P_{HZ} = 118.80$ psf @ 5'

@ $X = 3$

$\Delta P_{HX} = 118.80 \cos(1.1(45)) = 77.15$ psf

@ $X = 1.5$

$\Delta P_{HX} = 118.80 \cos(1.1(26.57)) = 103.68$ psf

$$\text{Total Load} = 2\left(\frac{1.5(77.15 + 103.68)}{2}\right) + 2\left(\frac{1.5(103.68 + 118.80)}{2}\right)$$

$= 604.97$ psf over 6'

Use uniform Load of 100.83 psf

$\frac{100.83}{118.80} = 0.849$ multiply Horizontal pressures by 0.849 To obtain The Pressures To input into "CWALSSI"

US Army Corps of Engineers Ohio River Division	Subject Island Creek, WV, LPP Post & Panel Wall	Page Of Pages
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5' Cantilever Wall (Con'T)

Summary of Results

The highest Values between The Two wedge method for each Load Case are provided Below.

Condition	Bending Moment	Deflection	Rigid Anchors Anchor 1	Anchor 2	Sum of Anchor
L.C. #1	2.579×10^5 lb-ft	3.919"	268548.79 lbs	-257673.37 lbs	10875.
L.C. #2	2.006×10^5 lb-ft	2.954"	209729.76 lbs	-200355.66 lbs	9374.1
L.C. #3	8.7×10^4 lb-ft	1.600"	77166.86 lbs	-77543.35 lbs	-376.49
L.C. #4	5.164×10^4 lb-ft	0.9149"	51018.39 lbs	-50168.96 lbs	849.43

Check Post Size Assumed W14×193 A588 Steel, $S = 310\ in^3$ $A = 56.8\ in^2$

2 halves

$$f_b = \frac{m}{s} = \frac{2.579\times10^5\,(2)(12)}{310} = 19.97\ ksi$$

$$F_b = 0.5 f_y = 0.5(50) = 25\ ksi > 19.97\ ksi \quad \underline{ok}$$

W14×193, A588 ok

Bearing

Assume Bearing Capacity of soil is 2000 psf

Assume 5.5'×2' Bearing Area

net pressure L.C. #1 $\frac{10.88^k \times 2}{24\times 66} = 0.0137\,ksi \rightarrow 13.7\ psi$

$$\text{Allowable} = \frac{2000}{144} = 13.89\ psi > 13.7\ psi \quad \underline{ok}$$

Shear on Failure Plane

Use "CSLIDE" Results for L.C. #1 To determine failure plane and Resultant

Wedges 7 & 8 will be examined

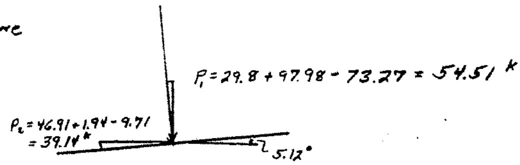
US Army Corps of Engineers Ohio River Division	Subject: Island Creek, WV, LPP Post & Panel Wall	Page Of Pages Computed by DAK Date 10-14-93 Checked by Date

5' Cantilever Wall (Con't)

Wedge 7

Area of Failure Plane = $2' \times 47.08' = 94.16\ ft^2 = 13{,}559\ in^2$

Load on Plane



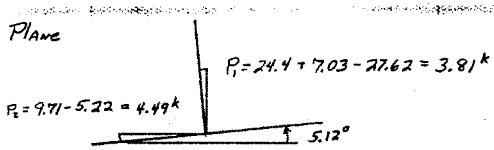
$$X\text{-dir} = {}^{-}54.51 \sin 5.12 + 39.14 \cos 5.12 = 34.12^k$$

$$f_v = \frac{34.12^k}{13{,}559} = 2.52\ psi \quad < \text{very Low} \quad \underline{ok}$$

Wedge 8

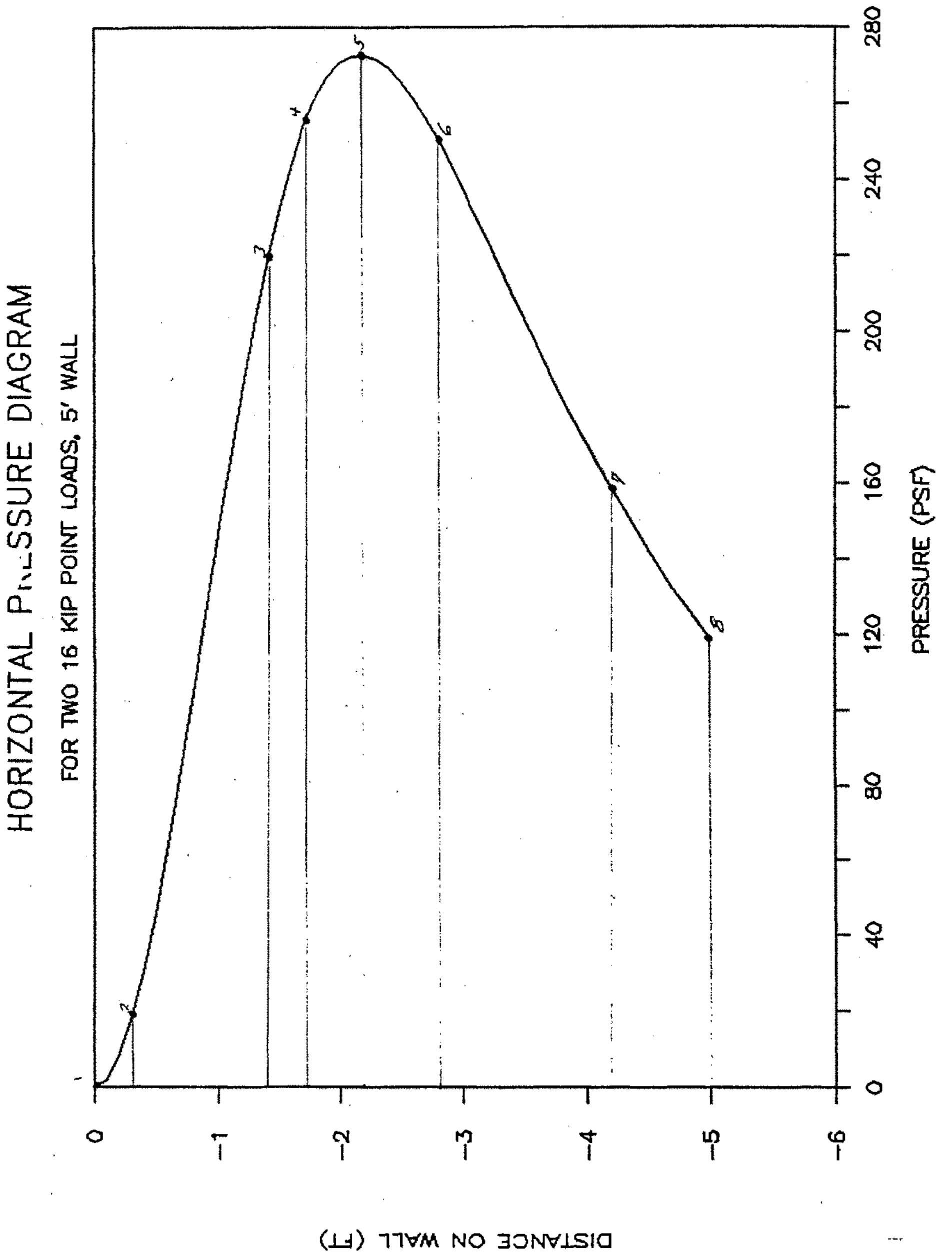
Area of Failure Plane = $2' \times 20.18' = 40.36\ ft^2 = 5812\ in^2$

Load on Plane



$$X\text{-dir} = {}^{-}3.81 \sin 5.12 + 4.49 \cos 5.12 = 4.13^k$$

$$f_v = \frac{4.13^k}{5812} = 0.71\ psi \quad < \text{Very Low} \quad \underline{ok}$$



HORIZONTAL PRESSURE DIAGRAM
FOR TWO 16 KIP POINT LOADS, 5' WALL
PRESSURE (PSF)
DISTANCE ON WALL (FT)
0
40
80
120
160
200
240
280
0
-1
-2
-3
-4
-5
-6
1
2
3
4
5
6
7
8

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HORIZONTAL PRESSURE FOR 16 KIP WHEEL LOADS

DISTANCE ON WALL (FT)	PRESSURE @ 3' (PSF)	PRESSURE @ 9' (PSF)	TOTAL PRESSURE (PSF)
0.00	0.00	0.00	0.00
0.10	1.97	0.02	1.99
0.20	7.80	0.10	7.89
0.30	17.25	0.22	17.47
0.40	29.98	0.39	30.37
0.50	45.49	0.60	46.09
0.60	63.22	0.87	64.08
0.70	82.56	1.17	83.73
0.80	102.88	1.52	104.40
0.90	123.55	1.92	125.47
1.00	144.00	2.35	146.35
1.10	163.71	2.82	166.53
1.20	182.23	3.33	185.56
1.30	199.21	3.87	203.09
1.40	214.38	4.45	218.83
1.50	227.56	5.05	232.61
1.60	238.63	5.69	244.32
1.70	247.58	6.34	253.92
1.80	254.43	7.02	261.45
1.90	259.25	7.72	266.98
2.00	262.18	8.44	270.62
2.10	263.34	9.17	272.51
2.20	262.91	9.92	272.82
2.30	261.05	10.67	271.72
2.40	257.94	11.43	269.37
2.50	253.77	12.20	265.96
2.60	248.68	12.96	261.64
2.70	242.84	13.73	256.57
2.80	236.40	14.49	250.89
2.90	229.49	15.25	244.74
3.00	222.22	16.00	238.22
3.10	214.71	16.74	231.45
3.20	207.04	17.47	224.51
3.30	199.29	18.19	217.48
3.40	191.54	18.89	210.43
3.50	183.83	19.58	203.41
3.60	176.23	20.25	196.47
3.70	168.76	20.90	189.65
3.80	161.46	21.53	182.98
3.90	154.35	22.13	176.49
4.00	147.46	22.72	170.18
4.10	140.79	23.28	164.07
4.20	134.36	23.82	158.18
4.30	128.17	24.33	152.50
4.40	122.22	24.82	147.04
4.50	116.52	25.28	141.81
4.60	111.07	25.72	136.79
4.70	105.85	26.13	131.98
4.80	100.87	26.51	127.39
4.90	96.12	26.87	122.99
5.00	91.59	27.20	118.80

SOIL PRESSURE FOR 2' STRIP
WATER AT NORMAL ELEVATION

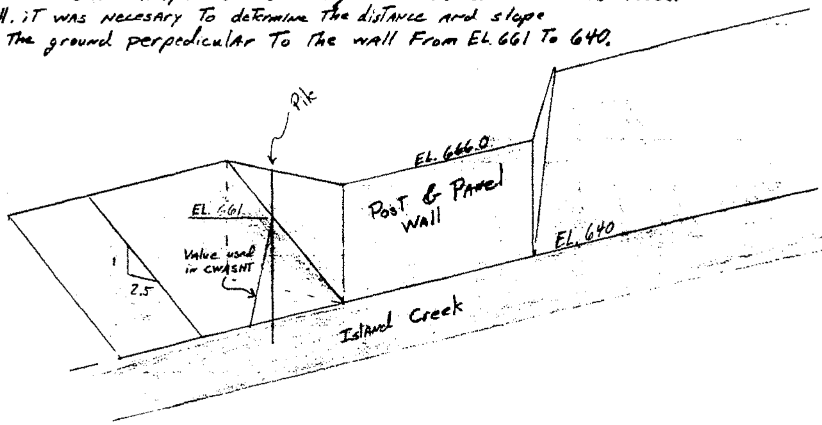
DISTANCE ON WALL (FT)	PRESSURE (PSF)	DISTANCE ON WALL (FT)	PRESSURE (PSF)
0.00	0.00	5.30	198.00
0.10	3.96	5.40	198.00
0.20	7.92	5.50	198.00
0.30	11.88	5.60	198.00
0.40	15.84	5.70	198.00
0.50	19.80	5.80	198.00
0.60	23.76	5.90	198.00
0.70	27.72	6.00	198.00
0.80	31.68	6.10	198.00
0.90	35.64	6.20	198.00
1.00	39.60	6.30	198.00
1.10	43.56	6.40	198.00
1.20	47.52	6.50	198.00
1.30	51.48	6.60	198.00
1.40	55.44	6.70	198.00
1.50	59.40	6.80	198.00
1.60	63.36	6.90	198.00
1.70	67.32	7.00	198.00
1.80	71.28		
1.90	75.24		
2.00	79.20		
2.10	83.16		
2.20	87.12		
2.30	91.08		
2.40	95.04		
2.50	99.00		
2.60	102.96		
2.70	106.92		
2.80	110.88		
2.90	114.84		
3.00	118.80		
3.10	122.76		
3.20	126.72		
3.30	130.68		
3.40	134.64		
3.50	138.60		
3.60	142.56		
3.70	146.52		
3.80	150.48		
3.90	154.44		
4.00	158.40		
4.10	162.36		
4.20	166.32		
4.30	170.28		
4.40	174.24		
4.50	178.20		
4.60	182.16		
4.70	186.12		
4.80	190.08		
4.90	194.04		
5.00	198.00		
5.10	198.00		
5.20	198.00		

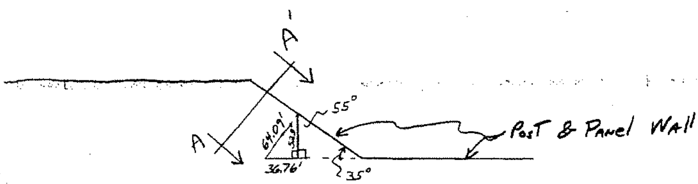
SOIL PRESSURE FOR 2' STRIP
WATER AT HIGH ELEVATION

DISTANCE ON WALL (FT)	PRESSURE (PSF)	DISTANCE ON WALL (FT)	PRESSURE (PSF)
0.00	0.00	5.30	889.60
0.10	17.79	5.40	889.60
0.20	35.58	5.50	889.60
0.30	53.38	5.60	889.60
0.40	71.17	5.70	889.60
0.50	88.96	5.80	889.60
0.60	106.75	5.90	889.60
0.70	124.54	6.00	889.60
0.80	142.34	6.10	889.60
0.90	160.13	6.20	889.60
1.00	177.92	6.30	889.60
1.10	195.71	6.40	889.60
1.20	213.50	6.50	889.60
1.30	231.30	6.60	889.60
1.40	249.09	6.70	889.60
1.50	266.88	6.80	889.60
1.60	284.67	6.90	889.60
1.70	302.46	7.00	889.60
1.80	320.26		
1.90	338.05		
2.00	355.84		
2.10	373.63		
2.20	391.42		
2.30	409.22		
2.40	427.01		
2.50	444.80		
2.60	462.59		
2.70	480.38		
2.80	498.18		
2.90	515.97		
3.00	533.76		
3.10	551.55		
3.20	569.34		
3.30	587.14		
3.40	604.93		
3.50	622.72		
3.60	640.51		
3.70	658.30		
3.80	676.10		
3.90	693.89		
4.00	711.68		
4.10	729.47		
4.20	747.26		
4.30	765.06		
4.40	782.85		
4.50	800.64		
4.60	818.43		
4.70	836.22		
4.80	854.02		
4.90	871.81		
5.00	889.60		
5.10	889.60		
5.20	889.60		

US Army Corps of Engineers Ohio River Division	Subject: Island Creek, WV, LPP Post & Panel Wall	Page Of Pages Computed by DAK Date 10-14-93 Checked by Date

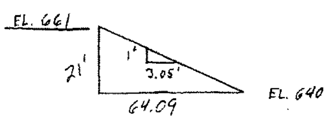
In order To accurately model The Loading Conditions on The Cantilever wall, iT was necesary To determine The distance and slope of The ground perpedicular To The wall From EL. 661 To 640.





$(661-640)\,2.5 = 52.5'$

$52.2/\sin 55^\circ = 64.09'$



View A-A'

For "CSLIDE" the additional load of the 2' of earth and the truck needed to be applied as a horizontal load. The tables below provide the total horizontal load to be applied for each load case. The loads for the truck were multiplied by three to account for 3' of wall. The values for the earth and water are for 2' of wall. The program accounts for 1'.

DISTANCE d (in)	TRUCK (lbs)	NORMAL WATER (lbs)	HIGH WATER (lbs)	3xTRUCK (lbs)
0.00	0.00	0.00	0.00	0.00
0.30	17.47	11.88	53.38	44.50
1.10	218.83	55.44	249.09	557.36
0.30	253.92	67.32	302.46	646.73
0.50	272.82	87.12	391.42	694.87
0.60	250.89	110.88	498.18	639.02
1.40	158.18	166.32	747.26	402.88
0.80	118.80	198.00	889.60	302.58
2.00	0.00	198.00	889.60	0.00

The total horizontal force was calculated by determining the area in the curve. This was accomplished by taking each section between load points and finding the area assuming the section to be a trapezoid.

AREA OF TRAPEZOID = d(b + b1)/2

SECTION	L.C. #1	L.C. #2	L.C. #3	L.C. #4
1	14.68	8.01	8.46	1.78
2	497.38	166.36	368.05	37.03
3	263.35	82.73	199.03	18.41
4	508.87	173.47	374.01	38.61
5	667.05	266.88	459.57	59.40
6	1601.14	871.81	923.37	194.04
7	936.93	654.74	427.92	145.73
8	2081.78	1779.20	698.58	396.00
TOTAL	6571.18	4003.20	3458.98	891.00

```
10010 TITL ISLAND CREEK, WV, LPP
10020 TITL POST AND PANEL WALL
10030 TITL 5' WALL, L.C. #1
10040 STRU  4      .15000      634.00     1.00000
10050           .00       634.00
10060           .00       666.00
10070          2.00       666.00
10080          2.00       634.00
10090 SOLT  1  1        28.00       .00000       .13600       666.00
10100       -50.00       666.00
10110 SOLT  2  1        28.00       .00000       .12900       659.20
10120       -50.00       659.20
10130 SOLT  3  1        30.00       .00000       .13100       643.90
10140       -50.00       643.90
10150 SOLT  4  1        28.00       .00000       .12300       641.40
10160       -50.00       641.40
10170 SOLT  5  1        32.00       .00000       .12400       638.20
10180       -50.00       638.20
10190 SORT  1  1        28.00       .00000       .12300       661.00
10200        64.09       640.00
10210 SORT  2  1        32.00       .00000       .12400       638.20
10220        75.00       638.20
10230 SOST         40.00      7.20000
10240 METH  1
10250 WATR        666.00       661.00       .06250          0.
10260 EQAC        .06700       .10000
10270 FACT           .50         1.50       1.0000
10280 HOLO  6      6.571
10290 END
```

PROGRAM CSLIDE - ECHOPRINT

DATE: 10-14-93 TIME: 08:45:58

ISLAND CREEK, WV, LPP
POST AND PANEL WALL
5' WALL, L.C. #1

SINGLE FAILURE PLANE ANALYSIS

HYDROSTATIC WATER FORCE COMPUTED FOR WEDGES

NO OF CORNERS IN STRUCTURE ---------- 4
DENSITY OF CONCRETE ----------------- .1500(KCF)
DENSITY OF WATER -------------------- .0625(KCF)
WATER LEVEL LEFT SIDE --------------- 666.00(FT)
WATER LEVEL RIGHT SIDE -------------- 661.00(FT)
NO. OF SOIL LAYERS LEFT SIDE -------- 5
NO. OF SOIL LAYERS RIGHT SIDE ------- 2

ELEV. OF WEDGE-STRUCTURE INTERSECTION
ON ACTIVE SIDE OF STRUCTURE ---------634.000(FT)

STRUCTURE INFORMATION

POINT	X-COORD	Y-COORD
1	.00	634.00
2	.00	666.00
3	2.00	666.00
4	2.00	634.00

LEFTSIDE SOIL DATA

LAYER NO.	FRICTION ANGLE (DEG)	COHESION (KSF)	UNIT WEIGHT (KCF)	ELEV AT STRUCTURE (FT)
1	28.00	.0000	.136	666.00
2	28.00	.0000	.129	659.20
3	30.00	.0000	.131	643.90
4	28.00	.0000	.123	641.40
5	32.00	.0000	.124	638.20

LAYER NO	POINT NO. 1 X-COORD	Y-COORD

1	-50.00	666.00
2	-50.00	659.20
3	-50.00	643.90
4	-50.00	641.40
5	-50.00	638.20

SOIL DATA BELOW STRUCTURE

FRICTION ANGLE --------- 40.00
COHESION --------------- 7.2000

RIGHTSIDE SOIL DATA

LAYER NO.	FRICTION ANGLE (DEG)	COHESION (KSF)	UNIT WEIGHT (KCF)	ELEV AT STRUCTURE (FT)
1	28.00	.0000	.123	661.00
2	32.00	.0000	.124	638.20

LAYER NO	POINT NO. 1 X-COORD	Y-COORD
1	64.09	640.00
2	75.00	638.20

SEISMIC ACCELERATIONS

VERTICAL --------- .067
HORIZONTAL ------- .100

HORIZONTAL LOADS

WEDGE NO	LOAD
6	6.571

PROGRAM CSLIDE - FINAL RESULTS

DATE: 10-14-93 TIME: 08:46:11

ISLAND CREEK, WV, LPP
POST AND PANEL WALL
5' WALL, L.C. #1

SINGLE FAILURE PLANE ANALYSIS

HYDROSTATIC WATER FORCE COMPUTED FOR WEDGES

WEDGE NUMBER	HORIZONTAL LOADS LEFT SIDE (KIPS)	HORIZONTAL LOADS RIGHT SIDE (KIPS)	VERTICAL LOAD (KIPS)
1	.305	.000	.205
2	2.840	.000	1.903
3	.743	.000	.498
4	1.064	.000	.713
5	1.583	.000	1.060
6	7.531	.000	.643
7	1.938	.000	29.803
8	.000	5.218	24.404

WATER PRESSURES ON WEDGES

LEFTSIDE WEDGES

WEDGE NO.	TOP PRESSURE (KSF)	BOTTOM PRESSURE (KSF)
1	.000	.425
2	.425	1.381
3	1.381	1.537
4	1.537	1.737
5	1.737	2.000

STRUCTURAL WEDGE

X-COORD. (FT)	PRESSURE (KSF)
.00	2.000
2.00	1.688

RIGHTSIDE WEDGES

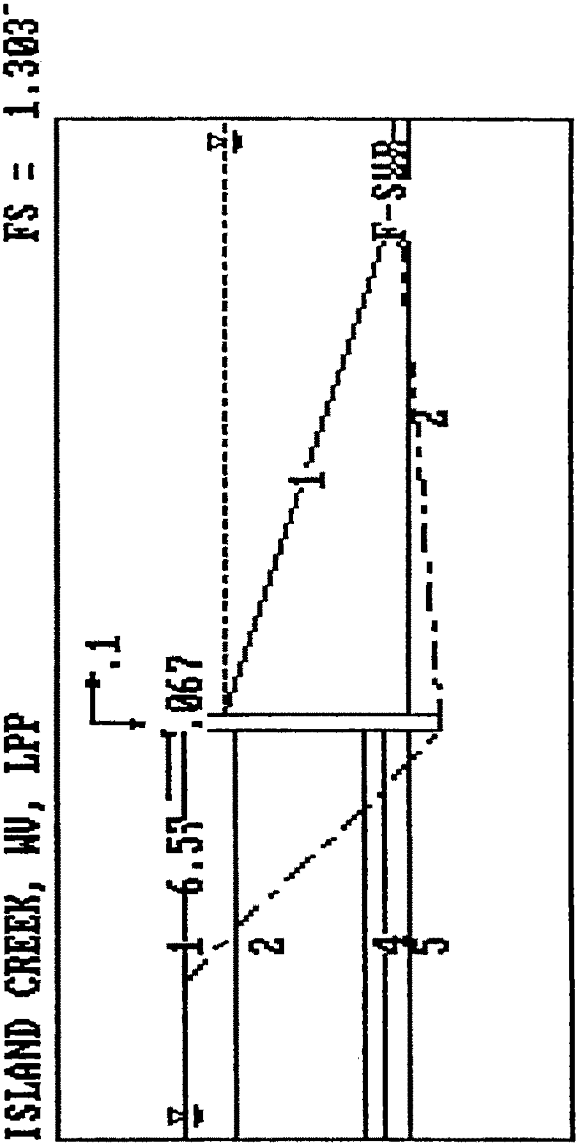
WEDGE NO.	TOP PRESSURE (KSF)	BOTTOM PRESSURE (KSF)
7	1.425	1.688
8	1.313	1.425

WEDGE NUMBER	FAILURE ANGLE (DEG)	TOTAL LENGTH (FT)	WEIGHT OF WEDGE (KIPS)	SUBMERGED LENGTH (FT)	UPLIFT FORCE (KIPS)
1	-45.840	9.479	3.053	9.479	2.014
2	-45.840	21.327	28.403	21.327	19.261
3	-45.840	3.485	7.434	3.485	5.086
4	-45.840	4.461	10.636	4.461	7.304
5	-45.840	5.855	15.825	5.855	10.941
6	.000	2.000	9.600	2.000	3.688
7	5.118	47.078	97.975	47.078	73.265
8	5.118	20.175	7.030	20.176	27.616

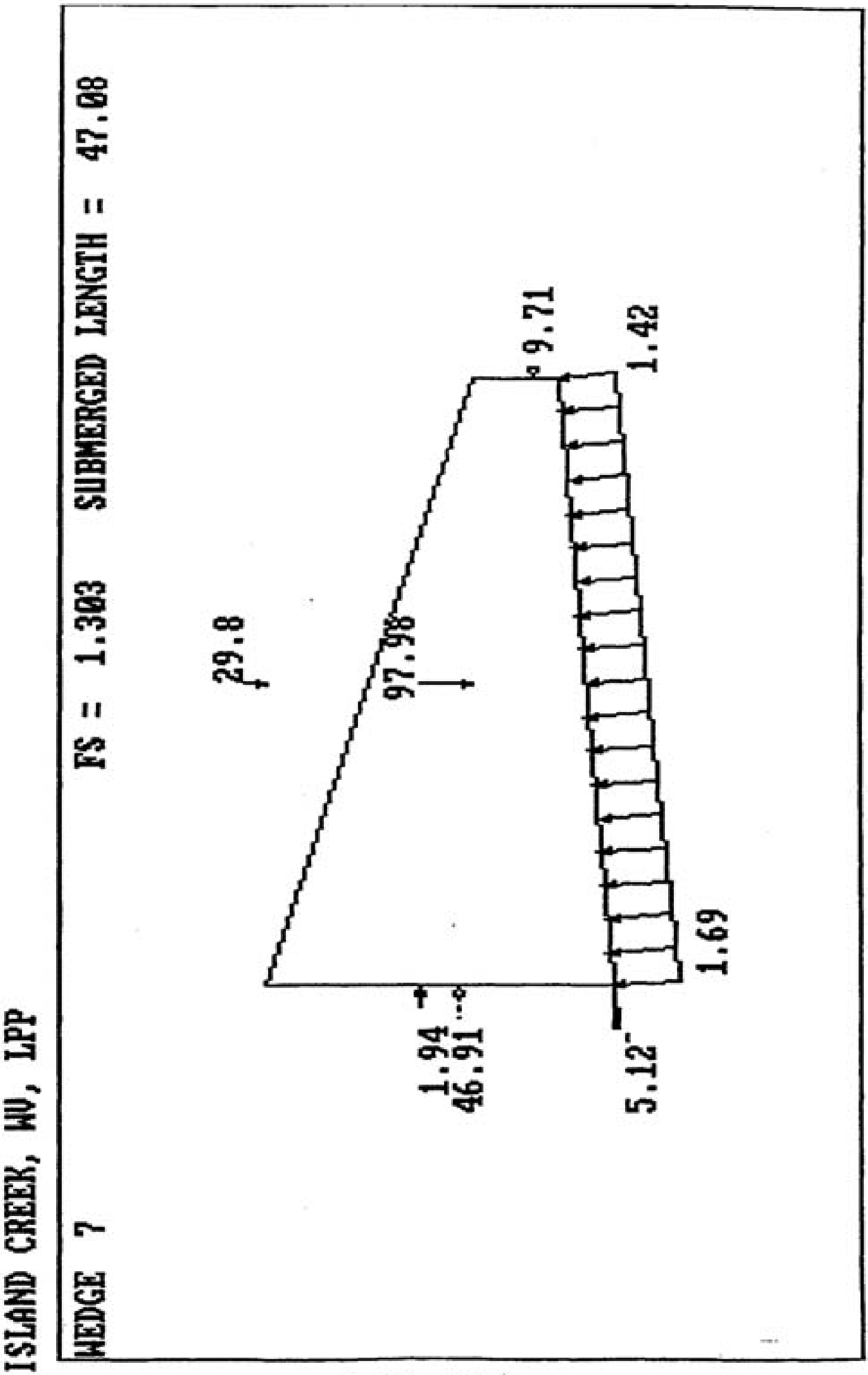
WEDGE NUMBER	NET FORCE ON WEDGE (KIPS)
1	-2.562
2	-24.049
3	-6.160
4	-9.043
5	-12.842
6	7.746
7	37.198
8	9.712

SUM OF FORCES ON SYSTEM ---- .000

FACTOR OF SAFETY ----------- 1.303 ≈ 1.33 ok EM 1110-2-2502
Table 4-1
Unusual Loading (Very)

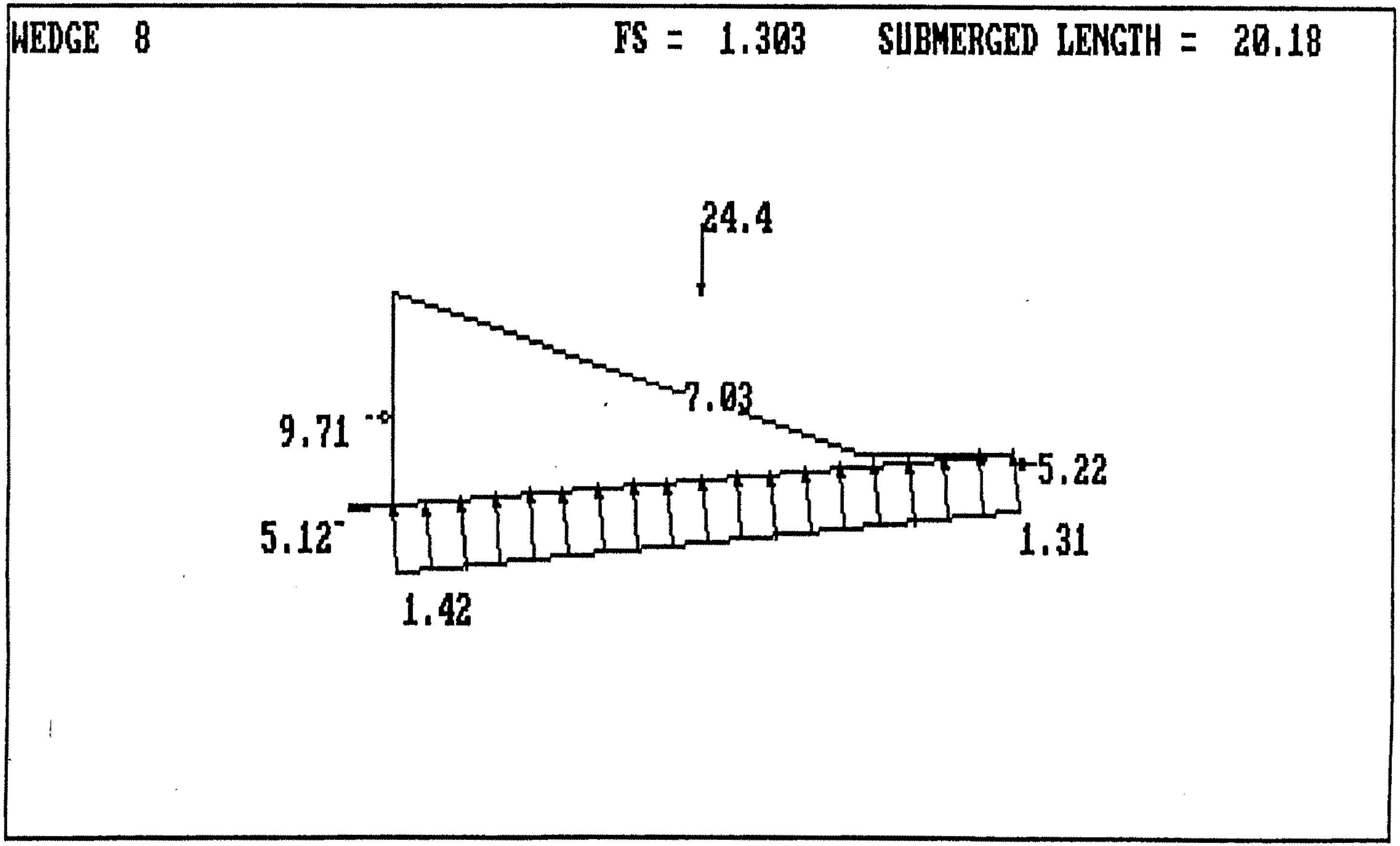


A-I- 196


ISLAND CREEK, WV, LPP
WEDGE 7
FS = 1.303
SUBMERGED LENGTH = 47.08
29.8
97.98
9.71
1.42
1.69
1.94
46.91
5.12

A-I- 197

ISLAND CREEK, WV, LPP



A-I- 198

```
1000 'ISLAND CREEK LPP, LOGAN, WV
1010 'POST AND PANEL WALL
1020 'WALL HEIGHT = 5', W14 X 193
1030 '6' C TO C SPACING, L.C. 1 (WATER HIGH & TRUCK)
1050 WALL 666 2.9E+07  1.20E+03  28.4
1060 WALL 634
1065 ANCHOR 635 R
1066 ANCHOR 634 R
1070 SURFACE RIGHTSIDE   1
1080  0.00    666.00
1090 SURFACE  LEFTSIDE   2
1100  0.00    661.00  64.09  640.0
1110 SOIL RIGHTSIDE  STRENGTH    7
1120   136.00  110.00   28.0     0.00    0.0  0.0   1.8    1.8    659.20 0
1130   129.00  110.00   28.0     0.00    0.0  0.0   1.8    1.8    647.60 0
1135   122.00  110.00   28.0     0.00    0.0  0.0   1.8    1.8    643.90 0
1136   131.00  123.00   30.0     0.00    0.0  0.0  52.0   52.0    641.40 0
1137   123.00  110.00   28.0     0.00    0.0  0.0   1.1    1.1    638.20 0
1138   124.00  114.00   32.0     0.00    0.0  0.0   3.5    3.5    631.00 0
1139   125.00  125.00   40.0    50.00    0.0  0.0   0.1    0.1
1140 SOIL  LEFTSIDE  STRENGTH    6
1141   129.00  110.00   28.0     0.00    0.0  0.0   1.8    1.8    647.60 0
1142   122.00  110.00   28.0     0.00    0.0  0.0   1.8    1.8    643.90 0
1143   131.00  123.00   30.0     0.00    0.0  0.0  52.0   52.0    641.40 0
1150   123.00  110.00   28.0     0.00    0.0  0.0   1.1    1.1    638.20 0
1155   124.00  114.00   32.0     0.00    0.0  0.0   3.5    3.5    631.00 0
1160   125.00  125.00   40.0    50.00    0.0  0.0   0.1    0.1
1170 INTERACTION   RIGHTSIDE   2   666   22.33  643.67  8.67
1171 INTERACTION   LEFTSIDE    2   661   17.33  643.67  8.67
1180 WATER ELEVATIONS    62.50  666.00  661.00
1190 H D 9 666 0.0 665.7 97.87 664.6 806.46 664.3 906.96 663.8 1086.28
1191 663.2 1133.87 661.8 1153.47 661.0 1192.18 659.0 889.60
1200 FINISH
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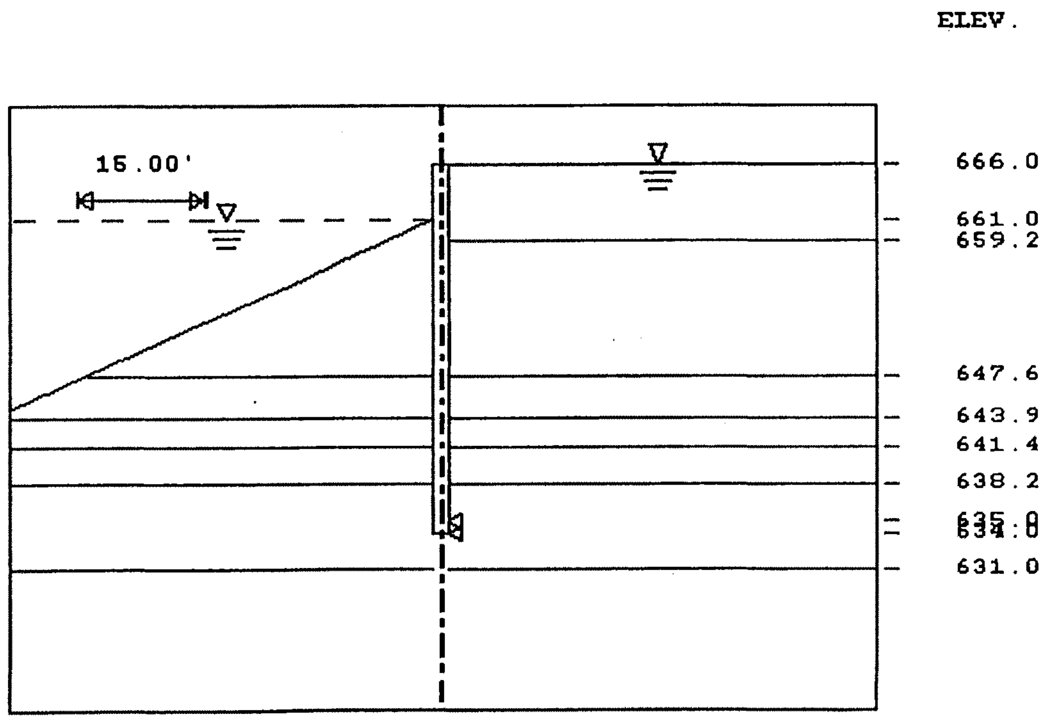
ISLAND CREEK LPP, LOGAN, WV

POST AND PANEL WALL

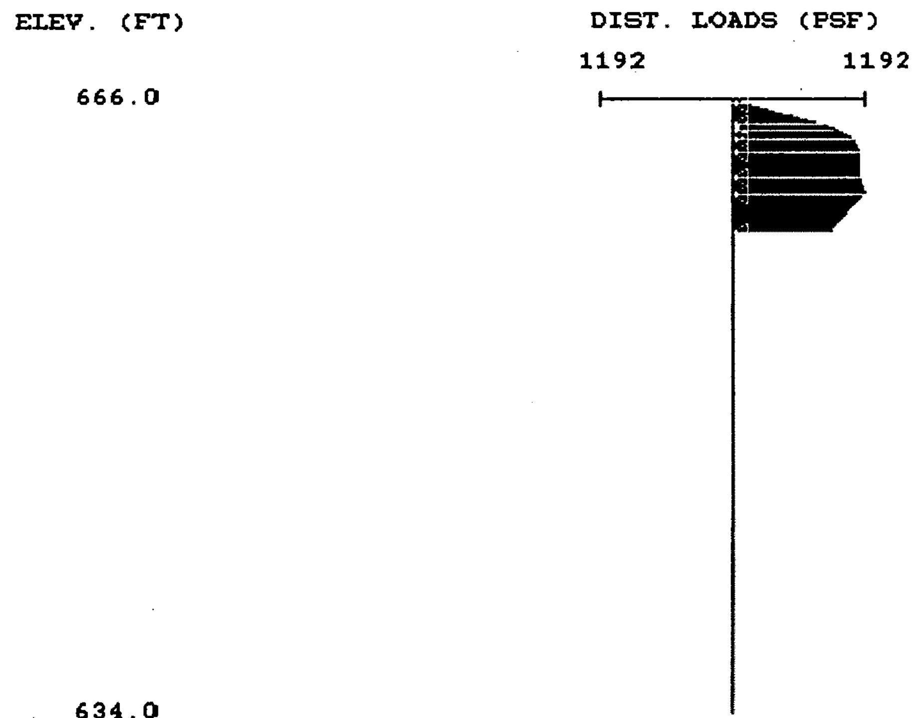


***** INPUT GEOMETRY *****

DATE: 10-OCT-1993 TIME: 17.27.54

'ISLAND CREEK LPP, LOGAN, WV

'POST AND PANEL WALL



***** INPUT HORIZONTAL LOADS *****

DATE: 10-OCT-1993 TIME: 17.31.43

A-I-201

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 10-OCT-1993 TIME: 18.47.13

INPUT DATA

I.--HEADING:
'ISLAND CREEK LPP, LOGAN, WV

'POST AND PANEL WALL

'WALL HEIGHT = 5', W14 X 193

'6' C TO C SPACING, L.C. 1 (WATER HIGH & TRUCK)

II.--WALL SEGMENT DATA

ELEVATION AT TOP OF SEGMENT (FT)	MODULUS OF ELASTICICTY (PSI)	MOMENT OF INERTIA (IN**4)	CROSS SECTION AREA (SQIN)
666.00	2.900E+07	1200.00	28.40

ELEVATION AT BOTTOM OF WALL = 634.00 (FT).

III.--ANCHOR DATA

ELEVATION AT WALL (FT)	ANCHOR TYPE ('R/F')	ULTIMATE TENSION FORCE (LB)	PRE-STRESS FORCE (LB)	ULTIMATE COMPRESSION FORCE (LB)	ANCHOR STIFFNESS (LB/IN)	ANCHOR SLOPE (FT)
635.00	RIGID					
634.00	RIGID					

IV.--SURFACE POINT DATA

IV.A.--RIGHTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	666.00

IV.B.-- LEFTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	661.00
64.09	640.00

V.--SOIL LAYER DATA

V.A.--RIGHTSIDE LAYER DATA

<UNIT SAT. (PCF)	WEIGHT> MOIST (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	WALL ADH-ESION (PSF)	<STIFF. ACT. (PCI)	COEF.> PASS. (PCI)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT)
136.00	110.00	28.00	.00	.00	.00	1.80	1.80	659.20	.00

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WA
DATE: 10-OCT-1993 TIME: 18.4

INPUT DATA

I.--HEADING:
'ISLAND CREEK LPP, LOGAN, WV

'POST AND PANEL WALL

'WALL HEIGHT = 5', W14 X 193

'6' C TO C SPACING, L.C. 1 (WATER HIGH & TRUCK)

II.--WALL SEGMENT DATA

ELEVATION AT TOP OF SEGMENT (FT)	MODULUS OF ELASTICICTY (PSI)	MOMENT OF INERTIA (IN**4)	CROSS SECTION AREA (SQIN)
666.00	2.900E+07	1200.00	28.40

ELEVATION AT BOTTOM OF WALL = 634.00 (FT).

III.--ANCHOR DATA

ELEVATION AT WALL (FT)	ANCHOR TYPE ('R/F')	ULTIMATE TENSION FORCE (LB)	PRE-STRESS FORCE (LB)	ULTIMATE COMPRESSION FORCE (LB)	ANCHOR STIFFNESS (LB/IN)	ANCHOR SLOPE (FT)
635.00	RIGID					
634.00	RIGID					

IV.--SURFACE POINT DATA

IV.A.--RIGHTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	666.00

IV.B.-- LEFTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	661.00
64.09	640.00

V.--SOIL LAYER DATA

V.A.--RIGHTSIDE LAYER DATA

<UNIT WEIGHT> SAT. (PCF)	MOIST (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	WALL ADH-ESION (PSF)	<STIFF. COEF.> ACT. (PCI)	PASS. (PCI)	<--BOTTOM--> ELEV. (FT)	SL (
136.00	110.00	28.00	.00	.00	.00	1.80	1.80	659.20	..

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129.00	110.00	28.00	.00	.00	.00	1.80	1.80	647.60	.00
122.00	110.00	28.00	.00	.00	.00	1.80	1.80	643.90	.00
131.00	123.00	30.00	.00	.00	.00	52.00	52.00	641.40	.00
123.00	110.00	28.00	.00	.00	.00	1.10	1.10	638.20	.00
124.00	114.00	32.00	.00	.00	.00	3.50	3.50	631.00	.00
125.00	125.00	40.00	50.00	.00	.00	.10	.10		

V.B.-- LEFTSIDE LAYER DATA

<UNIT WEIGHT>		ANGLE OF INTERNAL	COH-	ANGLE OF WALL	WALL ADH-	<STIFF. COEF.>		<--BOTTOM-->	
SAT.	MOIST	FRICTION	ESION	FRICTION	ESION	ACT.	PASS.	ELEV.	SLOPE
(PCF)	(PCF)	(DEG)	(PSF)	(DEG)	(PSF)	(PCI)	(PCI)	(FT)	(FT)
129.00	110.00	28.00	.00	.00	.00	1.80	1.80	647.60	.00
122.00	110.00	28.00	.00	.00	.00	1.80	1.80	643.90	.00
131.00	123.00	30.00	.00	.00	.00	52.00	52.00	641.40	.00
123.00	110.00	28.00	.00	.00	.00	1.10	1.10	638.20	.00
124.00	114.00	32.00	.00	.00	.00	3.50	3.50	631.00	.00
125.00	125.00	40.00	50.00	.00	.00	.10	.10		

VI.--INTERACTION ZONE DATA

VI.A.--RIGHTSIDE

ELEVATION AT TOP OF ZONE (FT)	INTERACTION DISTANCE (FT)
666.00	22.33
643.67	8.67

VI.B.-- LEFTSIDE

ELEVATION AT TOP OF ZONE (FT)	INTERACTION DISTANCE (FT)
661.00	17.33
643.67	8.67

VII.--WATER DATA

UNIT WEIGHT = 62.50 (PCF)
RIGHTSIDE ELEVATION = 666.00 (FT)
LEFTSIDE ELEVATION = 661.00 (FT)
NO SEEPAGE

VIII.--SURFACE LOADS
NONE

IX.--HORIZONTAL LOADS

IX.A.--EARTHQUAKE ACCELERATION = .00 (G'S)

IX.B.--HORIZONTAL LINE LOADS
NONE

IX.C.--HORIZONTAL DISTRIBUTED LOADS

ELEVATION (FT)	DIST. LOAD (PSF)
666.00	.00
665.70	97.87
664.60	806.46
664.30	906.96
663.80	1086.28

663.20	1133.87
661.80	1153.47
661.00	1192.18
659.00	889.60

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 10-OCT-1993 TIME: 18.22.05

SUMMARY OF RESULTS

I.A.--MAXIMA

		MAXIMUM	MINIMUM
BENDING MOMENT (LB-FT)	:	2.544E+05	-3.979E-07
AT ELEVATION (FT)	:	635.00	666.00
DEFLECTION (IN)	:	3.900E+00	-7.893E-04
AT ELEVATION (FT)	:	666.00	634.50
RIGHTSIDE SOIL PRESSURE (PSF)	:	993.99	
AT ELEVATION (FT)	:	634.00	
LEFTSIDE SOIL PRESSURE (PSF)	:	2427.50	
AT ELEVATION (FT)	:	642.00	

I.B.--ANCHOR FORCES

ELEVATION AT ANCHOR (FT)	ANCHOR TYPE	ANCHOR DEFORMATION (IN)	ANCHOR FORCE (LB)
635.00	RIGID	.00	264595.89
634.00	RIGID	.00	-254195.71

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WA
DATE: 10-OCT-1993 TIME: 18.2

SUMMARY OF RESULTS

I.A.--MAXIMA

		MAXIMUM	MINIMUM
BENDING MOMENT (LB-FT)	:	2.579E+05	-7.054E-07
AT ELEVATION (FT)	:	635.00	666.00
DEFLECTION (IN)	:	3.919E+00	-8.001E-04
AT ELEVATION (FT)	:	666.00	634.50
RIGHTSIDE SOIL PRESSURE (PSF)	:	993.99	
AT ELEVATION (FT)	:	634.00	
LEFTSIDE SOIL PRESSURE (PSF)	:	2231.73	
AT ELEVATION (FT)	:	641.50	

I.B.--ANCHOR FORCES

ELEVATION AT ANCHOR (FT)	ANCHOR TYPE	ANCHOR DEFORMATION (IN)	ANCHOR FORCE (LB)
635.00	RIGID	.00	268548.79
634.00	RIGID	.00	-257673.37

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  PROGRAM CSLIDE - ECHOPRINT
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DATE: 10-14-93                              TIME: 08:48:16

ISLAND CREEK, WV, LPP
POST AND PANEL WALL
5' WALL, L.C. #2

SINGLE FAILURE PLANE ANALYSIS

HYDROSTATIC WATER FORCE COMPUTED FOR WEDGES

NO OF CORNERS IN STRUCTURE ----------      4
DENSITY OF CONCRETE ----------------    .1500(KCF)
DENSITY OF WATER -------------------    .0625(KCF)
WATER LEVEL LEFT SIDE ---------------  666.00(FT)
WATER LEVEL RIGHT SIDE --------------  661.00(FT)
NO. OF SOIL LAYERS LEFT SIDE --------      5
NO. OF SOIL LAYERS RIGHT SIDE -------      2

ELEV. OF WEDGE-STRUCTURE INTERSECTION
ON ACTIVE SIDE OF STRUCTURE ---------634.000(FT)
```

STRUCTURE INFORMATION

POINT	X-COORD	Y-COORD
1	.00	634.00
2	.00	666.00
3	2.00	666.00
4	2.00	634.00

LEFTSIDE SOIL DATA

LAYER NO.	FRICTION ANGLE (DEG)	COHESION (KSF)	UNIT WEIGHT (KCF)	ELEV AT STRUCTURE (FT)
1	28.00	.0000	.136	666.00
2	28.00	.0000	.129	659.20
3	30.00	.0000	.131	643.90
4	28.00	.0000	.123	641.40
5	32.00	.0000	.124	638.20

```
LAYER       POINT NO. 1
 NO     X-COORD    Y-COORD
```

1	-50.00	666.00
2	-50.00	659.20
3	-50.00	643.90
4	-50.00	641.40
5	-50.00	638.20

SOIL DATA BELOW STRUCTURE

FRICTION ANGLE --------- 40.00
COHESION -------------- 7.2000

RIGHTSIDE SOIL DATA

LAYER NO.	FRICTION ANGLE (DEG)	COHESION (KSF)	UNIT WEIGHT (KCF)	ELEV AT STRUCTURE (FT)
1	28.00	.0000	.123	661.00
2	32.00	.0000	.124	638.20

LAYER NO	POINT NO. 1 X-COORD	Y-COORD
1	64.09	640.00
2	75.00	638.20

SEISMIC ACCELERATIONS

VERTICAL --------- .067
HORIZONTAL ------- .100

HORIZONTAL LOADS

WEDGE NO	LOAD
6	4.003

PROGRAM CSLIDE - FINAL RESULTS

DATE: 10-14-93 TIME: 08:48:26

ISLAND CREEK, WV, LPP
POST AND PANEL WALL
5' WALL, L.C. #2

SINGLE FAILURE PLANE ANALYSIS

HYDROSTATIC WATER FORCE COMPUTED FOR WEDGES

WEDGE NUMBER	HORIZONTAL LOADS LEFT SIDE (KIPS)	RIGHT SIDE (KIPS)	VERTICAL LOAD (KIPS)
1	.314	.000	.210
2	2.917	.000	1.955
3	.764	.000	.512
4	1.093	.000	.732
5	1.626	.000	1.089
6	4.963	.000	.643
7	1.352	.000	32.486
8	.000	4.502	26.430

WATER PRESSURES ON WEDGES

LEFTSIDE WEDGES

WEDGE NO.	TOP PRESSURE (KSF)	BOTTOM PRESSURE (KSF)
1	.000	.425
2	.425	1.381
3	1.381	1.537
4	1.537	1.737
5	1.737	2.000

STRUCTURAL WEDGE

X-COORD. (FT)	PRESSURE (KSF)
.00	2.000
2.00	1.688

RIGHTSIDE WEDGES

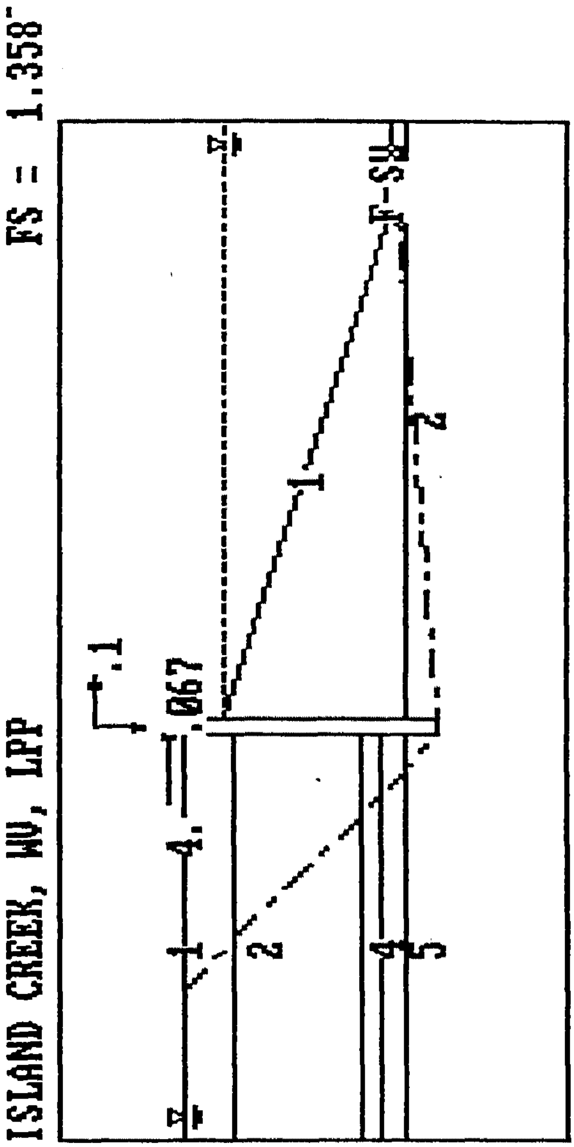
WEDGE NO.	TOP PRESSURE (KSF)	BOTTOM PRESSURE (KSF)
7	1.425	1.688
8	1.313	1.425

WEDGE NUMBER	FAILURE ANGLE (DEG)	TOTAL LENGTH (FT)	WEIGHT OF WEDGE (KIPS)	SUBMERGED LENGTH (FT)	UPLIFT FORCE (KIPS)
1	-45.072	9.605	3.136	9.605	2.041
2	-45.072	21.610	29.175	21.610	19.517
3	-45.072	3.531	7.636	3.531	5.153
4	-45.072	4.520	10.926	4.520	7.401
5	-45.072	5.932	16.255	5.932	11.086
6	.000	2.000	9.600	2.000	3.688
7	4.864	49.533	100.595	49.534	77.087
8	4.864	21.228	5.715	21.229	29.057

WEDGE NUMBER	NET FORCE ON WEDGE (KIPS)
1	-2.595
2	-24.347
3	-6.238
4	-9.154
5	-13.007
6	9.689
7	37.112
8	8.540

SUM OF FORCES ON SYSTEM ---- .000

FACTOR OF SAFETY ----------- 1.358



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1000 'ISLAND CREEK LPP, LOGAN, WV
1010 'POST AND PANEL WALL
1020 'WALL HEIGHT = 5', W14 X 193
1030 '6' C TO C SPACING, L.C. 2 (WATER HIGH & NO TRUCK)
1050 WALL 666 2.9E+07  1.20E+03  28.4
1060 WALL 634
1065 ANCHOR   635.00  R
1066 ANCHOR   634.00  R
1070 SURFACE RIGHTSIDE   1
1080  0.00    666.00
1090 SURFACE  LEFTSIDE   2
1100  0.00    661.00    64.09   640.00
1110 SOIL RIGHTSIDE  STRENGTH    7
1120   136.00  110.00   28.0     0.00   0.0  0.0   1.8   1.8   659.20 0
1130   129.00  110.00   28.0     0.00   0.0  0.0   1.8   1.8   647.60 0
1135   122.00  110.00   28.0     0.00   0.0  0.0   1.8   1.8   643.90 0
1136   131.00  123.00   30.0     0.00   0.0  0.0  52.0  52.0   641.40 0
1137   123.00  110.00   28.0     0.00   0.0  0.0   1.1   1.1   638.20 0
1138   124.00  114.00   32.0     0.00   0.0  0.0   3.5   3.5   631.00 0
1139   125.00  125.00   40.0    50.00   0.0  0.0   0.1   0.1
1140 SOIL  LEFTSIDE  STRENGTH    6
1141   129.00  110.00   28.0     0.00   0.0  0.0   1.8   1.8   647.60 0
1142   122.00  110.00   28.0     0.00   0.0  0.0   1.8   1.8   643.90 0
1143   131.00  123.00   30.0     0.00   0.0  0.0  52.0  52.0   641.40 0
1150   123.00  110.00   28.0     0.00   0.0  0.0   1.1   1.1   638.20  0
1155   124.00  114.00   32.0     0.00   0.0  0.0   3.5   3.5   631.00  0
1160   125.00  125.00   40.0    50.00   0.0  0.0   0.1   0.1
1165 INTERACTION  RIGHTSIDE  2  666  22.33  643.67  8.67
1166 INTERACTION  LEFTSIDE   2  661  17.33  643.67  8.67
1170 WATER ELEVATIONS    62.50  666.00  661.00
1175 H D 9 666.0 0.0 665.7 53.38 664.6 249.09 664.3 302.46 663.8 391.42
1176 663.2 498.18 661.8 747.26 661.0 889.60 659.0 889.6
1180 FINISH
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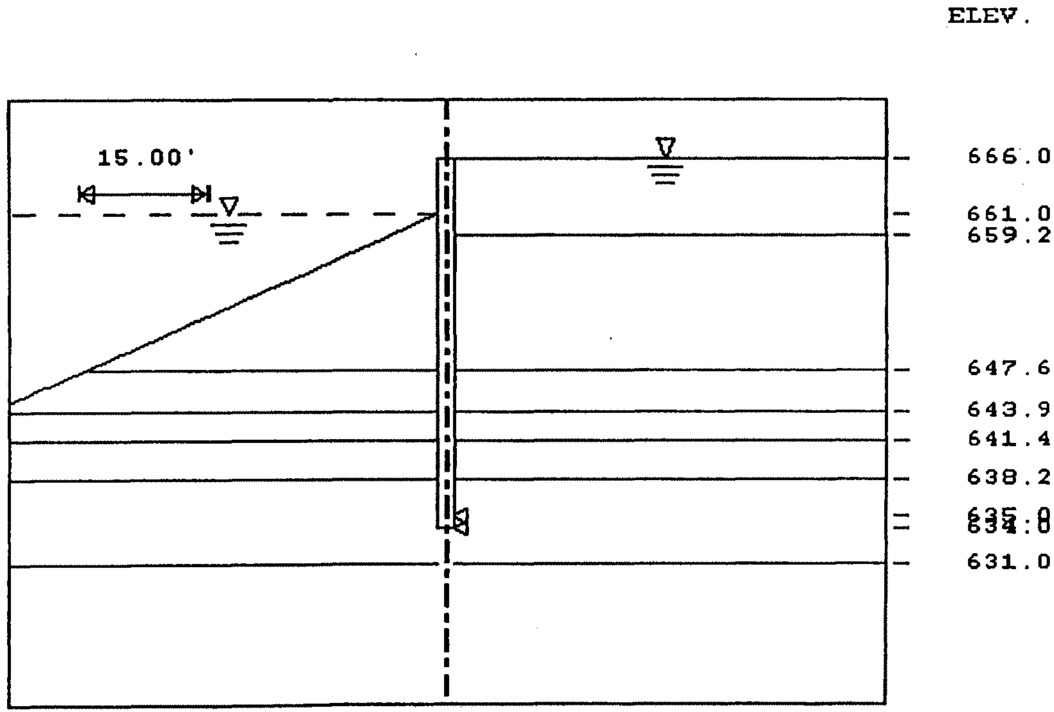
'ISLAND CREEK LPP, LOGAN, WV

'POST AND PANEL WALL



***** INPUT GEOMETRY *****

DATE: 10-OCT-1993 TIME: 18.41.17

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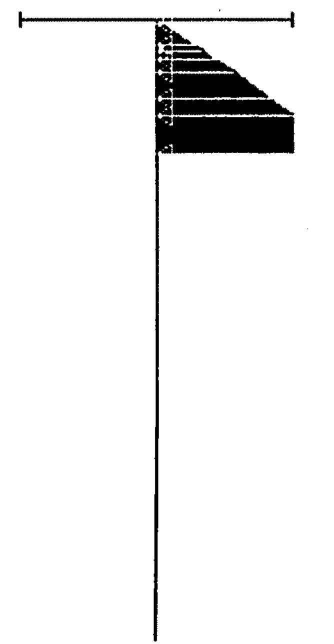
'ISLAND CREEK LPP, LOGAN, WV
'POST AND PANEL WALL

ELEV. (FT)

DIST. LOADS (PSF)

889 889

666.0



634.0

***** INPUT HORIZONTAL LOADS *****
DATE: 10-OCT-1993 TIME: 18.41.56

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 10-OCT-1993 TIME: 18.40.38

INPUT DATA

I.--HEADING:
'ISLAND CREEK LPP, LOGAN, WV

'POST AND PANEL WALL

'WALL HEIGHT = 5', W14 X 193

'6' C TO C SPACING, L.C. 2 (WATER HIGH & NO TRUCK)

II.--WALL SEGMENT DATA

ELEVATION AT TOP OF SEGMENT (FT)	MODULUS OF ELASTICICTY (PSI)	MOMENT OF INERTIA (IN**4)	CROSS SECTION AREA (SQIN)
666.00	2.900E+07	1200.00	28.40

ELEVATION AT BOTTOM OF WALL = 634.00 (FT).

III.--ANCHOR DATA

ELEVATION AT WALL (FT)	ANCHOR TYPE ('R/F')	ULTIMATE TENSION FORCE (LB)	PRE-STRESS FORCE (LB)	ULTIMATE COMPRESSION FORCE (LB)	ANCHOR STIFFNESS (LB/IN)	ANCHOR SLOPE (FT)
635.00	RIGID					
634.00	RIGID					

IV.--SURFACE POINT DATA

IV.A.--RIGHTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	666.00

IV.B.-- LEFTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	661.00
64.09	640.00

V.--SOIL LAYER DATA

V.A.--RIGHTSIDE LAYER DATA

<UNIT WEIGHT> SAT. (PCF)	MOIST (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	WALL ADH-ESION (PSF)	<STIFF. COEF.> ACT. (PCI)	PASS. (PCI)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT)
136.00	110.00	28.00	.00	.00	.00	1.80	1.80	659.20	.00

129.00	110.00	28.00	.00	.00	.00	1.80	1.80	647.60	.00
122.00	110.00	28.00	.00	.00	.00	1.80	1.80	643.90	.00
131.00	123.00	30.00	.00	.00	.00	52.00	52.00	641.40	.00
123.00	110.00	28.00	.00	.00	.00	1.10	1.10	638.20	.00
124.00	114.00	32.00	.00	.00	.00	3.50	3.50	631.00	.00
125.00	125.00	40.00	50.00	.00	.00	.10	.10		

V.B.-- LEFTSIDE LAYER DATA

<UNIT WEIGHT> SAT. (PCF)	MOIST (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	WALL ADH-ESION (PSF)	<STIFF. COEF.> ACT. (PCI)	PASS. (PCI)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT)
129.00	110.00	28.00	.00	.00	.00	1.80	1.80	647.60	.00
122.00	110.00	28.00	.00	.00	.00	1.80	1.80	643.90	.00
131.00	123.00	30.00	.00	.00	.00	52.00	52.00	641.40	.00
123.00	110.00	28.00	.00	.00	.00	1.10	1.10	638.20	.00
124.00	114.00	32.00	.00	.00	.00	3.50	3.50	631.00	.00
125.00	125.00	40.00	50.00	.00	.00	.10	.10		

VI.--INTERACTION ZONE DATA

VI.A.--RIGHTSIDE

ELEVATION AT TOP OF ZONE (FT)	INTERACTION DISTANCE (FT)
666.00	22.33
643.67	8.67

VI.B.-- LEFTSIDE

ELEVATION AT TOP OF ZONE (FT)	INTERACTION DISTANCE (FT)
661.00	17.33
643.67	8.67

VII.--WATER DATA

UNIT WEIGHT = 62.50 (PCF)
RIGHTSIDE ELEVATION = 666.00 (FT)
LEFTSIDE ELEVATION = 661.00 (FT)
NO SEEPAGE

VIII.--SURFACE LOADS
NONE

IX.--HORIZONTAL LOADS

IX.A.--EARTHQUAKE ACCELERATION = .00 (G'S)

IX.B.--HORIZONTAL LINE LOADS
NONE

IX.C.--HORIZONTAL DISTRIBUTED LOADS

ELEVATION (FT)	DIST. LOAD (PSF)
666.00	.00
665.70	53.38
664.60	249.09
664.30	302.46
663.80	391.42

663.20	498.18
661.80	747.26
661.00	889.60
659.00	889.60

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 10-OCT-1993 TIME: 18.42.39

SUMMARY OF RESULTS

I.A.--MAXIMA

		MAXIMUM	MINIMUM
BENDING MOMENT (LB-FT)	:	1.972E+05	9.242E-12
AT ELEVATION (FT)	:	635.00	634.00
DEFLECTION (IN)	:	2.935E+00	-6.116E-04
AT ELEVATION (FT)	:	666.00	634.50
RIGHTSIDE SOIL PRESSURE (PSF)	:	993.99	
AT ELEVATION (FT)	:	634.00	
LEFTSIDE SOIL PRESSURE (PSF)	:	2427.50	
AT ELEVATION (FT)	:	642.00	

I.B.--ANCHOR FORCES

ELEVATION AT ANCHOR (FT)	ANCHOR TYPE	ANCHOR DEFORMATION (IN)	ANCHOR FORCE (LB)
635.00	RIGID	.00	205825.69
634.00	RIGID	.00	-196923.61

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 10-OCT-1993 TIME: 18.43.14

SUMMARY OF RESULTS

I.A.--MAXIMA

		MAXIMUM	MINIMUM
BENDING MOMENT (LB-FT)	:	2.006E+05	-2.909E-07
AT ELEVATION (FT)	:	635.00	666.00
DEFLECTION (IN)	:	2.954E+00	-6.222E-04
AT ELEVATION (FT)	:	666.00	634.50
RIGHTSIDE SOIL PRESSURE (PSF)	:	993.99	
AT ELEVATION (FT)	:	634.00	
LEFTSIDE SOIL PRESSURE (PSF)	:	2231.73	
AT ELEVATION (FT)	:	641.50	

I.B.--ANCHOR FORCES

ELEVATION AT ANCHOR (FT)	ANCHOR TYPE	ANCHOR DEFORMATION (IN)	ANCHOR FORCE (LB)
635.00	RIGID	.00	209729.76
634.00	RIGID	.00	-200355.66

```
10010 TITL ISLAND CREEK, WV, LPP
10020 TITL POST AND PANEL WALL
10030 TITL 5' WALL, L.C. #3
10040 STRU  4        .15000        634.00       1.00000
10050            .00       634.00
10060            .00       666.00
10070           2.00       666.00
10080           2.00       634.00
10090 SOLT  1  1        28.00       .00000       .13600       666.00
10100         -50.00       666.00
10110 SOLT  2  1        28.00       .00000       .12900       659.20
10120         -50.00       659.20
10130 SOLT  3  1        30.00       .00000       .13100       643.90
10140         -50.00       643.90
10150 SOLT  4  1        28.00       .00000       .12300       641.40
10160         -50.00       641.40
10170 SOLT  5  1        32.00       .00000       .12400       638.20
10180         -50.00       638.20
10190 SORT  1  1        28.00       .00000       .12300       661.00
10200          64.09       640.00
10210 SORT  2  1        32.00       .00000       .12400       638.20
10220          75.00       638.20
10230 SOST        40.00       7.20000
10240 METH  1
10250 WATR       642.00       642.00       .06250          0.
10260 EQAC       .06700       .10000
10270 FACT          .50         1.50       1.0000
10280 HOLO  6       3.459
10290 END
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  PROGRAM CSLIDE - ECHOPRINT
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DATE: 10-14-93                              TIME: 08:51:01


ISLAND CREEK, WV, LPP
POST AND PANEL WALL
5' WALL, L.C. #3


SINGLE FAILURE PLANE ANALYSIS

HYDROSTATIC WATER FORCE COMPUTED FOR WEDGES


NO OF CORNERS IN STRUCTURE ----------        4
DENSITY OF CONCRETE -----------------    .1500(KCF)
DENSITY OF WATER --------------------    .0625(KCF)
WATER LEVEL LEFT SIDE ---------------   642.00(FT)
WATER LEVEL RIGHT SIDE --------------   642.00(FT)
NO. OF SOIL LAYERS LEFT SIDE --------        5
NO. OF SOIL LAYERS RIGHT SIDE -------        2


ELEV. OF WEDGE-STRUCTURE INTERSECTION
ON ACTIVE SIDE OF STRUCTURE ---------634.000(FT)
```

STRUCTURE INFORMATION

POINT	X-COORD	Y-COORD
1	.00	634.00
2	.00	666.00
3	2.00	666.00
4	2.00	634.00

LEFTSIDE SOIL DATA

LAYER NO.	FRICTION ANGLE (DEG)	COHESION (KSF)	UNIT WEIGHT (KCF)	ELEV AT STRUCTURE (FT)
1	28.00	.0000	.136	666.00
2	28.00	.0000	.129	659.20
3	30.00	.0000	.131	643.90
4	28.00	.0000	.123	641.40
5	32.00	.0000	.124	638.20

```
LAYER       POINT NO. 1
 NO     X-COORD   Y-COORD
```

1	-50.00	666.00
2	-50.00	659.20
3	-50.00	643.90
4	-50.00	641.40
5	-50.00	638.20

SOIL DATA BELOW STRUCTURE

FRICTION ANGLE --------- 40.00
COHESION -------------- 7.2000

RIGHTSIDE SOIL DATA

LAYER NO.	FRICTION ANGLE (DEG)	COHESION (KSF)	UNIT WEIGHT (KCF)	ELEV AT STRUCTURE (FT)
1	28.00	.0000	.123	661.00
2	32.00	.0000	.124	638.20

LAYER NO	POINT NO. 1 X-COORD	Y-COORD
1	64.09	640.00
2	75.00	638.20

SEISMIC ACCELERATIONS

VERTICAL --------- .067
HORIZONTAL ------- .100

HORIZONTAL LOADS

WEDGE NO	LOAD
6	3.459

PROGRAM CSLIDE - FINAL RESULTS

DATE: 10-14-93 TIME: 08:51:12

ISLAND CREEK, WV, LPP
POST AND PANEL WALL
5' WALL, L.C. #3

SINGLE FAILURE PLANE ANALYSIS

HYDROSTATIC WATER FORCE COMPUTED FOR WEDGES

WEDGE NUMBER	HORIZONTAL LOADS LEFT SIDE (KIPS)	HORIZONTAL LOADS RIGHT SIDE (KIPS)	VERTICAL LOAD (KIPS)
1	.287	.000	.192
2	2.667	.000	1.787
3	.698	.000	.468
4	.999	.000	.669
5	1.486	.000	.996
6	4.419	.000	.643
7	10.652	.000	7.137
8	.215	.000	2.865

WATER PRESSURES ON WEDGES

LEFTSIDE WEDGES

WEDGE NO.	TOP PRESSURE (KSF)	BOTTOM PRESSURE (KSF)
1	.000	.000
2	.000	.000
3	.000	.037
4	.037	.237
5	.237	.500

STRUCTURAL WEDGE

X-COORD. (FT)	PRESSURE (KSF)
.00	.500
2.00	.500

RIGHTSIDE WEDGES

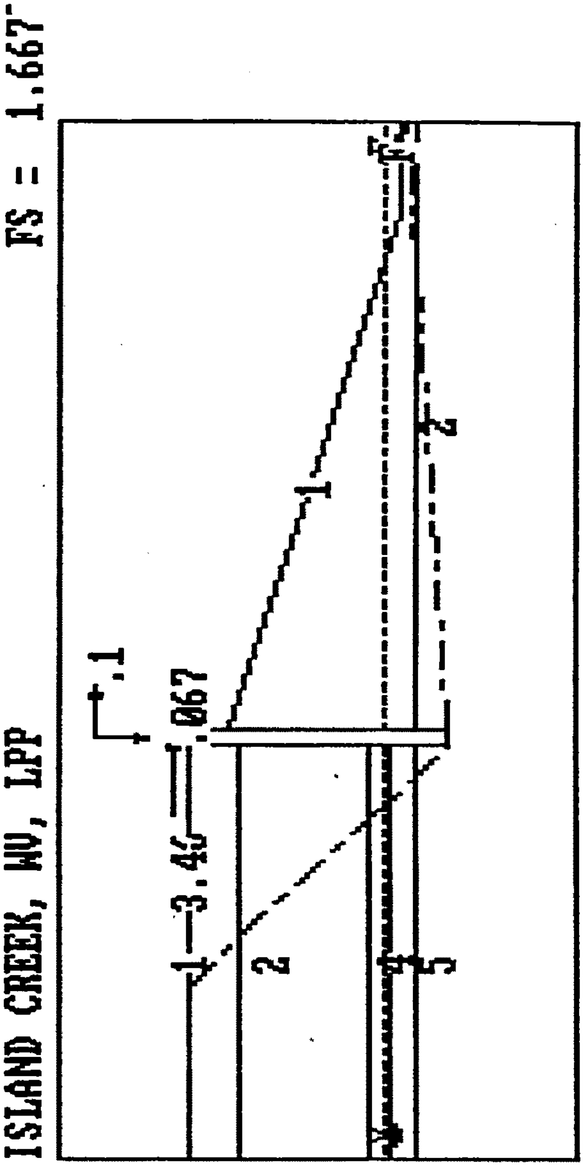
WEDGE NO.	TOP PRESSURE (KSF)	BOTTOM PRESSURE (KSF)
7	.237	.500
8	.125	.237

WEDGE NUMBER	FAILURE ANGLE (DEG)	TOTAL LENGTH (FT)	WEIGHT OF WEDGE (KIPS)	SUBMERGED LENGTH (FT)	UPLIFT FORCE (KIPS)
1	-47.635	9.203	2.868	.000	.000
2	-47.635	20.707	26.674	.000	.000
3	-47.635	3.384	6.982	.812	.015
4	-47.635	4.331	9.989	4.331	.596
5	-47.635	5.684	14.862	5.684	2.096
6	.000	2.000	9.600	2.000	1.000
7	4.277	56.319	106.517	56.319	20.768
8	4.277	24.137	3.395	24.137	4.375

WEDGE NUMBER	NET FORCE ON WEDGE (KIPS)
1	-2.049
2	-19.064
3	-4.754
4	-7.348
5	-10.423
6	8.871
7	33.890
8	.877

SUM OF FORCES ON SYSTEM ---- .000

FACTOR OF SAFETY ----------- 1.667 > 1.5 ok EM 1110-2-2502
Table 4-1
Usual Loading



A-I-226

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1000 'ISLAND CREEK LPP, LOGAN, WV
1010 'POST AND PANEL WALL
1020 'WALL HEIGHT = 5', W14 X 193
1030 '6' C TO C SPACING, L.C. 3 (NORMAL WATER & TRUCK)
1050 WALL 666 2.9E+07  1.20E+03  28.4
1060 WALL 634
1065 ANCHOR   635.00  R
1066 ANCHOR   634.00  R
1070 SURFACE RIGHTSIDE   1
1080  0.00      666.00
1090 SURFACE  LEFTSIDE   2
1100  0.00      661.00    64.09    640.00
1110 SOIL RIGHTSIDE  STRENGTH    8
1120    136.00  110.00    28.0      0.00    0.0   0.0    3.0     3.0     659.20 0
1130    129.00  110.00    28.0      0.00    0.0   0.0    3.0     3.0     647.60 0
1134    122.00  110.00    28.0      0.00    0.0   0.0    3.0     3.0     643.90 0
1135    131.00  123.00    30.0      0.00    0.0   0.0   86.7    86.7     642.00 0
1136    131.00  123.00    30.0      0.00    0.0   0.0   52.0    52.0     641.40 0
1137    123.00  110.00    28.0      0.00    0.0   0.0    1.1     1.1     638.20 0
1138    124.00  114.00    32.0      0.00    0.0   0.0    3.5     3.5     631.00 0
1139    125.00  125.00    40.0     50.00    0.0   0.0    0.1     0.1
1140 SOIL  LEFTSIDE  STRENGTH    7
1141    129.00  110.00    28.0      0.00    0.0   0.0    3.0     3.0     647.60 0
1142    122.00  110.00    28.0      0.00    0.0   0.0    3.0     3.0     643.90 0
1143    131.00  123.00    30.0      0.00    0.0   0.0   86.7    86.7     642.00 0
1143    131.00  123.00    30.0      0.00    0.0   0.0   52.0    52.0     641.40 0
1150    123.00  110.00    28.0      0.00    0.0   0.0    1.1     1.1     638.20 0
1155    124.00  114.00    32.0      0.00    0.0   0.0    3.5     3.5     631.00 0
1160    125.00  125.00    40.0     50.00    0.0   0.0    0.1     0.1
1165 INTERACTION RIGHTSIDE  2  666    22.33    643.67    8.67
1166 INTERACTION LEFTSIDE   2  661    17.33    643.67    8.67
1170 WATER ELEVATIONS    62.50  642.00  642.00
1180 H D 9 666 0.0 665.7 56.38 664.6 612.80 664.3 714.05 663.8 781.99
1185 663.2 749.90 661.8 569.20 661.0 500.58 659.0 198.0
1190 FINISH
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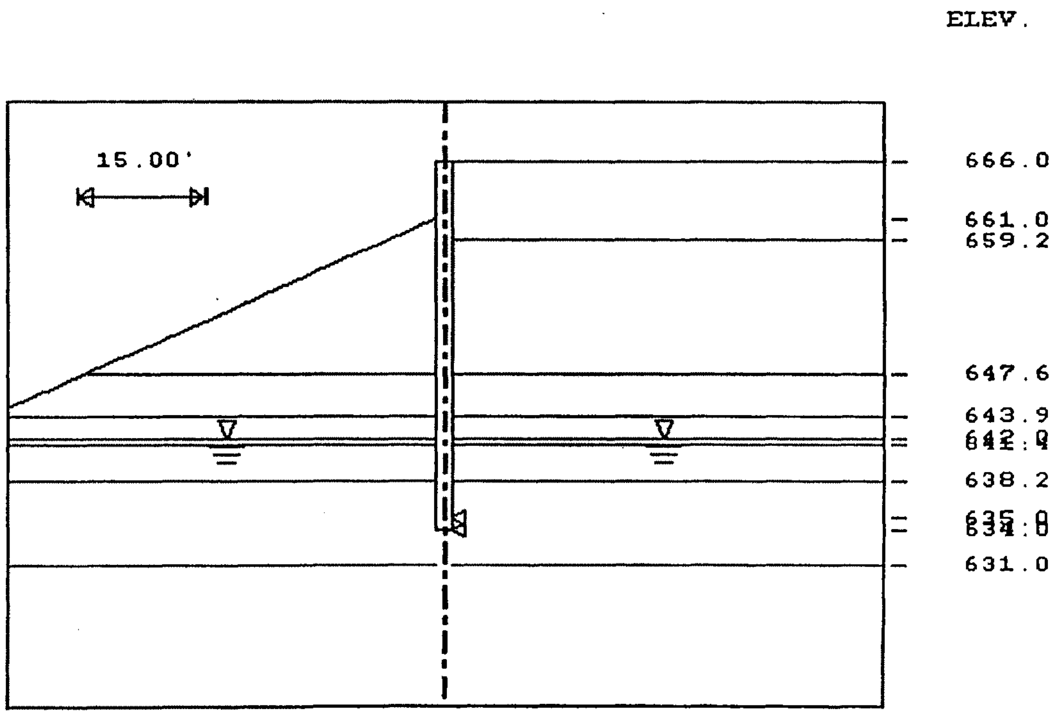
'ISLAND CREEK LPP, LOGAN, WV

'POST AND PANEL WALL

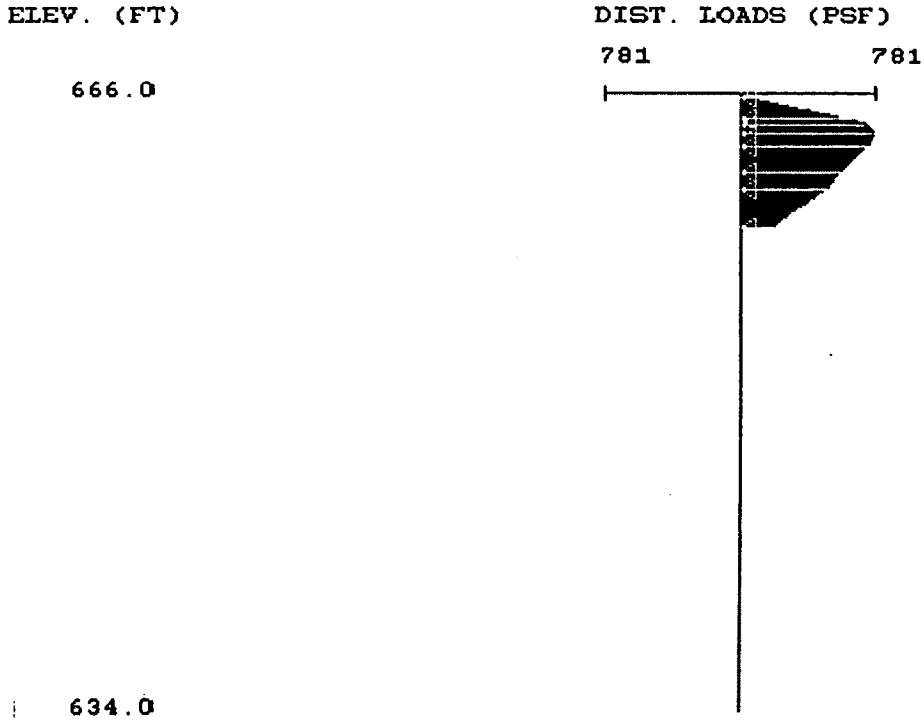


***** INPUT GEOMETRY *****

DATE: 10-OCT-1993 TIME: 19.01.00

A-I- 228

'ISLAND CREEK LPP, LOGAN, WV
'POST AND PANEL WALL



***** INPUT HORIZONTAL LOADS *****
DATE: 10-OCT-1993 TIME: 19.01.24

A-I-229

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 10-OCT-1993 TIME: 19.00.34

INPUT DATA

I.--HEADING:
'ISLAND CREEK LPP, LOGAN, WV

'POST AND PANEL WALL

'WALL HEIGHT = 5', W14 X 193

'6' C TO C SPACING, L.C. 3 (NORMAL WATER & TRUCK)

II.--WALL SEGMENT DATA

ELEVATION AT TOP OF SEGMENT (FT)	MODULUS OF ELASTICICTY (PSI)	MOMENT OF INERTIA (IN**4)	CROSS SECTION AREA (SQIN)
666.00	2.900E+07	1200.00	28.40

ELEVATION AT BOTTOM OF WALL = 634.00 (FT).

III.--ANCHOR DATA

ELEVATION AT WALL (FT)	ANCHOR TYPE ('R/F')	ULTIMATE TENSION FORCE (LB)	PRE-STRESS FORCE (LB)	ULTIMATE COMPRESSION FORCE (LB)	ANCHOR STIFFNESS (LB/IN)	ANCHOR SLOPE (FT)
635.00	RIGID					
634.00	RIGID					

IV.--SURFACE POINT DATA

IV.A.--RIGHTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	666.00

IV.B.-- LEFTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	661.00
64.09	640.00

V.--SOIL LAYER DATA

V.A.--RIGHTSIDE LAYER DATA

<UNIT WEIGHT> SAT. (PCF)	MOIST (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	WALL ADH-ESION (PSF)	<STIFF. COEF.> ACT. (PCI)	PASS. (PCI)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT)
136.00	110.00	28.00	.00	.00	.00	3.00	3.00	659.20	.00

129.00	110.00	28.00	.00	.00	.00	3.00	3.00	647.60	.00
122.00	110.00	28.00	.00	.00	.00	3.00	3.00	643.90	.00
131.00	123.00	30.00	.00	.00	.00	86.70	86.70	642.00	.00
131.00	123.00	30.00	.00	.00	.00	52.00	52.00	641.40	.00
123.00	110.00	28.00	.00	.00	.00	1.10	1.10	638.20	.00
124.00	114.00	32.00	.00	.00	.00	3.50	3.50	631.00	.00
125.00	125.00	40.00	50.00	.00	.00	.10	.10		

V.B.-- LEFTSIDE LAYER DATA

<UNIT	WEIGHT>	ANGLE OF INTERNAL	COH-	ANGLE OF WALL	WALL ADH-	<STIFF.	COEF.>	<--BOTTOM-->	
SAT.	MOIST	FRICTION	ESION	FRICTION	ESION	ACT.	PASS.	ELEV.	SLOPE
(PCF)	(PCF)	(DEG)	(PSF)	(DEG)	(PSF)	(PCI)	(PCI)	(FT)	(FT)
129.00	110.00	28.00	.00	.00	.00	3.00	3.00	647.60	.00
122.00	110.00	28.00	.00	.00	.00	3.00	3.00	643.90	.00
131.00	123.00	30.00	.00	.00	.00	86.70	86.70	642.00	.00
131.00	123.00	30.00	.00	.00	.00	52.00	52.00	641.40	.00
123.00	110.00	28.00	.00	.00	.00	1.10	1.10	638.20	.00
124.00	114.00	32.00	.00	.00	.00	3.50	3.50	631.00	.00
125.00	125.00	40.00	50.00	.00	.00	.10	.10		

VI.--INTERACTION ZONE DATA

VI.A.--RIGHTSIDE

ELEVATION AT TOP OF ZONE (FT)	INTERACTION DISTANCE (FT)
666.00	22.33
643.67	8.67

VI.B.-- LEFTSIDE

ELEVATION AT TOP OF ZONE (FT)	INTERACTION DISTANCE (FT)
661.00	17.33
643.67	8.67

VII.--WATER DATA

UNIT WEIGHT = 62.50 (PCF)
RIGHTSIDE ELEVATION = 642.00 (FT)
LEFTSIDE ELEVATION = 642.00 (FT)
NO SEEPAGE

VIII.--SURFACE LOADS
NONE

IX.--HORIZONTAL LOADS

IX.A.--EARTHQUAKE ACCELERATION = .00 (G'S)

IX.B.--HORIZONTAL LINE LOADS
NONE

IX.C.--HORIZONTAL DISTRIBUTED LOADS

ELEVATION (FT)	DIST. LOAD (PSF)
666.00	.00
665.70	56.38
664.60	612.80

664.30	714.05
663.80	781.99
663.20	749.90
661.80	569.20
661.00	500.58
659.00	198.00

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 10-OCT-1993 TIME: 19.02.18

SUMMARY OF RESULTS

I.A.--MAXIMA

		MAXIMUM	MINIMUM
BENDING MOMENT (LB-FT)	:	8.693E+04	-2.616E-08
AT ELEVATION (FT)	:	642.00	666.00
DEFLECTION (IN)	:	1.592E+00	-2.359E-04
AT ELEVATION (FT)	:	666.00	634.50
RIGHTSIDE SOIL PRESSURE (PSF)	:	1517.51	
AT ELEVATION (FT)	:	638.20	
LEFTSIDE SOIL PRESSURE (PSF)	:	3950.59	
AT ELEVATION (FT)	:	643.00	

I.B.--ANCHOR FORCES

ELEVATION AT ANCHOR (FT)	ANCHOR TYPE	ANCHOR DEFORMATION (IN)	ANCHOR FORCE (LB)
635.00	RIGID	.00	75328.16
634.00	RIGID	.00	-75921.88

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 10-OCT-1993 TIME: 19.02.57

SUMMARY OF RESULTS

I.A.--MAXIMA

		MAXIMUM	MINIMUM
BENDING MOMENT (LB-FT)	:	8.700E+04	-1.344E-07
AT ELEVATION (FT)	:	642.00	666.00
DEFLECTION (IN)	:	1.600E+00	-2.409E-04
AT ELEVATION (FT)	:	666.00	634.50
RIGHTSIDE SOIL PRESSURE (PSF)	:	1517.13	
AT ELEVATION (FT)	:	638.20	
LEFTSIDE SOIL PRESSURE (PSF)	:	3833.91	
AT ELEVATION (FT)	:	642.00	

I.B.--ANCHOR FORCES

ELEVATION AT ANCHOR (FT)	ANCHOR TYPE	ANCHOR DEFORMATION (IN)	ANCHOR FORCE (LB)
635.00	RIGID	.00	77166.86
634.00	RIGID	.00	-77543.35

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10010 TITL ISLAND CREEK, WV, LPP
10020 TITL POST AND PANEL WALL
10030 TITL 5' WALL, L.C. #4
10040 STRU  4      .15000      634.00      1.00000
10050          .00       634.00
10060          .00       666.00
10070         2.00       666.00
10080         2.00       634.00
10090 SOLT  1  1       28.00      .00000      .13600      666.00
10100       -50.00       666.00
10110 SOLT  2  1       28.00      .00000      .12900      659.20
10120       -50.00       659.20
10130 SOLT  3  1       30.00      .00000      .13100      643.90
10140       -50.00       643.90
10150 SOLT  4  1       28.00      .00000      .12300      641.40
10160       -50.00       641.40
10170 SOLT  5  1       32.00      .00000      .12400      638.20
10180       -50.00       638.20
10190 SORT  1  1       28.00      .00000      .12300      661.00
10200        64.09       640.00
10210 SORT  2  1       32.00      .00000      .12400      638.20
10220        75.00       638.20
10230 SOST         40.00      7.20000
10240 METH  1
10250 WATR        642.00      642.00      .06250        0.
10260 EQAC        .06700      .10000
10270 FACT           .50        1.50      1.0000
10280 HOLO  6       0.891
10290 END
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  PROGRAM CSLIDE - ECHOPRINT
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DATE: 10-14-93                                    TIME: 08:51:47


ISLAND CREEK, WV, LPP
POST AND PANEL WALL
5' WALL, L.C. #4

SINGLE FAILURE PLANE ANALYSIS

HYDROSTATIC WATER FORCE COMPUTED FOR WEDGES


NO OF CORNERS IN STRUCTURE ----------         4
DENSITY OF CONCRETE ----------------       .1500(KCF)
DENSITY OF WATER -------------------       .0625(KCF)
WATER LEVEL LEFT SIDE --------------     642.00(FT)
WATER LEVEL RIGHT SIDE -------------     642.00(FT)
NO. OF SOIL LAYERS LEFT SIDE --------         5
NO. OF SOIL LAYERS RIGHT SIDE -------         2

ELEV. OF WEDGE-STRUCTURE INTERSECTION
ON ACTIVE SIDE OF STRUCTURE ---------634.000(FT)
```

STRUCTURE INFORMATION

POINT	X-COORD	Y-COORD
1	.00	634.00
2	.00	666.00
3	2.00	666.00
4	2.00	634.00

LEFTSIDE SOIL DATA

LAYER NO.	FRICTION ANGLE (DEG)	COHESION (KSF)	UNIT WEIGHT (KCF)	ELEV AT STRUCTURE (FT)
1	28.00	.0000	.136	666.00
2	28.00	.0000	.129	659.20
3	30.00	.0000	.131	643.90
4	28.00	.0000	.123	641.40
5	32.00	.0000	.124	638.20

```
LAYER       POINT NO. 1
 NO     X-COORD    Y-COORD
```

1	-50.00	666.00
2	-50.00	659.20
3	-50.00	643.90
4	-50.00	641.40
5	-50.00	638.20

SOIL DATA BELOW STRUCTURE

FRICTION ANGLE --------- 40.00
COHESION --------------- 7.2000

RIGHTSIDE SOIL DATA

LAYER NO.	FRICTION ANGLE (DEG)	COHESION (KSF)	UNIT WEIGHT (KCF)	ELEV AT STRUCTURE (FT)
1	28.00	.0000	.123	661.00
2	32.00	.0000	.124	638.20

LAYER NO	POINT NO. 1 X-COORD	Y-COORD
1	64.09	640.00
2	75.00	638.20

SEISMIC ACCELERATIONS

VERTICAL --------- .067
HORIZONTAL ------- .100

HORIZONTAL LOADS

WEDGE NO	LOAD
6	.891

PROGRAM CSLIDE - FINAL RESULTS

DATE: 10-14-93 TIME: 08:51:56

ISLAND CREEK, WV, LPP
POST AND PANEL WALL
5' WALL, L.C. #4

SINGLE FAILURE PLANE ANALYSIS

HYDROSTATIC WATER FORCE COMPUTED FOR WEDGES

WEDGE NUMBER	HORIZONTAL LOADS LEFT SIDE (KIPS)	HORIZONTAL LOADS RIGHT SIDE (KIPS)	VERTICAL LOAD (KIPS)
1	.293	.000	.196
2	2.722	.000	1.824
3	.713	.000	.477
4	1.019	.000	.683
5	1.517	.000	1.016
6	1.851	.000	.643
7	10.652	.000	7.137
8	.215	.000	2.865

WATER PRESSURES ON WEDGES

LEFTSIDE WEDGES

WEDGE NO.	TOP PRESSURE (KSF)	BOTTOM PRESSURE (KSF)
1	.000	.000
2	.000	.000
3	.000	.037
4	.037	.237
5	.237	.500

STRUCTURAL WEDGE

X-COORD. (FT)	PRESSURE (KSF)
.00	.500
2.00	.500

RIGHTSIDE WEDGES

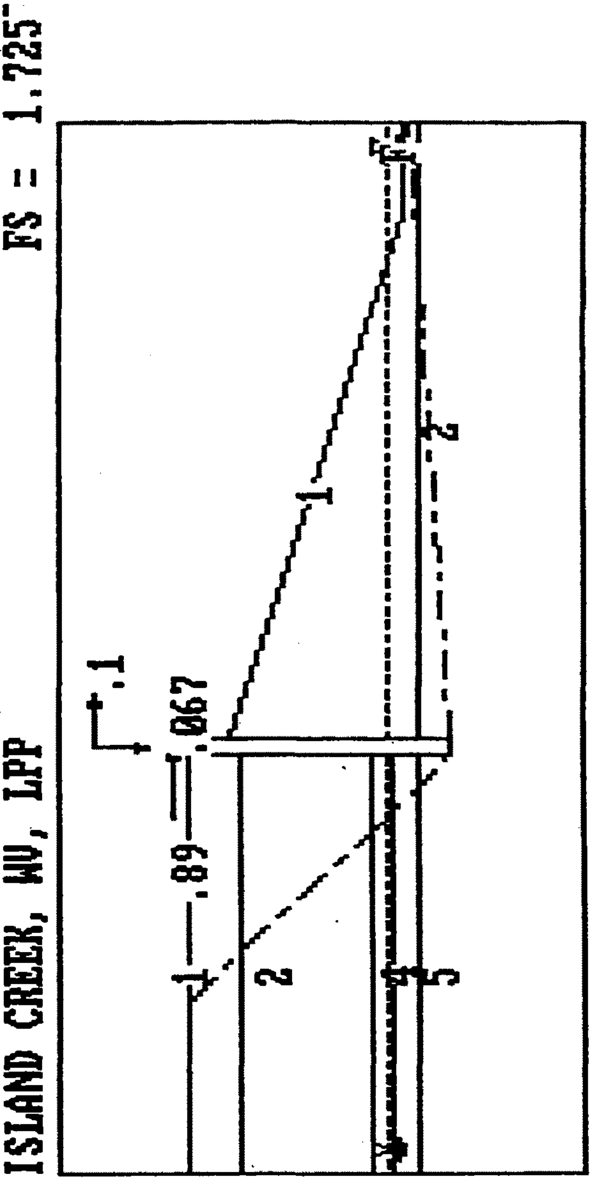
WEDGE NO.	TOP PRESSURE (KSF)	BOTTOM PRESSURE (KSF)
7	.237	.500
8	.125	.237

WEDGE NUMBER	FAILURE ANGLE (DEG)	TOTAL LENGTH (FT)	WEIGHT OF WEDGE (KIPS)	SUBMERGED LENGTH (FT)	UPLIFT FORCE (KIPS)
1	-47.056	9.289	2.926	.000	.000
2	-47.056	20.901	27.221	.000	.000
3	-47.056	3.415	7.125	.820	.015
4	-47.056	4.371	10.194	4.371	.601
5	-47.056	5.738	15.167	5.738	2.116
6	.000	2.000	9.600	2.000	1.000
7	4.277	56.319	106.517	56.319	20.768
8	4.277	24.137	3.395	24.137	4.375

WEDGE NUMBER	NET FORCE ON WEDGE (KIPS)
1	-2.090
2	-19.441
3	-4.855
4	-7.485
5	-10.623
6	10.992
7	32.645
8	.856

SUM OF FORCES ON SYSTEM ---- .000

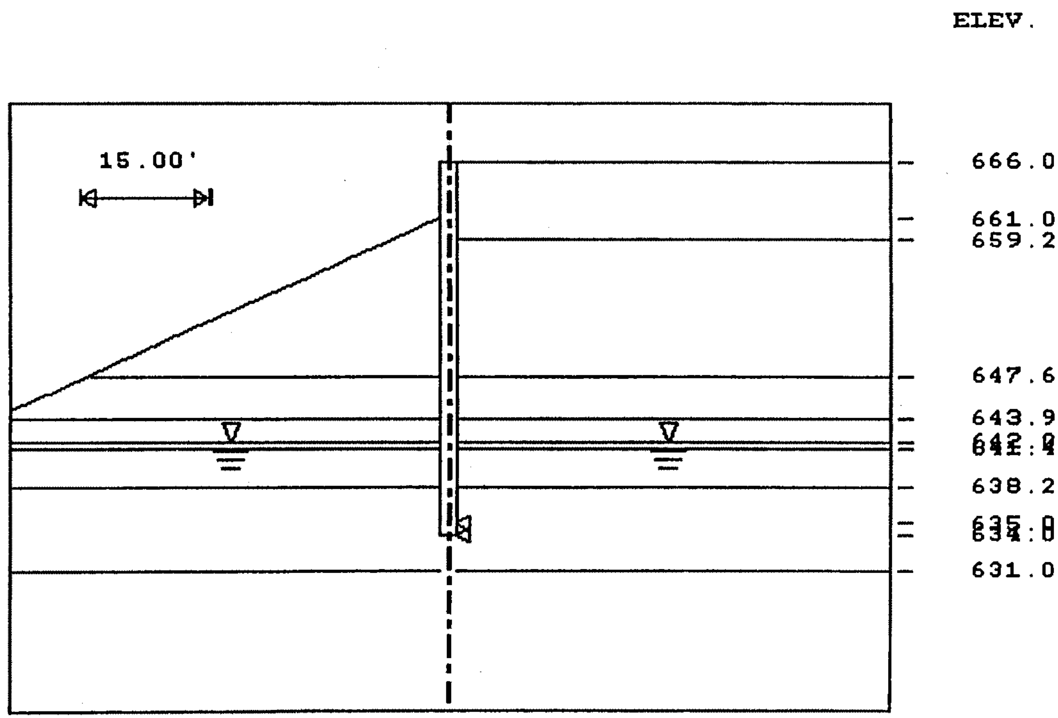
FACTOR OF SAFETY ----------- 1.725 > 1.5 ok EM 1110-2-2502 Table 4-1 usual loading



A-I-240

```
1000 'ISLAND CREEK LPP, LOGAN, WV
1010 'POST AND PANEL WALL
1020 'WALL HEIGHT = 5', W14 X 193
1030 '6' C TO C SPACING, L.C. 4 (NORMAL WATER & NO TRUCK)
1050 WALL 666 2.9E+07  1.20E+03  28.4
1060 WALL 634
1065 ANCHOR   635.00  R
1066 ANCHOR   634.00  R
1070 SURFACE RIGHTSIDE   1
1080  0.00    666.00
1090 SURFACE  LEFTSIDE   2
1100  0.00    661.00    64.09    640.00
1110 SOIL RIGHTSIDE  STRENGTH    8
1120   136.00  110.00   28.0     0.00   0.0  0.0   3.0    3.0    659.20 0
1130   129.00  110.00   28.0     0.00   0.0  0.0   3.0    3.0    647.60 0
1133   122.00  110.00   28.0     0.00   0.0  0.0   3.0    3.0    643.90 0
1134   131.00  123.00   30.0     0.00   0.0  0.0  86.7   86.7    642.00 0
1136   131.00  123.00   30.0     0.00   0.0  0.0  52.0   52.0    641.40 0
1137   123.00  110.00   28.0     0.00   0.0  0.0   1.1    1.1    638.20 0
1138   124.00  114.00   32.0     0.00   0.0  0.0   3.5    3.5    631.00 0
1139   125.00  125.00   40.0    50.00   0.0  0.0   0.1    0.1
1140 SOIL  LEFTSIDE  STRENGTH    7
1141   129.00  110.00   28.0     0.00   0.0  0.0   3.0    3.0    647.60 0
1142   122.00  110.00   28.0     0.00   0.0  0.0   3.0    3.0    643.90 0
1143   131.00  123.00   30.0     0.00   0.0  0.0  86.7   86.7    642.00 0
1144   131.00  123.00   30.0     0.00   0.0  0.0  52.0   52.0    641.40 0
1150   123.00  110.00   28.0     0.00   0.0  0.0   1.1    1.1    638.20 0
1155   124.00  114.00   32.0     0.00   0.0  0.0   3.5    3.5    631.00 0
1160   125.00  125.00   40.0    50.00   0.0  0.0   0.1    0.1
1165 INTERACTION  RIGHTSIDE  2   666   22.33   643.67   8.67
1166 INTERACTION  LEFTSIDE   2   661   17.33   643.67   8.67
1170 WATER ELEVATIONS    62.50  642.00  642.00
1180   H D 9
1181  666  0   665.7  11.88  664.6  55.44  664.3  67.32
1182  663.8   87.12  663.2  110.88  661.8  166.32  661.0  198.0
1183  659.0   198.0
1190 FINISH
```

'ISLAND CREEK LPP, LOGAN, WV
'POST AND PANEL WALL



***** INPUT GEOMETRY *****
DATE: 10-OCT-1993 TIME: 19.22.18

A-I-242

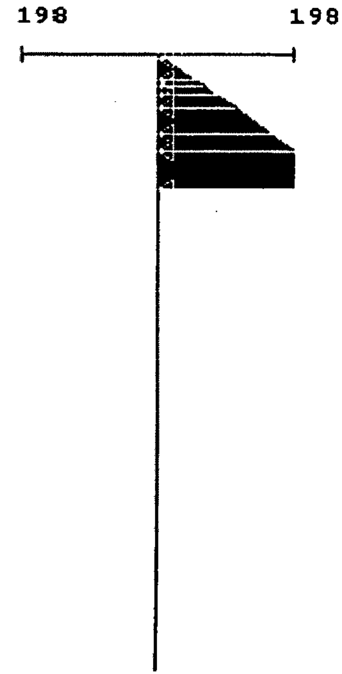
'ISLAND CREEK LPP, LOGAN, WV

'POST AND PANEL WALL

ELEV. (FT)

DIST. LOADS (PSF)

666.0



634.0

A-T-243

***** INPUT HORIZONTAL LOADS *****

DATE: 10-OCT-1993 TIME: 19.22.43

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 10-OCT-1993 TIME: 19.20.04

INPUT DATA

I.--HEADING:
'ISLAND CREEK LPP, LOGAN, WV

'POST AND PANEL WALL

'WALL HEIGHT = 5', W14 X 193

'6' C TO C SPACING, L.C. 4 (NORMAL WATER & NO TRUCK)

II.--WALL SEGMENT DATA

ELEVATION AT TOP OF SEGMENT (FT)	MODULUS OF ELASTICICTY (PSI)	MOMENT OF INERTIA (IN**4)	CROSS SECTION AREA (SQIN)
666.00	2.900E+07	1200.00	28.40

ELEVATION AT BOTTOM OF WALL = 634.00 (FT).

III.--ANCHOR DATA

ELEVATION AT WALL (FT)	ANCHOR TYPE ('R/F')	ULTIMATE TENSION FORCE (LB)	PRE-STRESS FORCE (LB)	ULTIMATE COMPRESSION FORCE (LB)	ANCHOR STIFFNESS (LB/IN)	ANCHOR SLOPE (FT)
635.00	RIGID					
634.00	RIGID					

IV.--SURFACE POINT DATA

IV.A.--RIGHTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	666.00

IV.B.-- LEFTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	661.00
64.09	640.00

V.--SOIL LAYER DATA

V.A.--RIGHTSIDE LAYER DATA

<UNIT WEIGHT> SAT. (PCF)	MOIST (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	WALL ADH-ESION (PSF)	<STIFF. COEF.> ACT. (PCI)	PASS. (PCI)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT)
136.00	110.00	28.00	.00	.00	.00	3.00	3.00	659.20	.00

129.00	110.00	28.00	.00	.00	.00	3.00	3.00	647.60	.00
122.00	110.00	28.00	.00	.00	.00	3.00	3.00	643.90	.00
131.00	123.00	30.00	.00	.00	.00	86.70	86.70	642.00	.00
131.00	123.00	30.00	.00	.00	.00	52.00	52.00	641.40	.00
123.00	110.00	28.00	.00	.00	.00	1.10	1.10	638.20	.00
124.00	114.00	32.00	.00	.00	.00	3.50	3.50	631.00	.00
125.00	125.00	40.00	50.00	.00	.00	.10	.10		

V.B.-- LEFTSIDE LAYER DATA

<UNIT WEIGHT> SAT. (PCF)	MOIST (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	WALL ADH-ESION (PSF)	<STIFF. ACT. (PCI)	COEF.> PASS. (PCI)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT)
129.00	110.00	28.00	.00	.00	.00	3.00	3.00	647.60	.00
122.00	110.00	28.00	.00	.00	.00	3.00	3.00	643.90	.00
131.00	123.00	30.00	.00	.00	.00	86.70	86.70	642.00	.00
131.00	123.00	30.00	.00	.00	.00	52.00	52.00	641.40	.00
123.00	110.00	28.00	.00	.00	.00	1.10	1.10	638.20	.00
124.00	114.00	32.00	.00	.00	.00	3.50	3.50	631.00	.00
125.00	125.00	40.00	50.00	.00	.00	.10	.10		

VI.--INTERACTION ZONE DATA

VI.A.--RIGHTSIDE

ELEVATION AT TOP OF ZONE (FT)	INTERACTION DISTANCE (FT)
666.00	22.33
643.67	8.67

VI.B.-- LEFTSIDE

ELEVATION AT TOP OF ZONE (FT)	INTERACTION DISTANCE (FT)
661.00	17.33
643.67	8.67

VII.--WATER DATA

UNIT WEIGHT = 62.50 (PCF)
RIGHTSIDE ELEVATION = 642.00 (FT)
LEFTSIDE ELEVATION = 642.00 (FT)
NO SEEPAGE

VIII.--SURFACE LOADS
NONE

IX.--HORIZONTAL LOADS

IX.A.--EARTHQUAKE ACCELERATION = .00 (G'S)

IX.B.--HORIZONTAL LINE LOADS
NONE

IX.C.--HORIZONTAL DISTRIBUTED LOADS

ELEVATION (FT)	DIST. LOAD (PSF)
666.00	.00
665.70	11.88
664.60	55.44

664.30	67.32
663.80	87.12
663.20	110.88
661.80	166.32
661.00	198.00
659.00	198.0C

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 10-OCT-1993 TIME: 19.21.19

SUMMARY OF RESULTS

I.A.--MAXIMA

		MAXIMUM	MINIMUM
BENDING MOMENT (LB-FT)	:	5.164E+04	-6.743E-12
AT ELEVATION (FT)	:	642.00	634.00
DEFLECTION (IN)	:	9.149E-01	-1.559E-04
AT ELEVATION (FT)	:	666.00	634.50
RIGHTSIDE SOIL PRESSURE (PSF)	:	1524.78	
AT ELEVATION (FT)	:	638.20	
LEFTSIDE SOIL PRESSURE (PSF)	:	3203.26	
AT ELEVATION (FT)	:	643.67	

I.B.--ANCHOR FORCES

ELEVATION AT ANCHOR (FT)	ANCHOR TYPE	ANCHOR DEFORMATION (IN)	ANCHOR FORCE (LB)
635.00	RIGID	.00	51018.39
634.00	RIGID	.00	-50168.96

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 10-OCT-1993 TIME: 19.21.53

SUMMARY OF RESULTS

I.A.--MAXIMA

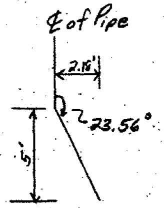
		MAXIMUM	MINIMUM
BENDING MOMENT (LB-FT)	:	5.164E+04	-6.743E-12
AT ELEVATION (FT)	:	642.00	634.00
DEFLECTION (IN)	:	9.149E-01	-1.559E-04
AT ELEVATION (FT)	:	666.00	634.50
RIGHTSIDE SOIL PRESSURE (PSF)	:	1524.78	
AT ELEVATION (FT)	:	638.20	
LEFTSIDE SOIL PRESSURE (PSF)	:	3203.26	
AT ELEVATION (FT)	:	643.67	

I.B.--ANCHOR FORCES

ELEVATION AT ANCHOR (FT)	ANCHOR TYPE	ANCHOR DEFORMATION (IN)	ANCHOR FORCE (LB)
635.00	RIGID	.00	51018.39
634.00	RIGID	.00	-50168.96

Special Panel Section for 18" RCP @ STA 7+48.10; Invert EL. 650.63

By using a 45° Bend the pipe can be angled to pretrude through the center of the panel (Between Posts). This will also drop the pipe deep enough so the the anchor will not interfer with the pipe.



View from Top

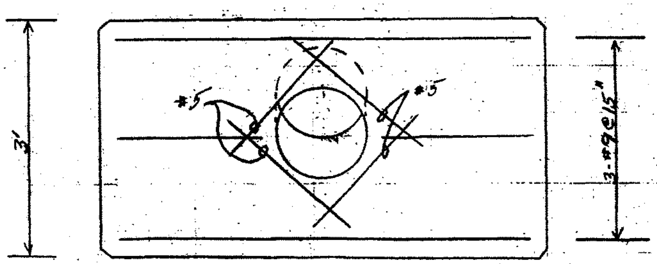
By placing the 45° Bend in such a manor to obtain the desired angle (23.56°) the pipe will also angle downwards.

The downward distance from the initial invert EL. 650.63 is 4.5021'.

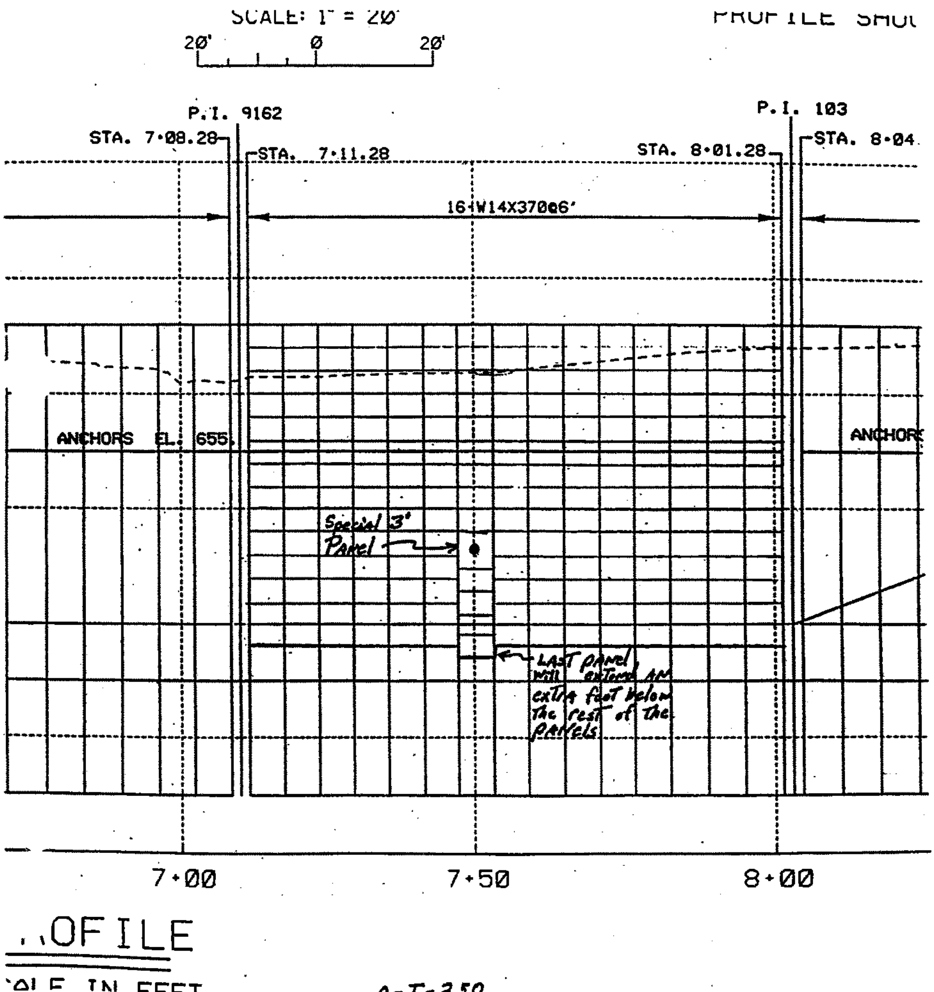
The new invert EL. is 646.13

A special panel is required at the location of where the pipe goes through the wall. The panel will be 3' high instead of 2'. To account for the additional foot, the bottom panel at this location will be a foot lower than the rest of the panels.

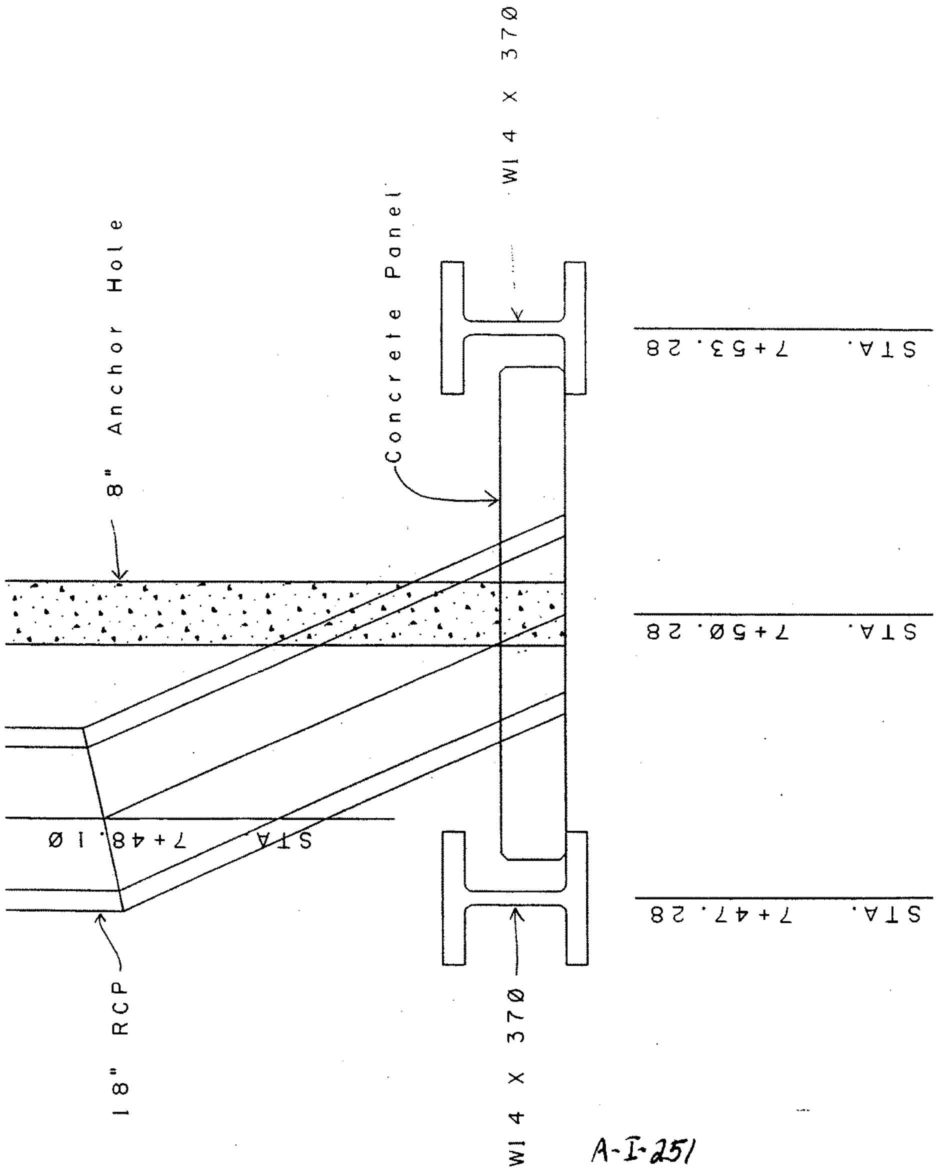
*note the same size reinforcement was use as calculated for the 32' wall



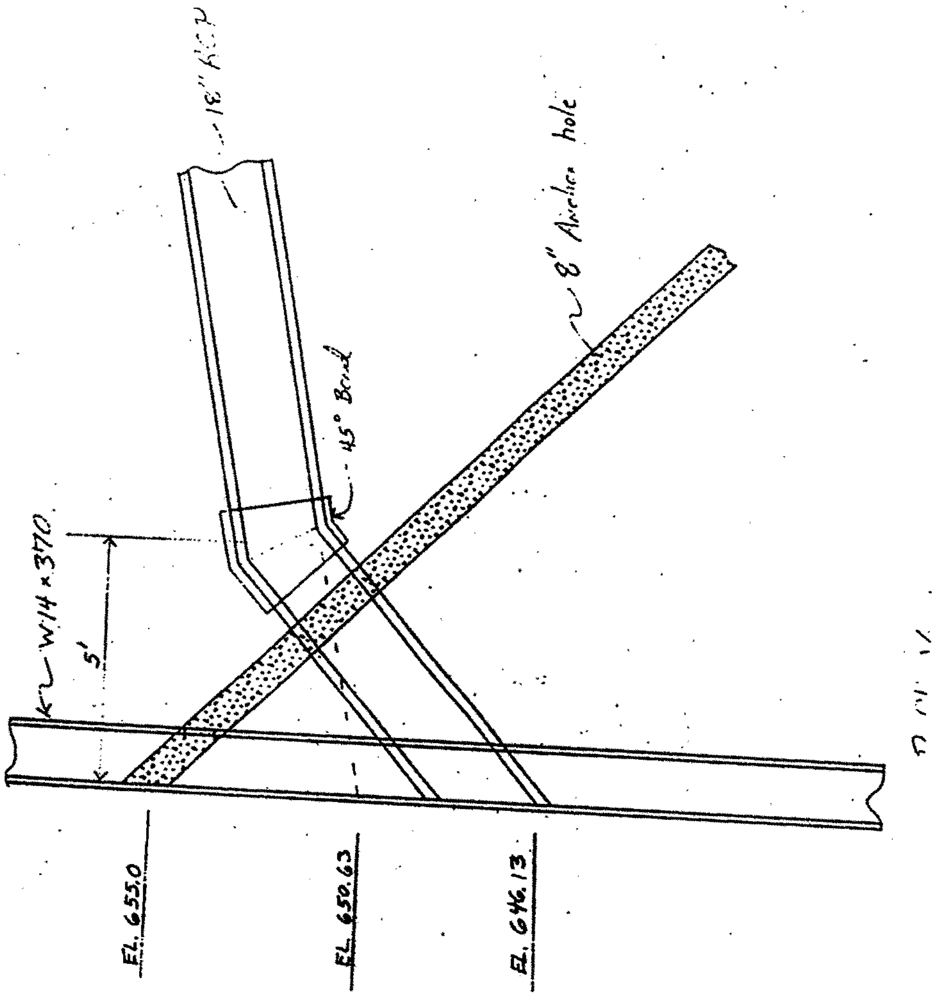
A-I-249


SCALE: 1" = 20'
20'
0
20'
PROFILE SHO
P.I. 9162
STA. 7+08.28
STA. 7+11.28
P.I. 103
STA. 8+01.28
STA. 8+04.
16-W14X370@6'
ANCHORS EL. 655
ANCHORS
Special 3' Panel
LAST panel will extend an extra foot below the rest of the panels
7+00
7+50
8+00
OFILE
LE IN FEET

A-I-250


W14 X 37Ø
8" Anchor Hole
Concrete Panel
STA. 7+53.28
STA. 7+5Ø.28
STA. 7+48.1Ø
STA. 7+47.28
18" RCP
W14 X 37Ø

A-I-251


18" RCP
8" Anchor hole
45° Bend
W14 x 370
5'
EL. 655.0
EL. 650.63
EL. 646.13

A-I-252

Computed by: JRB Date:10-13-93
Checked by: Date:

ISLAND CREEK
OUTFALL CONTROL STRUCTURE
S-CONDITIONS - LOAD CASE 1

HEADWALL/FLOODWALL 15.0' BASE

	ITEM	VERT	HORIZ	ARM	MOMENT ABT X
	CONCRETE				
C1	1.0 * 2.00 * 10.00 * 15.00 * 0.150	45.00		4.50	202.50
C2	1.0 * 15.00 * 2.00 * 15.00 * 0.150	67.50		7.50	506.25
C3	REDUCTION FOR PIPE OPENINGS	-11.55		4.50	-51.98
	EARTH				
E1	1.0 * 9.50 * 10.00 * 15.00 * 0.110	156.75		9.75	1528.31
E2	REDUCTION FOR PIPE OPENINGS	-40.22		9.75	-392.15
	HORIZONTAL PRESSURE				
H1	0.5 * -1.00 * 12.00 * 15.00 * 0.701		-63.09	4.00	-252.36
!2	0.5 * 1.00 * 2.00 * 15.00 * 0.117		1.76	0.67	1.18
H3	REDUCTION FOR PIPE OPENINGS		14.61	5.03	73.49
	SUBTOTAL	217.48	-46.72		1615.25

RESULTANT LOCATION = M/V = 7.43
B/3 = 5.00 100.00 %IN COMPR

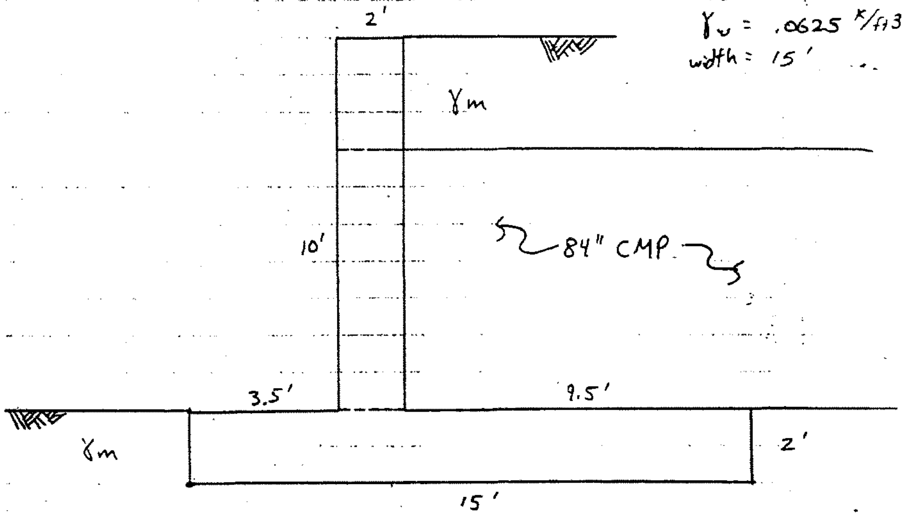
2.43 FT INSIDE KERN

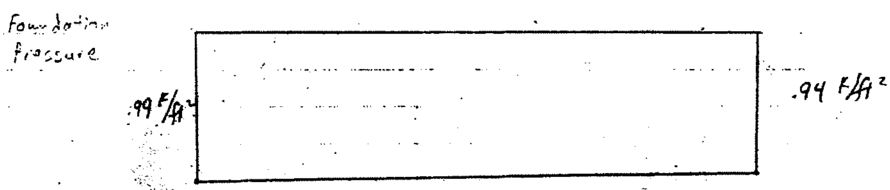
B = 15 e = 0.07 AREA = 225.00 SF

FOUNDATION PRESSURE = V/A[1 +- (6e/B)] = 0.99 ksf RIVER SIDE
0.94 ksf LAND SIDE

LC#1 : Moist fill to top of wall

$\phi = 28°$
$c = 0$
$\gamma_m = .110$ K/ft³
$\gamma_s = .136$ K/ft³
$\gamma_w = .0625$ K/ft³
width = 15'





5 Strength (Long Term)

LC #1 Moist fill to top of wall

Concrete : $c = w \times h \times l \times \gamma_c$

$c_1 = (2')(10')(15')(.150\ K/ft^3)$
$c_1 = 45\ K$ Arm$_{c1}$ = 4.50'

$c_2 = (15')(2')(15')(.150\ K/ft^3)$
$c_2 = 67.5\ K$ Arm$_{c2}$ = 7.50'

Reduction in Concrete : $c = -[\pi r^2 \times w \times \gamma_c]$

$C = -[\pi (3.5')^2 \times 2' \times .150\ K/ft^3]$
$c = -11.55\ K$ Arm$_c$ = 4.50'

Earth : $E = w \times h \times l \times \gamma_m$

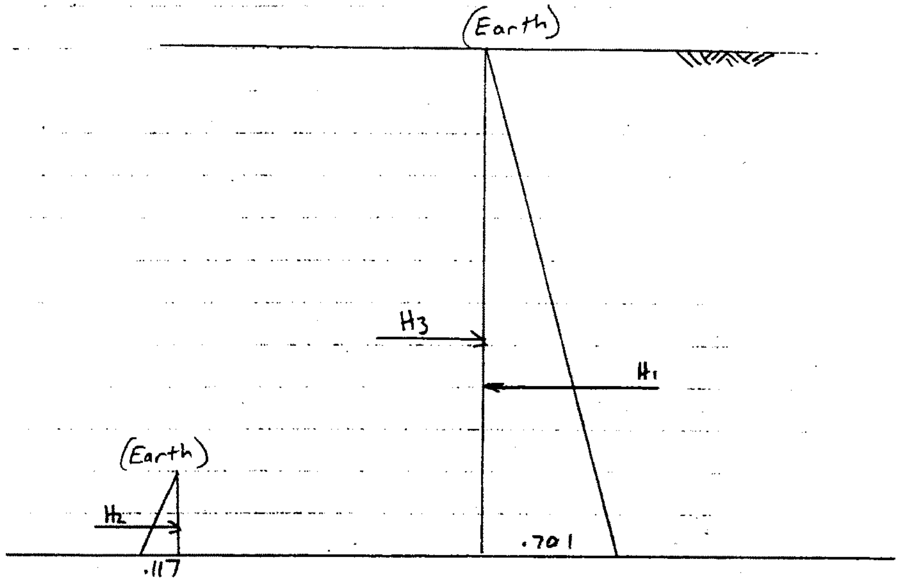
$E_1 = (9.5')(10')(15')(.110\ K/ft^3)$
$E_1 = 156.75\ K$ Arm$_{E_1}$ = 9.75'

Reduction in Earth : $E = -[\pi r^2 \times w \times \gamma_m]$

$E = -[\pi (3.5')^2 \times 9.5' \times .110\ K/ft^3]$
$E = -40.22\ K$ Arm$_E$ = 9.75'

Horizontal Pressures

LC#1 Moist fill to top of wall



S Strength (Long Term)

LC #1 Moist fill to top of wall

$K_o = 1 - \sin\phi$
$K_o = 1 - \sin 28°$
$K_o = .531$

Horizontal Forces : $P = \gamma_m K_o Z w$ $H = \frac{1}{2} P Z w$

$P_1 = (.110\ ^K/_{ft^3})(.531)(12')$ $H_1 = \frac{1}{2}(.701\ ^K/_{\square'})(12')(15')$ $Arm_{H_1} = \frac{1}{}$
$P_1 = .701\ ^K/_{\square'}$ $H_1 = 63.09\ K$ $Arm_{H_1} =$

$P_2 = (.110\ ^K/_{ft^3})(.531)(2')$ $H_2 = \frac{1}{2}(.117\ ^K/_{\square'})(2')(15')$ $Arm_{H_2} = \frac{1}{3}$
$P_2 = .117\ ^K/_{\square'}$ $H_2 = 1.76\ K$ $Arm_{H_2} =$

Reduction in horizontal forces $H = \gamma \bar{h} A K_o$ $y_p = \bar{y} + \frac{K^2}{\bar{y}}$

$H = (.110\ ^K/_{ft^3})(6.5')(\pi)(3.5')^2(.531)$
$H = 14.61\ K$

$K^2 = \frac{3.5^2}{4} = 3.0625$

$y_p = 6.5 + \frac{3.0625}{6.5}$
$y_p = 6.97$

$\therefore Arm = 12 - 6.97$
$Arm = 5.03'$

S Strength (Long Term)

LC#1 Moist fill to top of wall

Sliding Stability

$N = 217.48^K$ $c = 0$ $\phi = 28^\circ$

$T = 46.72$ $L = 15'$

$$FS = \frac{N \tan\phi + cL}{T}$$

$$FS = \frac{217.48 (\tan 28^\circ) + 0(15)}{46.72}$$

$FS = 2.48 > 1.5$ ok

Page

Computed by: JRB Date:10-13-93
Checked by: Date:

ISLAND CREEK
OUTFALL CONTROL STRUCTURE
S-CONDITIONS - LOAD CASE 2

HEADWALL/FLOODWALL 15.0' BASE

ITEM		VERT	HORIZ	ARM	MOMENT ABT X
	CONCRETE				
C1	1.0 * 2.00 * 10.00 * 15.00 * 0.150	45.00		4.50	202.50
C2	1.0 * 15.00 * 2.00 * 15.00 * 0.150	67.50		7.50	506.25
C3	REDUCTION FOR PIPE OPENINGS	-11.55		4.50	-51.98
	EARTH				
E1	1.0 * 9.50 * 3.50 * 15.00 *0.0735	36.66		9.75	357.42
E2	1.0 * 9.50 * 6.50 * 15.00 *0.1100	101.89		9.75	993.40
E3	REDUCTION FOR PIPE OPENINGS	-33.54		9.75	-327.02
	WATER				
W1	1.0 * 9.50 * 3.50 * 15.00 *0.0625	31.17		9.75	303.93
W2	REDUCTION FOR PIPE OPENINGS	-11.43		9.75	-111.44
	UPLIFT				
U1	1.0 * 15.00 * -1.00 * 15.00 * 0.125	-28.13		7.50	-210.94
U2	0.5 * 15.00 * -1.00 * 15.00 * 0.344	-38.70		10.00	-387.00
	HORIZONTAL PRESSURE				
H1	0.5 * -1.00 * 6.50 * 15.00 * 0.380		-18.53	7.67	-142.09
H2	1.0 * -1.00 * 5.50 * 15.00 * 0.380		-31.35	2.75	-86.21
H3	0.5 * -1.00 * 5.50 * 15.00 * 0.215		-8.87	1.83	-16.23
H4	0.5 * -1.00 * 5.50 * 15.00 * 0.344		-14.19	1.83	-25.97
H5	0.5 * 1.00 * 2.00 * 15.00 * 0.078		1.17	0.67	0.78
H6	0.5 * 1.00 * 2.00 * 15.00 * 0.125		1.88	0.67	1.26
H7	REDUCTION FOR PIPE OPENINGS - EARTH,M		5.64	6.81	38.41
H8	REDUCTION FOR PIPE OPENINGS - EARTH,S		8.42	3.91	32.92
H9	REDUCTION FOR PIPE OPENINGS - WATER		1.79	3.44	6.16
	SUBTOTAL	158.87	-54.04		1084.16

RESULTANT LOCATION = M/V = 6.82
B/4 = 3.75 100.00 %IN COMPR

3.07 FT WITHIN MID. HALF

B = 15 e = 0.68 AREA = 225.00 SF

FOUNDATION PRESSURE = V/A[1 + - (6e/B)] = 0.90 ksf RIVER SIDE
0.52 ksf LAND SIDE

LC#2 : Saturated fill ½ way up pipe

$\phi = 28°$

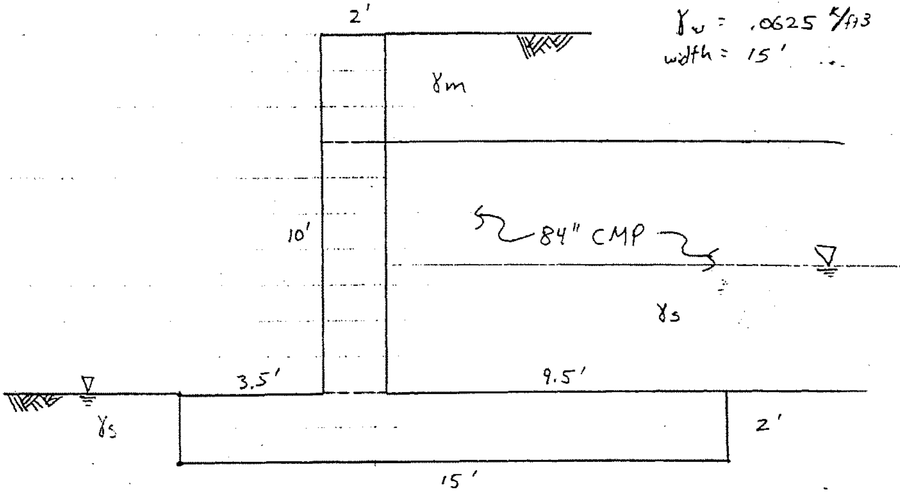
$c = 0$

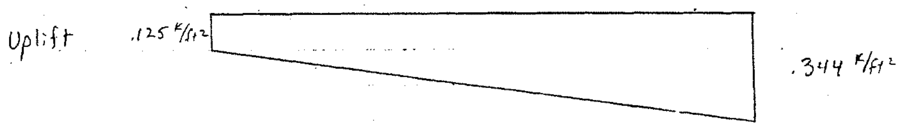
$\gamma_m = .110$ K/ft³

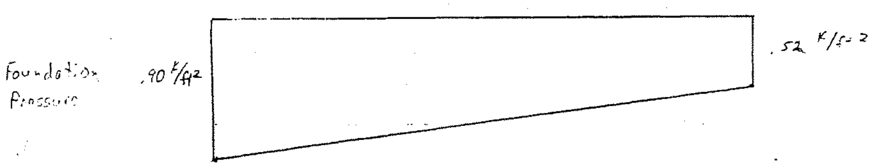
$\gamma_s = .136$ K/ft³

$\gamma_w = .0625$ K/ft³

width = 15'







5 (Long Term) Strength

LC # 2 Saturated fill ½ way up pipe

Concrete same as LC # 1

$C_1 = 45.00\ K$ $Arm_{C1} = 4.50\ ft$

$C_2 = 67.00\ K$ $Arm_{C2} = 7.50\ ft$

Reduction in Concrete (pipe openings) same as LC #

$C_{red.} = -11.55\ K$ $Arm_{Cred} = 4.50\ ft$

3/

5 Strength (Long Term)

LC #2 Saturated fill half-way up pipe.

Earth

$E_1 + E_2 = whl(\gamma_s - \gamma_w) + whl(\gamma_m)$

$E_1 + E_2 = (9.5')(3.5')(15')(.136\ ^K/ft^3 - .0625\ ^K/ft^3) + (9.5')(6.5')(15')(.110'$

$E_1 + E_2 = 138.55\ K$

Reduction in Earth

$E_3 = -[\frac{1}{2}\pi r^2 (w)(\gamma_s - \gamma_w) + \frac{1}{2}\pi r^2 (w)(\gamma_m)]$

$E_3 = -[\frac{1}{2}\pi (3.5')^2 (9.5')(.136 - .0625) + \frac{1}{2}\pi (3.5')^2 (9.5')(.110)]$

$E_3 = -33.54\ k$

Moment Arm for each = 9.75 ft

S (Long Term) Strength

LC # 2 Saturated fill ½ way ~~up pipe~~

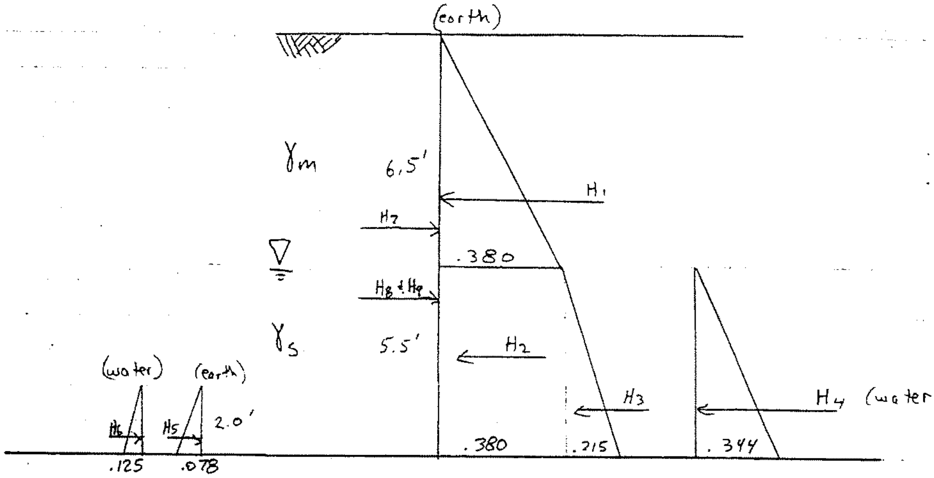
Water

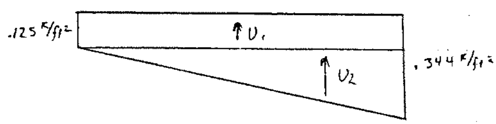
$w_1 = w \times h \times l \times \gamma_w$ Arm w_1 = 9.75'
$w_1 = (9.5ft)(3.5ft)(15ft)(.0625\ K/ft^3)$
$w_1 = 31.17\ K$

Reduction in water (pipe opening)

$W_{red} = -[\pi r^2 \times w \times \gamma_w]$ Arm W_{red} = "
$W_{red} = -[\pi (3.5ft)^2 \times 9.5ft\ \ .0625\ K/ft^3] \times 1/2$
$W_{red} = -11.43\ K$

Horizontal Pressures & Uplift
LC #2: Saturated fill 1/2 way up pipe





Note: Uplift pressures not modified to reflect area of 84" CMP. ∴ results are conservative

$K_w = 1$

$K_0 = 1.5$

$K_0 = .531$

S Strength (Long Term)
LC#2 Saturated fill ½-way up pipe

$P_1 = \gamma_m K_o z = (.110^{K/ft^3})(.531)(6.5') = .380^{K/ft^2}$
$H_1 = \frac{1}{2} P_1 z w = (\frac{1}{2})(.380^{K/ft^2})(6.5')(15') = 18.525\ K$
$Arm_{H_1} = 5.5' + \frac{1}{3}(6.5') = 7.67'$

$P_2 = P_1 = .380^{K/ft^2}$
$H_2 = P_2 z w = (.380^{K/ft^2})(5.5')(15') = 31.35\ K$
$Arm_{H_2} = \frac{1}{2}(5.5') = 2.75'$

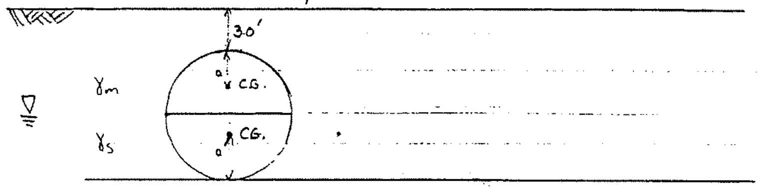
$P_3 = (\gamma_s - \gamma_w) K_o z = (.136^{K/ft^3} - .0625^{K/ft^3})(.531)(5.5') = .215^{K/ft^2}$
$H_3 = \frac{1}{2} P_3 z w = \frac{1}{2}(.215^{K/ft^2})(5.5')(15') = 8.85\ K$
$Arm_{H_3} = \frac{1}{3}(5.5') = 1.83'$

$P_4 = \gamma_w z = (.0625^{K/ft^3})(5.5') = .344^{K/ft^2}$
$H_4 = \frac{1}{2} P_4 z w = \frac{1}{2}(.344^{K/ft^2})(5.5')(15') = 14.19\ K$
$Arm_{H_4} = \frac{1}{3}(5.5') = 1.83'$

$P_5 = (\gamma_s - \gamma_w) K_o z = (.136^{K/ft^3} - .0625^{K/ft^3})(.531)(2') = .078^{K/ft^2}$
$H_5 = \frac{1}{2} P_5 z w = \frac{1}{2}(.078^{K/ft^2})(2')(15') = 1.17\ K$
$Arm_{H_5} = \frac{1}{3}(2') = .67'$

$P_6 = \gamma_w z = (.0625^{K/ft^3})(2') = .125^{K/ft^2}$
$H_6 = \frac{1}{2} P_6 z w = \frac{1}{2}(.125^{K/ft^2})(2')(15') = 1.88\ K$
$Arm_{H_6} = \frac{1}{3}(2') = .67'$

5 Strength (Long Term)
LC#2 : Saturated fill 1/2 way up pipe
Reduction in horizontal pressures



$a = .5756\,r = .5756\,(3.5) = 2.015'$

$K^2 = .06987r^2 = .06987(3.5)^2 = .856$

$K_0 = 1 - \sin\phi = 1 - \sin 28° = .531$

$A = \frac{1}{2}\pi r^2 = \frac{1}{2}\pi\,(3.5)^2 = 19.24\square$

radius = 3.5'

$y_p = \bar{y} + \frac{K^2}{\bar{y}}$

Moist Earth ;

$H_7 = \gamma_m \bar{h} A K_0$

$H_7 = (.110\,^K/ft^3)(5.015')(19.24\square')(.531)$

$H_7 = 5.64\ K$

$y_{p7} = 5.015 + \frac{.856}{5.015} = 5.186'$

$Arm_H = 12 - 5.186' = 6.81'$

Saturated Earth:

$H_8 = [\gamma_m h_m + (\gamma_s - \gamma_w)(\bar{h}_s)]\ A\ K_0$

$H_8 = [.110\,^K/ft^3(6.5\ ft) + (.136\,^K/ft^3 - .0625\,^K/ft^3)(1.485)](19.24$

$H_8 = 8.42\ K$

$y_{P8} = 7.985 + \frac{.856}{7.985} = 8.092'$

$Arm_{H8} = 12' - 8.092' = 3.91'$

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5 Strength (Long Term)
LC #2 : Saturated fill ½ way up pipe
Reduction in horizontal pressures

Water : $H_9 = \gamma_w \bar{h} A$

$H_9 = (.0625\ ^k/_{ft^3})(3.5 - 2.015)(19.24)$

$H_9 = 1.79\ K$

$y_{p9} = (3.5 - 2.015) + \frac{.856}{(3.5 - 2.015)} = 2.06'$

$Arm_{H9} = 5.5 - 2.06' = 3.44'$

S Strength (Long Term)
LC # 2 : Saturated fill ½-way up pipe
Sliding stability

$N = 158.87$ K $\qquad c = 0 \qquad \phi = 28°$
$T = 54.04$ K $\qquad L = 15'$

$$FS = \frac{N \tan\phi + cL}{T}$$

$$FS = \frac{158.87 (\tan 28°) + 0(15')}{54.04}$$

$FS = 1.56 > 1.5$ ok//

Quantities Island Creek Headwall

Concrete

Base : $11.5' \times 15' \times 2' \times 1/27 = 12.8$ cy

Stem ; $10' \times 15' \times 2' \times 1/27 = 11.1$ cy

Slab : $(15' + 38.5')\frac{1}{2} \times 22.25' \times 2' \times 1/27 = 44.1$ cy

Wingwalls : $2\left[1' \times 22.25/\cos 30° \times \frac{1}{2}(3+12)\right] \times 1/27 = 14.3$ cy

less Pipe Opening : $-2(\pi)(3.5)^2 \times 1/27 = -2.9$ cy.

79.4 cy.

say 80 cy

Reinforcing Steel

Assume weight of reinforcing steel to be 2.5% total weight of concrete.

$\therefore$ Wt. Steel = $.025(80\,cy)(27\,cf/cy)(150\,lb/cf)$

Wt Steel = 8100 lb

say 8100 lb

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APPALACHIAN POWER(APCO) BRIDGE

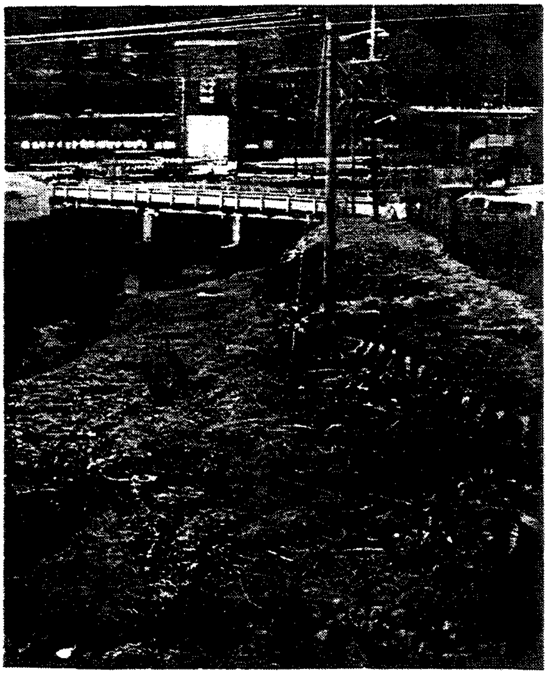

FIG. NO. 1 APCO Bridge from wall alignment.

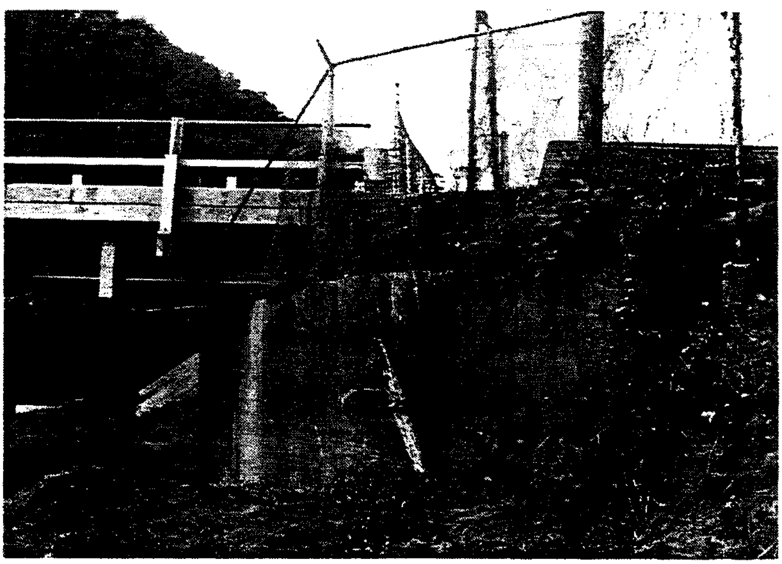

FIG. NO. 2 - The APCO bridge left abutment. The tieback wall will be contiguous to this abutment.

U.S. 119/S.R. 10 Bridge

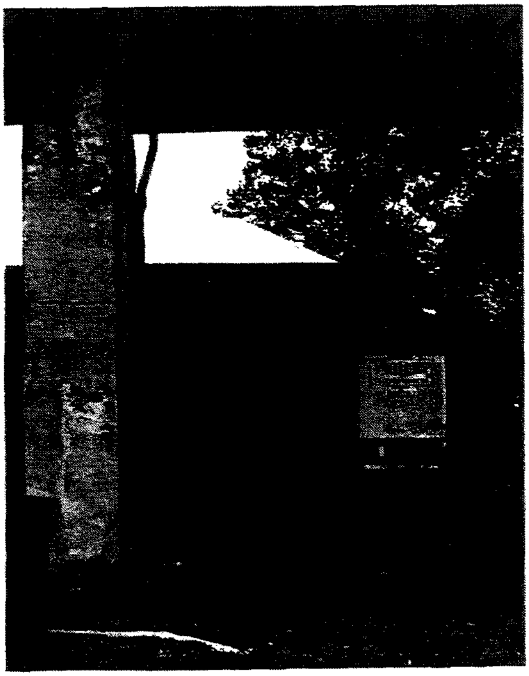

FIG. NO. 3.- Vertical clearance under the U.S. 119/S.R. 10 bridge.

U.S. 119/26 Bridge

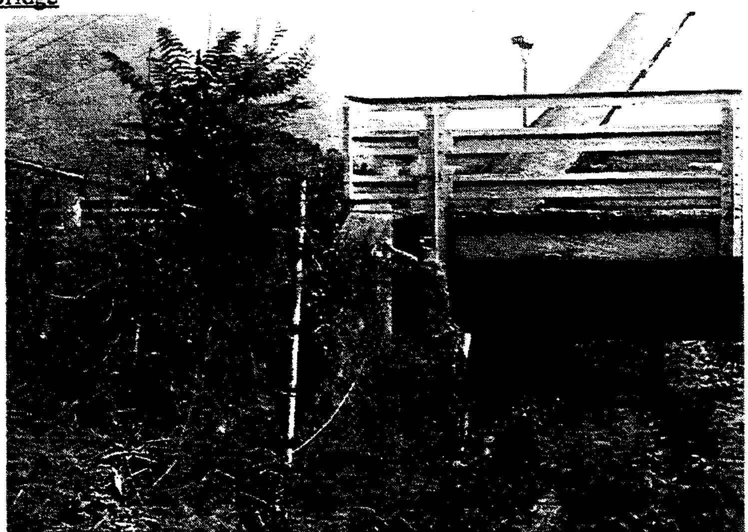

FIG. NO. 4 - Bridge 119/26 left U/S abutment. The tie-back Wall begins(STA. 0+0.0) at this location.

ISLAND CREEK

LOCAL PROTECTION PROJECT

ENGINEERING TECHNICAL APPENDIX

TO THE

GENERAL REEVALUATION REPORT

TAB II

HYDROLOGY AND HYDRAULICS

SECTION A

Department of the Army
Huntington District, Corps of Engineers
Huntington, West Virginia

ISLAND CREEK LPP - LOGAN, WV
TAB II - HYDROLOGY AND HYDRAULICS (SECTION A)

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EXHIBITS

ISLAND CREEK LPP - LOGAN, WV
TAB II
HYDROLOGY AND HYDRAULICS

1. CLIMATOLOGY

a. Drainage Basin Description. The Island Creek Drainage Basin is tributary to the Guyandotte River, rising near the Logan-Mingo County line and flowing in a northerly direction to its confluence with the Guyandotte River at Logan, WV.

Island Creek is about 19 miles in length and drains an area of 104.5 square miles. Island Creek falls about 1600 feet from its headwaters to the mouth with an average gradient of about 90 feet per mile. The stream gradient varies from about 250 feet per mile at the headwaters to less than 20 feet per mile at the mouth. The rugged mountains, narrow valleys and precipitous slopes are conducive to rapid concentrations of surface runoff and rapid rises in the stream.

b. Climate. The climate of the Island Creek Drainage Basin is temperate and subject to the usual seasonal variations. The basin is affected by frontal air mass activity and is subject to both continental polar and maritime tropical air masses. Frequent and rapid changes in weather occur due to the passage of fronts associated with general low-pressure areas. The prevailing wind is from the southwest. Normal temperature distribution ranges from 0 to the low 90's. The growing season averages six months, usually from mid-April to mid-October. Climatological data for five stations located near the Island Creek Drainage Basin are given in Table A-II-1.

c. Precipitation. The average annual precipitation over the Island Creek Drainage Basin is about 46 inches. Most of the precipitation in the summer months is of short duration and high intensity and is generally associated with thunderstorms covering a small area. These storms are a result of concentrated frontal activity of convectional or oregraphic origin. Some winter precipitation is in the form of snow; however, most large daily amounts are in the form of rain. Winter precipitation is generally the result of well developed frontal systems and occasional stagnation and stationary development produce prolonged periods of precipitation. Annual snowfall averages only a small portion of the total precipitation. Precipitation data for five stations located near the Island Creek Drainage Basin are given in Table A-II-1.

2. STREAMFLOW DATA. Stream flow records for the Guyandotte River near Island Creek are available, beginning in 1915, when a staff gage was installed at Logan. Stream flow data has never been collected for Island Creek, with the exception of Whitman Creek, a tributary of Island Creek, for the period April 1969 through September 1977. Data for three gaging stations on the Guyandotte River and Whitman Creek at the Whitman gage are presented in Table A-II-2.

3. MAJOR FLOODS.

a. General. Island Creek is subject to both headwater flooding and backwater flooding from the Guyandotte River. The floodplains in the vicinity of the confluence with the Guyandotte River are highly developed, and river stages for the Guyandotte River at Logan suggest backwater flooding. The following are descriptions of the highest floods of record at Logan, WV.

b. Storm and flood of July 1875. The flood was caused by a series of summer-type storms beginning about 25 July and ending 6 August. The series of summer storms moved through Illinois, Indiana, Ohio, Kentucky, West Virginia and portions of Pennsylvania, so that the Ohio River reached flood stage at Pittsburgh on 3 August, and progressively increased downstream to Cincinnati where a crest stage is commonly called the flood of August 1875. Due to the extended duration of the storm and variations in intensity during the many storm periods, the crest dates in the Guyandotte River Basin were 29-30 July, and local historians refer to the flood as that of July 1875. A crest stage of 27.3 feet was reached at Logan, the seventh highest of record.

c. Storm and flood of January 1918. The storm which caused this flood was preceded by snow, sleet and freezing temperatures, all of which assisted in causing excessive runoff. Snowfall was heavy for the month and at Huntington, WV, at the mouth of Guyandotte River, 17.3 inches were recorded. At Wayne, WV, just outside the basin, 22.5 inches of snow were recorded. Precipitation, generally in the form of snow, was almost a daily occurrence during the first three weeks of January. On the 26th, a minor low-pressure area passed near the headwaters of the basin, and 2.18 inches of rain was recorded at Gary and 1.05 inches was recorded at Raleigh, both stations near the headwaters of the Guyandotte River. On the 27th, a distinctive low-pressure area moved over the basin and temperatures rose from below freezing to 53 degrees at Beckley. Rain began in the late evening of the same day and ended the morning of the 28th. During this period 0.80 inches of rain fell at Gary and 1.46 inches at Raleigh. The heavy precipitation together with melted snow produced a crest stage of 26.3 feet at Logan, the ninth highest of record.

d. Storm and flood of January 1957. Frontal activity between strongly contrasting air masses brought excessive rainfall to the Southern Appalachian region from 27 to 29 January 1957. Rainfall from 27 January to 1 February averaged 5.1 inches over the basin above Logan. The streams were at average flows and the ground was saturated from antecedent

TABLE A-II-1

CLIMATOLOGICAL DATA FOR STATIONS NEAR

ISLAND CREEK DRAINAGE BASIN

STATION	ELEVATION (M.S.L.)	PERIOD OF RECORD	EQUIPMENT *	AVERAGE ANNUAL TEMP(F)	PRECIP. INCHES	SNOW** INCHES
IAEGER, WV	980	1948-1989	NRG	-------	44.88	-----
KERMIT, WV	620	1948-1985	NRG	-------	43.53	------
KOPPERSTON, WV	1,660	1963-1989	NRG.T	52.68	50.51	28.0
LOGAN, WV	720	1948-1989	RG.T	56.52	45.73	20.5
WILLIAMSON, WV	670	1962-1989	NRG-T	56.58	44.05	------

*RG: RECORDING RAIN GAGE

NRG: NON-RECORDING RAIN GAGE

T: THERMOMETER

** UNMELTED

TABLE A-II-2

STREAM FLOW DATA

STREAM	LOCATION	MILES ABOVE MOUT	DRAINAGE AREA SQ.MI.	PERIOD OF RECORD	AGENCY	TYPE OF GAGE (a)	MAXIMUM STAGE FEET	FLOW IN CFS (b) MAXIMUM	MINIMUM	AVERAGE ANNUAL
GUYANDOTTE RIVER	MAN	93.4	758	1928-34	USGS	C				
				1934-62	USGS	R	24.78	49,000	3.0	984
				1962-80	USGS	R (c)				
GUYANDOTTE RIVER	LOGAN	81.0	833	1915-62	USWB	S (c)	34.98	55,000	33	1,162
				1962-90	USWB	R				
GUYANDOTTE RIVER	BRANCHLAND	35.3	1,224	1915-17	USGS	c				
				1917-22	USGS	C(c)				
				1924-90	USGS	R	43.83	44,500	3.6	1,631
WHITMAN CR.	WHITMAN	2.0	10.9	1969-77	USGS	R(d)	6.66	1,420	0	13.9

(a) C-Chain gage; R-Recording gage; S-Staff gage; WW- Wire

(b) Maximum stage and discharge during period of record; discharge estimates as furnished by USGS

(c) Gage heights only

(d) Gage discontinued

rainfall at the onset of the storm. The flood on the Guyandotte River reached a stage of 28.2 feet at Logan, the fifth highest of record. The historical crest stage at Logan was one foot higher than July 1875. The volume of runoff from the drainage area above Logan amounted to approximately 4.1 inches.

e. **Storm and flood of March 1963**. A succession of storms associated with low pressure systems moved northeastward from northern Alabama to West Virginia and Ohio during the period 2-19 March 1963. On the 5th and 6th of March, two to three inches of rain fell over the Guyandotte River Basin. On the 11th and 12th of March, the second storm moved over the basin, producing rainfall amounts of three to three and a half inches in twenty-two hours. The rains that occurred on the fifth and sixth of March primed the basin for the second storm which produced the highest known flooding along the main stem of the Guyandotte River, and along most tributaries. This flood produced a crest stage of 34.90 feet at Logan, the highest of record.

f. **Storm and flood of January 1974**. The flood of January 1974 resulted from the passage of two distinct systems. On 3-5 January, the first storm moved over the Guyandotte Basin and released slightly more than 1.0 inch of rainfall. The second storm period, 9-12 January, produced about 3.5 inches in the upper portion of the basin and approximately 3.15 inches in the lower part of the basin. The Guyandotte River reached a crest stage of 31.1 feet at Logan, the third highest stage of record.

g. **Storm and flood of April 1977**. Precipitation began on the evening of 2 April. This set the stage for increased runoff when the rain began again Sunday evening, 3 April. A series of disturbances, with heavy rainfall, moved from the southern plains states into the Appalachians late Sunday, 3 April and Monday, 4 April. Three bursts of heavy rainfall occurred over southern West Virginia, southeastern Kentucky and western Virginia. The first heavy rain fell during the period from late Sunday night to about 5 a.m. Monday morning; the next burst of rain came around midday Monday; and the third around sunset.

On the ridge separating the Tug and Levisa Fork Basins, unofficial storm rainfall measurements ranged from 13 inches near War, WV, to over 5.0 inches near Grundy, VA. From 7 a.m. on 2 April to 7 a.m. on the 5th, a total of 3.14 inches of rainfall was recorded at Logan, WV. This flood produced the fourth highest stage of record.

h. **Storm and flood of May 1984**. The 6-11 May flood event on Island Creek was a result of traditional antecedent flood conditions. Above normal precipitation occurred during the latter part of April which produced above average soil water content along with slightly elevated stream stages. These conditions were followed by extremely heavy daily precipitation which was well above normal and lasted several days in May. Most stations in the vicinity of Island Creek reported 5 to 6 inches of rain for the month of April and 6 to 7 inches for the month of May.

This rainfall in May was produced by a storm front which became stationary in the region. Contrasting temperatures associated with this front produced an unstable atmospheric condition resulting in heavy precipitation that began on the 2nd of May and continued through the 9th of May. Most stations recorded flood waters cresting during the day of 8 May and returning to near normal stages by 20 May. Preliminary field investigation of flood marks in the Island Creek basin indicated normal water elevations were exceeded by as much as 16 feet.

Record flooding occurred in the upper Guyandotte River Basin where the crest stage at the Weather Service gage at Pineville, WV, was 17.76 feet, exceeding the previous high in 1963 by about 2.5 feet. At the U.S. Geological Survey stream gage near Baileysville, the record discharge was estimated to exceed the 100-year event. Lesser flooding occurred downstream on the Guyandotte River due to the impounding of flood water behind the almost completed R.D. Bailey Dam and also due to the reduced amounts of rainfall over the lower Guyandotte River Basin. A crest stage of 23.3 feet was reached at the Guyandotte River at the Logan stream gaging station, the twelfth highest of record.

4. UNIT HYDROGRAPHS.

As indicated previously, there are no stream gaging stations in the Island Creek Basin. However, streamflow data are available for Whitman Creek, a tributary of Island Creek, for the period April 1969 through September 1977. A unit hydrograph was derived from the April 1977 flood for the 10.9 square mile area above the Whitman Creek gage and is shown as Exhibit No. A-II-1. The Island Creek Drainage Basin was subdivided into drainage areas compatible in size with the drainage area represented by the Whitman Creek unit graph. The Whitman Creek unit hydrograph was transferred to other pertinent subbasins within the Island Creek Basin, using Snyder's coefficients, and unit hydrographs were developed for them.

Island Creek, which drains an area of 104.5 square miles, joins the Guyandotte River at Logan, WV. Approximately 3,900 feet upstream of the confluence with the Guyandotte River, the upper 56.9 square mile drainage area of the main stem Island Creek is joined by its major tributary, Copperas Mine Fork, which drains an area of about 45.8 square miles. To determine the Standard Project Flood values, it was considered desirable to obtain unit hydrographs from an area compatible with these drainage areas. A unit hydrograph was available for Johns Creek near Meta, KY, representing a drainage area of 55.7 square miles. This unit hydrograph was transferred, using Snyder's coefficients, to subbasins in the Island Creek Basin to develop the streamflow for the Island Creek Standard Project Flood. The Johns Creek near Meta, KY, unit hydrograph is shown as Exhibit No. A-II-2.

5. **STANDARD PROJECT FLOOD.** The Standard Project Flood (SPF) was computed in accordance with Civil Engineering Bulletin 52-8, EM 1110-2-1411, dated March 1952 (Revised March 1965), and titled "Standard Project Flood Determination." The Index Rainfall for Island Creek is 12.1 inches. the total 96 hour rainfall over the Island Creek Basin, adjusted for drainage area and storm transportation, is 15.62 inches. The rainfall over each subbasin

producing the Island Creek SPF, was determined from the isohyetal pattern. Initial and uniform rainfall losses of one inch and 0.05 inch per hour, respectively, were applied to determine the runoff. The rainfall excess or runoff was applied to the subbasin unit hydrographs to determine the resulting hydrographs. The hydrograph at the mouth of Island Creek, resulting from the Island Creek SPF, is shown as Exhibit No. A-II-3. Peak discharges at various locations resulting from the Island Creek SPF are shown in Table A-II-3.

6. FLOOD PROBABILITY.

Hydrologic analyses were used to establish the peak discharge-frequency relationship at selected points in the Island Creek Drainage Basin. Reliable estimates of discharge frequency relationships could not be made from the relatively short period of record of flow data that was collected at the Whitman Creek gage during the period April 1969 through September 1977.

Natural discharge-frequency relationships used in the study were developed on a regionalized basis in accordance with the methods outlined in "Statistical Methods in Hydrology" by Leo R. Beard, dated January 1962, and Bulletin 17b published by the United States Water Resources Council, dated 1976, and entitled "Guidelines for Determining Flood Flow Frequency."

A Log-Pearson Type III distribution was fitted to annual event series at gaging stations in the surrounding drainage basins. Generalized relationships were determined which relate mean and standard deviation to individual basin characteristics and further allowed a map of the entire region to be drawn which delineates isolines showing areas of equal skew. These data were utilized in making frequency estimates for ungaged areas in the Island Creek Drainage Basin. The partial duration portion of the discharge-frequency curves was defined by analysis of observed peak discharge above a selected base discharge at the gaging stations used in the regional analysis. Elevation-frequency relationships at key locations were developed from the discharge-frequency relationships and discharge-elevation data at these locations determined by backwater studies utilizing the HEC-2 computer program. Flood events of a magnitude which are expected to be equaled or exceeded once on the average of 1, 2, 5, 10, 20, 50, 100, and 500 year period (recurrence interval) have been selected for use in this study. Although the recurrence interval represents the long term average period between floods of a specific magnitude, large or rare floods can occur at short intervals or even within the same year. Estimated discharges for the selected recurrence intervals at key locations in the Island Creek Drainage Basin are shown in Table A-II-3.

TABLE A-II-3
ESTIMATED DISCHARGES AT KEY LOCATIONS

Stream Name and Location	Drainage Area (sq.mi.)	Peak Discharge (cfs)						
		SPF	500-Yr.	100-Yr.	20-Yr.	5-Yr.	2-Yr.	1-Yr.
Island Creek								
At Mouth	104.5	49,000	37,100	27,700	19,200	12,600	9,000	6,600
Upstream of Copperas Mine Fork	56.9	25,000	24,400	18,000	12,300	8,100	5,700	3,950
At Chauncey	44.0	---	18,880	13,930	9,520	6,270	4,410	3,060
Copperas Mine Fork								
At Mouth	45.8	27,500	21,300	15,500	10,400	6,700	4,700	3,400
Mud Fork								
At Mouth	13.8	8,200	6,800	4,850	3,230	2,010	1,380	980
Whitman Creek								
At Mouth	13.4	9,100	6,600	4,650	3,030	1,900	1,290	920

7. WATER SURFACE PROFILES

a. Existing Conditions.

i. Island Creek.

The existing condition water surface profiles were originally developed on Island Creek at Logan, WV, for approximately 10.5 miles. The Island Creek profiles begin at the confluence of Island Creek and the Guyandotte River and extend upstream to a point approximately 1,000 feet upstream of Cow Creek near the community of Barnabus, WV. Due to the lack of discharge data that corresponds with available high water marks, the starting water surface elevation for each profile on Island Creek was based upon a flood frequency elevation of the Guyandotte River. However, because of the large difference in drainage areas, the probability of having coincidental peaks on the Guyandotte River and Island Creek would be extremely low. Therefore, the relationship shown in Table A-II-4 between the flood frequency events for Island Creek and for the Guyandotte River was adopted for the starting conditions on Island Creek. To assure profile accuracy, additional studies have been carried out to evaluate the computed water surface profiles. It was necessary to obtain and add bridge data to the existing model. After the data for the bridge was added, additional survey data was obtained to ensure little or no changes had taken place in the channel during the past few years. Updating the data to current conditions consisted of adding one additional bridge at the mouth of Island Creek, and four new channel cross-sections. New water surface profiles were then developed using the updated model. The newly computed water surface profiles, and the published profiles in the December 1993 report were compared. The comparison revealed no significant changes in the different computed water surface profiles. In the interest of time and money, the profile exhibits have not been changed from the previous report.

TABLE A-II-4
Starting Water Surface Elevation Relationship
Island Creek and Guyandotte River

Flood Frequency Event	Corresponding Flood Frequency Event Guyandotte River	Starting WSEL on Island Creek
1-yr	1-yr	649.7
2-yr	1-yr	649.7
5-yr	1-yr	649.7
10-yr	2-yr	650.9
20-yr	5-yr	653.0
50-yr	10-yr	654.9
100-yr	20-yr	656.8
500-yr	50-yr	659.6

Water surface profiles were computed for the 1-, 2-, 5-, 10-, 20-, 50-, 100-, and 500-year frequency floods, using the computer program HEC-2, developed by the Hydrologic Engineering Center. The existing water surface profiles for Island Creek are shown on Exhibit No. A-II-4. Exhibit No. A-II-5 provides the Island Creek existing profiles for the lower stream reach influenced by the channel modification. A weighted roughness coefficient was computed for a typical cross-section within reaches of similar channel characteristics for the main channel as determined by field inspection. The coefficients were based upon a subsectional "n" value and its associated wetted perimeter. Subsectional "n" values used in the computations are shown in Table A-II-5.

TABLE A-II-5
Island Creek Manning "n" Values
Existing Conditions

Subsection	"n"
Channel Bottom	.020 - .035
Channel Side Slopes	.015 - .070

The resulting Manning "n" values used to compute the water surface profiles for Island Creek varied from 0.024 to 0.058 for the main channel and from 0.030 to 0.070 for the overbank. The coefficients of contraction and expansion used were 0.10 and 0.30, respectively.

The existing water surface profiles were developed on Island Creek using 234 cross-sections and 24 bridge sections. On the lower 1.6 miles of Island Creek, the water surface profile development was based upon topographic mapping and field surveys completed in 1991 - 1992. Of the 234 cross-section and 24 bridge sections, 60 of the cross-sections and 6 of the bridge sections were used in the lower 1.6 mile reach. The water surface profiles for the remainder of the Island Creek study reach were based upon topographic mapping and field surveys completed in 1978 -1979 for the original feasibility report.

The special bridge option in the HEC-2 computer program was used to determine bridge losses at 21 of the 24 bridges in the study area. This option computes pressure flow through the bridge and weir flow over the bridge and approach roadways on the flood plain when the tailwater elevation exceeds the low chord elevation of the bridge. For the remaining bridges, the normal bridge option of the HEC-2 program was used to determine the bridge losses. This option handles a bridge cross-section in the manner similar to a natural river cross-section with the exception that the area of the bridge structure and piers below the water surface is subtracted from the total area, and the wetted perimeter is increased where the water is in contact with the bridge structure. The coefficients of contraction and expansion used were 0.30 and 0.50, respectively, for the bridge sections.

ii. Copperas Mine Fork.

The development of the Copperas Mine Fork water surface profiles was initiated at the direction of the Ohio River Division Office during the June 1993 Review Conference held in the Huntington District Office. It was emphasized during this meeting that no new cross-sectional data was available for the Copperas Mine Fork. Therefore, it was agreed that the profile development would be based upon the HEC-2 model used for the original Island Creek Feasibility Report.

The existing conditions water surface profiles begin at the confluence with Island Creek and extend approximately 5.5 miles upstream ending at the community of Diamond, WV. Due to the similar drainage areas for the Island Creek and Copperas Mine Fork drainage basins, the starting water surface elevations on Copperas Mine Fork were assumed to be equal to the corresponding water surface elevations on Island Creek. As for Island Creek, profiles were computed for the 1-, 2-, 5-, 20-, 50-, 100-, and 500-year frequency floods, using the computer program HEC-2. The existing conditions water surface profiles for Copperas Mine Fork are shown on Exhibit No. A-II-6. Exhibit No. A-II-7 provides the existing condition water surface profiles for the reach of Copperas Mine Fork effected by the Island Creek channel modification. The Manning "n" values used to compute the profiles varied from 0.042 to 0.045 for the main channel and from 0.05 to 0.08 for the overbank. The coefficients of contraction and expansion used were 0.10 and 0.30, respectively.

The water surface profiles were developed on Copperas Mine Fork using 137 cross-sections and 18 bridge sections. These sections were developed from aerial photographs taken in December 1978, scale of one inch equals two hundred feet. The special bridge option of the HEC-2 program was used to determine bridge losses at 16 of the 18 bridges in the study area. For the remaining bridges, the normal bridge option of the HEC-2 program was used to determine the bridge losses. The coefficients of contraction and expansion used were 0.30 and 0.50, respectively, for the bridge sections.

b. Modified Channel Plan.

i. Channel Optimization.

As discussed in detail in Paragraph 5.a.ii. of the main appendix a channel optimization study was undertaken to determine the most feasible channel width for the recommended channel improvement plan. This optimization study involved three channel widths, 60-, 80-, and 100-feet. All channel plans begin at the confluence of Island Creek and the Guyandotte River and end at the sandbar removal located under the US 119/SR 26 South bridge. Each plan was analyzed with various channel components of retaining walls, upstream extensions of the modified channel and one-sided trapezoidal cuts.

Tables A-1, A-2 and A-3, of the main appendix, provide a summary of the various components studied for the 60-, 80- and 100-foot channels, respectively. Based upon a benefit/cost analysis, the most cost effect modified channel was an 80-foot channel with post and panel walls in the lower portion of Island Creek and around Baisden Hardware with one sided trapezoidal cut for the remainder of the channel modification.

ii. Island Creek Recommended Channel Improvement Plan.

The recommended channel modification plan on Island Creek (shown in the attached plans of the main appendix) involves widening the existing channel to a minimum 80-foot bottom width. The plan includes a combination of post and panel wall and excavated banks with 1V on 2.5H side slopes. Except in some transition areas, the channel widening was limited to one side. The first section of post and panel wall begins approximately 50 feet upstream of the 119/26 bridge (Station 6+50) and extends upstream approximately 920 feet to a point approximately 120 feet upstream of the US 119/10 bridge (Station 15+70). The second section of post and panel wall is at Baisden Hardware and extends from Station 26+35 to Station 29+92. At both locations of the post and panel wall, the channel excavation would be on the left descending bank. The first section of channel widening with the 1V on 2.5H side slopes begins approximately 110 feet upstream of the 119/10 bridge (Station 15+60) and extends upstream approximately 1,075 feet to near Baisden Hardware. The second section of the channel widening, with the excavated side slopes, begins upstream of Baisden Hardware at Station 29+92 and extends upstream to Station 32+00 (208 feet). These two sections of cut are also on the left descending bank. The last section of channel widening, with the 1V on 2.5H side slopes, is a right descending bank cut and begins at Station 30+14 and ends at Station 41+32 approximately 75 feet downstream of the CSX Railroad bridge. The waterway openings of the Appalachian Power Company access bridge (Station 9+50) and the US 119/10 bridge (Station 14+50) were increased to accommodate the 80-foot modified channel.

Two additional areas of channel work are also involved in the recommended plan. The first area is around the CSX Railroad bridge. This work involves the placement of stone slope protection from approximately 25 feet downstream of the bridge to approximately 25 feet upstream of the bridge. Although the channel widening ends downstream of the bridge, there is a significant increase in the 100-year velocity at the bridge because of the reduction in water surface profile with the downstream channel improvement. The second additional area of channel work is around the 119/26 South bridge. This work involves the removal of a large sand and debris bar which has essentially closed one arch of the twin arch bridge.

The computed water surface profiles for the recommended channel improvement plan on Island Creek are shown on Exhibit No. A-II-8. It should be noted that Station 6+10 of the Plan and Profile Drawings corresponds with the zero point of the water surface profile exhibits. Exhibit No. A-II-9 provides a combination plot for the 1- and 100-yr frequency flood events for the most cost effective 60- and 100-foot modified channels and the recommended 80-foot channel. A combined plot of the water surface profiles on Island

Creek for comparison of the 1-, 10-, and 100-year frequency floods for the existing conditions and with the recommended Island Creek channel plan are shown on Exhibit No. A-II-10. The HEC-2 computer program was used to compute these flood frequency profiles.Manning "n" values used for the modified channel were computed by the same method described previously in Paragraph 7-a-i. Subsectional "n" values used in the computations are shown in Table A-II-6.

TABLE A-II-6
Manning "n" Values
Modified Conditions

Subsection	"n"
Channel Bottom	Same as Existing
Stone Slope Protection	0.035
Post and Panel Wall	0.02
Grass	0.033

The resulting Manning "n" values used to compute the modified water surface profiles varied from 0.024 to 0.034 for the main channel. The coefficients of contraction and expansion and the overbank "n" values remained the same as were used for the existing conditions except in the area of the transitions between post and panel wall and excavated side slopes where the contraction and expansion coefficients were increase to 0.3 and 0.5, respectively.

iii. Copperas Mine Fork. With the recommended channel plan, no channel improvements are planned for Copperas Mine Fork. All water surface profile reductions on Copperas Mine Fork are achieved by the lowering of the starting elevations at the confluence with Island Creek. The Copperas Mine Fork water surface profiles with the lowered starting elevations due to the Island Creek modifications are shown on Exhibit No. A-II-11. A combined plot of the water surface profiles on Copperas Mine Fork for comparison of the 1-, 5-, and 100-year frequency floods for the existing conditions and with the improved Island Creek channel are shown on Exhibit No. A-II-12.

c. Risk and Uncertainty Analysis.

i. General. The transmittal memorandum for the draft EC entitled "Risk Analysis Framework for Evaluation of Hydrology/Hydraulics and Economics in Flood Damage Reduction Studies" stated that for projects further along in feasibility, risk and uncertainty (R&U) principles should be addressed, but the explicitly computational procedures will not be required. Because this report is a reevaluation of the completed Island Creek Local Protection Project Feasibility Report, the R&U procedures contained in the draft EC were not used. In lieu of the R&U computational procedures, sensitivity analyses were used. These analyses were performed only for the Island Creek water surface profiles because these profiles are the ones of primary interest and from which the major percentage of project benefits are achieved.

ii. Existing Conditions. Two sensitivity analyses were completed on the existing condition water surface profiles. The first analysis was a check on the sensitivity to the starting water surface elevation. This was accomplished by varying the Guyandotte River water surface elevation, adopted as the starting elevation for the Island Creek profiles, by plus and minus two feet. Exhibit No. A-II-13 gives a comparison plot of the 1- 10- and 100-year water surface profiles with the three starting elevations. The Exhibit shows that the profiles basically converge at the US 119/SR10 bridge. The second analysis was on the sensitivity of the water surface profiles to variations in the channel "n" values. The sensitivity was determined by increasing and decreasing the roughness coefficients by 10%. Exhibit No. A-II-14 shows comparison plots of the 1- 10- and 100-year water surface profiles using the selected "n" values and the "n" values increased and decreased by 10%. The difference between the water surface profiles developed with the 10% increase and 10% decrease is approximately 1 foot with the profile developed with the selected "n" values falling between these two profiles. This shows that the predicted water surface elevations using the selected "n" values are reasonably stable and accurate.

iii. Modified Conditions.

Three sensitivity analyses were completed on the modified conditions water surface profiles. The first analysis was a check on the sensitivity of the water surface profiles to variations in channel "n" values. The same technique of roughness coefficient variation as used for the existing conditions was used for the modified conditions. Exhibit No. A-II-15 shows the comparison plots of the 1-, 10- and 100-year water surface profiles using the selected "n" values and the "n" values increased and decreased by 10%. The difference between the water surface profiles developed with the 10% increase and decrease is approximately 1 foot with the profile developed with the selected "n" values falling between these two profiles. Again, as for the existing conditions, this analysis shows that the predicted water surface elevations using the selected "n" values are reasonably stable and accurate.

The second sensitive analysis involved an assessment of the impact on the water surface profiles assuming significant sediment deposition. For this analysis, it was assumed that 2 feet of deposition occurred over the entire project reach. Exhibit No. A-II-16 shows a comparison plot of the 1-, 10- and 100-year water surface profiles with and without the assumed sediment deposition. With the assumed deposition, the profiles show approximately a 1.5 feet and 1.0 foot increase in water surface elevation for the 1-yr and 100-yr frequency flood events, respectively. This increase is not significant considering the amount of deposition assumed.

The third sensitivity analysis involved an assessment of the impact of drift and debris blockage of bridges. This analysis was accomplished by using the ice cover option of HEC-2 to simulate floating drift and debris. Based upon historical pictures of debris build-up during major floods, floating debris blockage seemed to be the most prevalent problem. In this analysis, a 5-foot debris layer was assumed to be built-up at all the bridges in the project reach. The amount of build-up behind the bridges varied from 218 linear feet to 330 linear feet and covered the complete channel area. Using this technique with the above listed assumptions, Exhibit No. A-II-17 shows the water surface profile with and without the debris build-up for the 1-, 10- and 100-yr frequency flood events. It is felt that the analysis shows an extreme case of debris build-up which would have a low probability of occurrence. However, even with these extreme assumptions, there was still only a 1.5 feet increase in water surface profile.

d. Downstream Effects From Channel Modification. Valley storage during flood periods in the natural channel of Island Creek within the limits of the study reach is quite limited due to the lack of any substantial flood plain or natural ponding areas. Increases in crest discharges at the downstream end of the project due to the loss of valley storage through channel improvement is considered insignificant and since little channel realignment or straightening is planned which would, in effect, shorten the river reach, no measurable increase in downstream flood heights is anticipated for the channel modification under consideration.

8. RESIDUAL FLOODING AND INUNDATION LIMITS. The main report provides a listing of the residual average annual damages associated with the various channel plan alternatives. The overbank velocities for the 100-year flood with project conditions average approximately 2.5 feet per second (fps) for the left overbank and 1.0 fps for the right overbank. Inundation limits are provided on Exhibit No. A-II-18 for the 100-year frequency flood event with and without the modified channel. In addition, this same exhibit also provides the floodway limits for the with and without project conditions. It should be noted that the 1- and 10-yr frequency flood events are essentially contained in the modified channel through the 0.7 mile project reach.

9. STONE SLOPE PROTECTION.

The analysis to determine stone slope protection (SSP) requirements for the stream channel modification was based upon the criteria and procedures outlined in EM 1110-2-1601 and ETL 1110-2-120 and used the computer package "SAM" to perform the computations. The "Alpha" method as described in Appendix C of EM 1110-2-1601 was used to determine the average local velocities for the SSP design discharge. These velocities were computed at the toe of the SSP using the "CORPS" computer package. The design discharge was selected as the discharge which resulted in the combination of local velocity and water depth that required the largest layer thickness of SSP. However, the 100-year frequency flood was used as the upper limit for the design discharge. The 100-year average channel velocities for the existing and modified channel conditions on Island Creek are shown on Exhibit No. A-II-19. Although no SSP is specified for the Copperas Mine Fork, a comparison plot of 100-yr channel velocities with and without the Island Creek modification is shown on Exhibit No. A-II-20.

On Island Creek, a 30-inch thick graded stone with 20-inch top size was specified for use from Station 5+00 to Station 26+35. From Station 29+29 to Station 41+32, an 18-inch thick graded stone was specified with a 12-inch top size. Due to the extremely high velocity at the CSX Railroad bridge, a 54-inch thick graded stone was specified for this area. Sample output from the "SAM" computer program at selected sections are shown on Exhibit No. A-II-21. The height of protection will extend 12 feet vertically above the channel cut line at all locations of SSP placement. This height provides protection to approximately the elevation of the 2-year frequency flood. Standard toe and end keys will be provided. Typical sections of the SSP design are shown on Drawing No. 16/05 in the main appendix drawings.

10. AVERAGE ANNUAL MAINTENANCE DREDGING REQUIREMENTS.

a. Analytical Approach.

A "sediment impact assessment" level of study was conducted to examine the potential impacts of sedimentation on the proposed Island Creek, West Virginia channel modification. As described in EM 1110-2-4000, this approach was used to assess how the proposed LPP will affect the erosion and deposition trends in the channel, and to aid in estimating the maintenance requirements of the project. Much of the analysis used in the study followed the procedures and examples outlined in the U.S. Army Corps of Engineers training course: 'Hydraulic Design of Movable-Bed Flood Control Channels'. Calculations performed in the course of the study utilized the "SAM" computer package.

A sediment budget analysis is used to test for degradation and aggradation of sediment. With this procedure, the estimated average annual sediment yield entering the project is compared to the average annual sediment yield that the project is capable of transporting. If there is more material entering the project than the project is capable of passing, the difference will most likely be deposited in the project. If the project can transport more material than is entering the area, then erosion can be assumed to occur.

In addition, field reconnaissance and photographs have been used to assess the historical stability of the reach. Because no sediment records exist for the study reach, a quantitative study is not feasible. Therefore, only a qualitative assessment can be made to determine the changes that the study reach will experience after construction of the project.

b. Available Field Data.

The only tributary to Island Creek that is examined in the current study is Copperas Mine Fork. As can be observed in Exhibit No. A-II-22, the Copperas Mine Fork confluence with Island Creek is immediately upstream of the beginning of the proposed channel modifications. Only minimal sediment and water discharge data is available for these two streams, long term data was obtained for streams that are in the same watershed. In addition, information was gathered from the study area during site visits.

The only available sediment discharge measurements for streams in the watershed with comparable drainage areas and topographical characteristics were found on the Guyandotte River at Baileysville and on Clear Fork Creek. Both of these sites are upstream of R.D. Bailey dam. These measurements are expressed as suspended load in tons/day correlated with water discharge in cfs/day. For lack of any additional information, it was assumed that these measurements were comparable to calculated daily sediment transport rates for Copperas Mine Fork and for Island Creek.

On 3 August 1993, Huntington District personnel collected several bed samples from the water's edge along Island Creek and Copperas Mine Fork. It was noted during this visit that significant bed armoring was not evident. The bed surface of the streams appear to be well mixed gravel and sand. A sieve analysis was conducted on the samples of bed material to obtain a grain size distribution by weight. The grain size distributions were observed to be very similar in three study reaches of the stream system; 1) in the project reach, 2) above the project reach, and 3) on Copperas Mine Fork. The gradations for the samples taken within each of these three areas were averaged and the resulting distribution assumed to be typical for their respective reaches. The final gradations are shown in Exhibit No. A-II-23.

No discharge measurements are available for either Island Creek, or for Copperas Mine Fork, for which flow duration computations could be performed. However, flow measurements are available for John's Creek, which is in the adjacent Levisa Fork River basin. The duration information for John's Creek has been scaled by a ratio of drainage areas for application to Island Creek at the upstream end of the project, at its confluence with the Guyandotte river, and for Copperas Mine Fork at its confluence with Island Creek. The flow duration data are tabulated below in Table A-II-7.

TABLE A-II-7
FLOW DURATION

%TIME FLOW IS EQUALLED OR EXCEEDED	ISLAND CREEK @ D/S END OF PROJECT D.A.=104.5 Ac.	ISLAND CREEK @ U/S END OF PROJECT D.A.=58.7 Ac.	COPPERAS MINE FORK D.A.=45.8 Ac.
96	0.9	0.5	0.4
72	11.3	6.3	4.9
11	265	149	116
4.5	497	279	218
1.1	1282	720	562
0.06	4531	2545	1986
0.01	5800	3258	2542
0	6212	3489	2723

c. Site Reconnaissance.

Photographs of Island Creek and Copperas Mine Fork were taken during several site visits in 1992 and 1993. In addition, photographs taken after the April 1977 flood and the May 1984 flood have also been obtained. In general, the photographic records show a stream that has changed very little in width, depth, and plan-form. Large scale erosion and deposition are not evident. With the exception of three relatively small areas of deposition, it can be assumed that the project area is stable under current conditions.

In all of the time periods represented in the photographic record, deposition of material at three sites within the project area can be observed. The first is centered around the APCO bridge between stations 8+00 and 10+00. The second falls between the confluence of Copperas Mine Fork with Island Creek and the CSX railroad bridge, approximately between stations 42+00 and 43+00. The third depositional area is in the vicinity of the 119/26 bridge between stations 46+50 and 48+50. The combined volume of the material at these three sites is estimated to be approximately 1,500 yd^3.

These gravel deposits do not appear to be stable formations. The lack of vegetative growth and a very little amount of algae growth on the depositional bars is most likely indicative of their transitory nature. According to interviews with APCO personnel, the channel in the vicinity of the APCO bridge is periodically cleared of sediment. After this maintenance dredging, the material is redeposited in about the same location. For lack of any other data, it has been assumed that if the material found in either of the other two sites were to be removed, it would also be redeposited. If these three sites were to be simultaneously dredged, a conservative estimate would have the entire 1,500 yd^3 of material return within a year.

d. Estimating Possible Deposition or Erosion in the Project Channel.

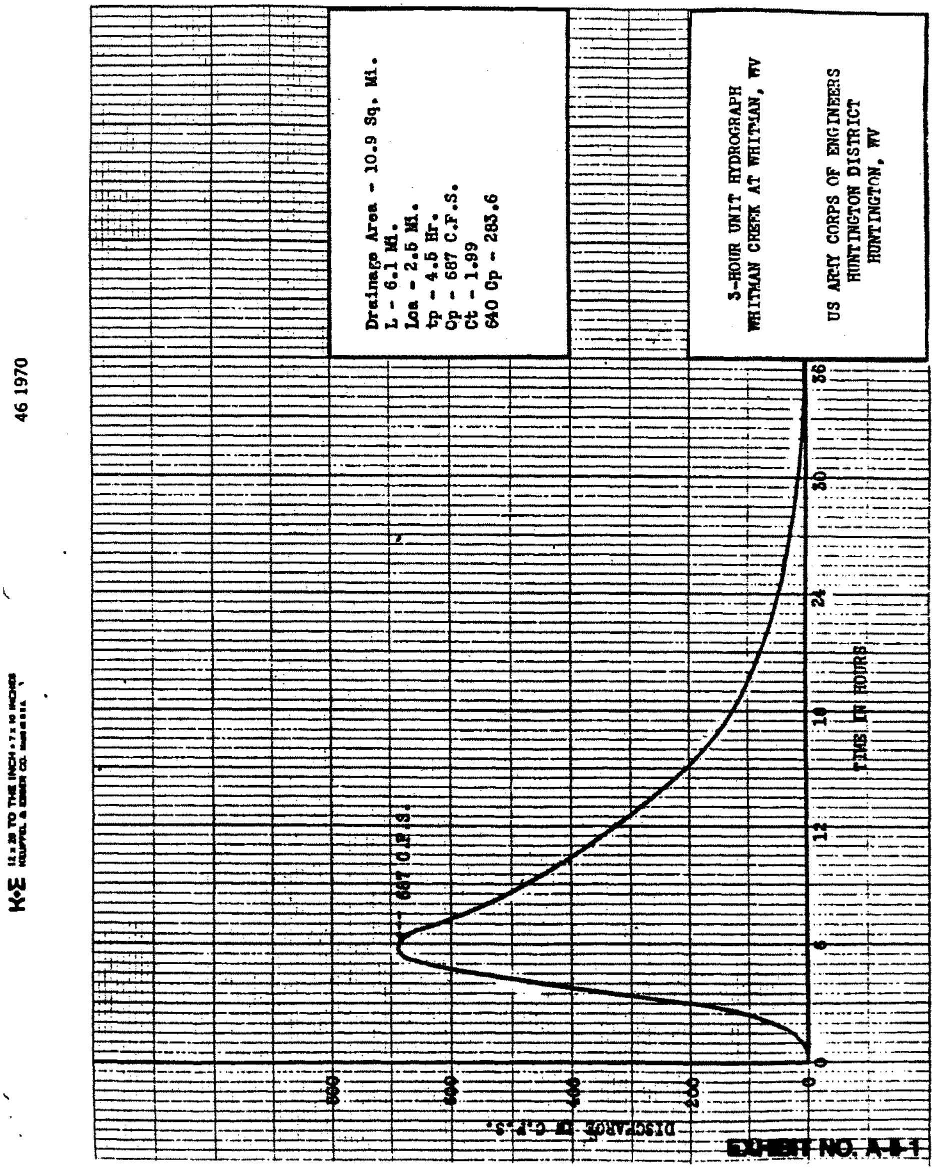
The potential for deposition and erosion in the project channel was estimated with a sediment budget analysis for sand and gravel size particles. This was accomplished using sediment transport equations to estimate the average annual sediment transport capacity of flows entering the project from Island Creek and from Copperas Mine Fork. This total was then compared to the average annual sediment transport capacity within the project. Since there is little evidence of armoring in the project reach, it was assumed that the entire sediment transport capacity is utilized. Both existing conditions and project conditions were analyzed to determine what changes, if any, would occur with respect to sediment transport capacity if the proposed project was implemented.

The sediment transport equations provided in the U.S. Army Corps of Engineers' "Hydraulic Design Package for Channels (SAM)" were used to approximate the sediment yield for different flows under different conditions. An HEC-2 model of the stream system was used to calculate hydraulic parameters for the three different study reaches as previously described. The formulas that apply to the Island Creek stream conditions include; Yang, Acker-White, Toffaleti-Schoklitsch, Laursen-Madden (1985), Laursen-Copeland, Meyer-Peter and Muller, Toffaleti-Meyer-Peter and Muller. Each of these techniques produce a distinct sediment-discharge rating curve. In order to select the technique which more closely represents the behavior of the current stream system, the sediment discharge rates from the different sediment transport equations under existing conditions were compared to the sediment discharge measurements from the Guyandotte River at Baileysville and from Clear Fork Creek. A comparison of the results of these techniques as applied to the project reach of Island Creek, is shown in Exhibit No. A-II-24. With the use of confidence limits, the sediment transport technique which more closely represents the available data in all three study reaches was determined to be Meyer-Peter and Muller. An average of 80% of the sediment discharge rates that are predicted with this sediment transport technique for the three study reaches fall within the 80% confidence limits. The second best match is provided by the Acker-White technique, which predicts values that fall within the 80% confidence limits an average of over 65% of the time for the three study reaches.

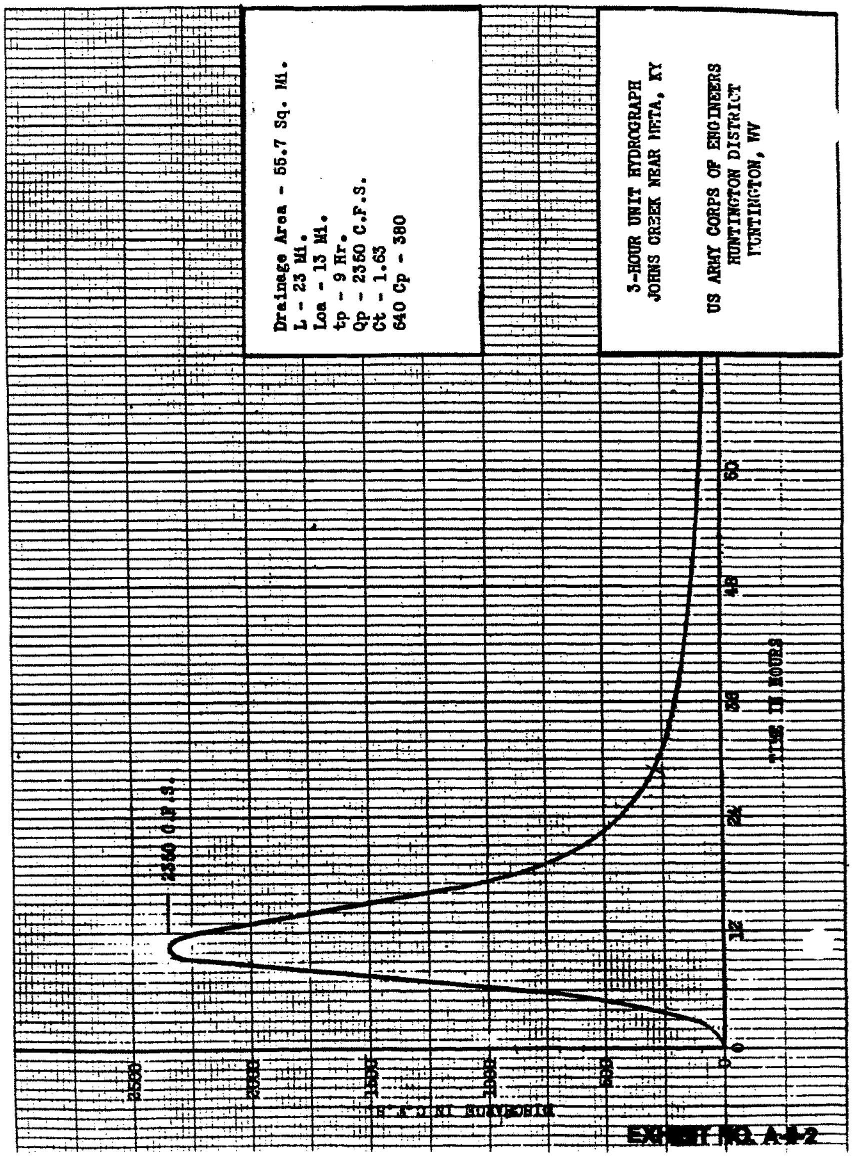
The sediment-discharge rating curves can be integrated with the flow-duration measurements that are tabulated in Table A-II-7. This produces an average annual yield for the three different zones for existing and project conditions. The results for the two best techniques are illustrated in Exhibit No. A-II-25. Existing conditions were calculated so that a base ratio of available inflow to available outflow can be approximated for quasi-stable conditions. It can be observed, in the case of the Meyer-Peter and Muller technique, that the ratio of sediment inflow to outflow is about 1.5 for both existing and project conditions. This indicates that there will be minimal change in sedimentation in the project after construction.

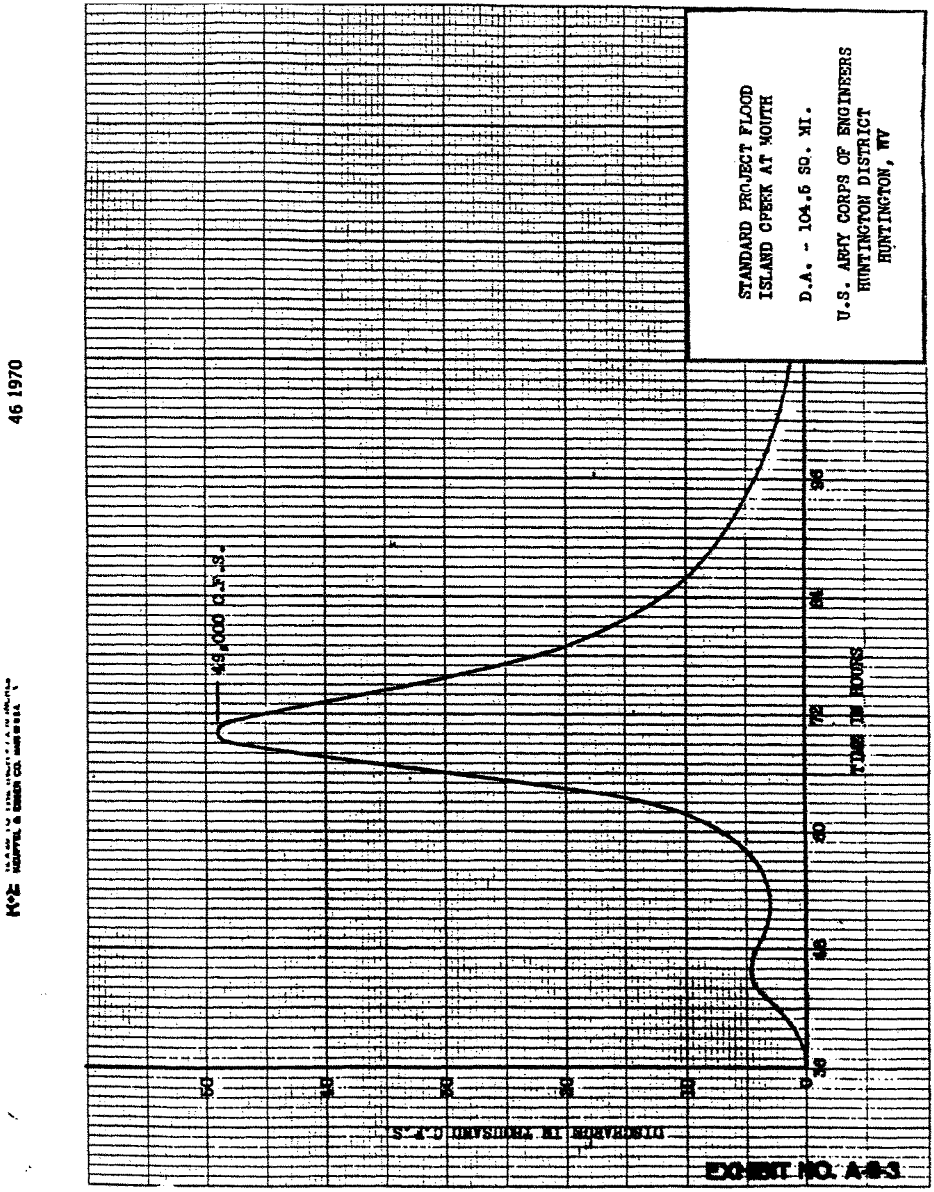
It can be observed in Exhibit No. A-II-25 that the available sediment yield above the project and in Copperas Mine Fork increase slightly under project conditions. This is attributed to the widened cross sectional area of the project channel, which lowers the water surface profiles throughout the project. The effects of the lower water depth is translated upstream into the lower reach of Copperas Mine Fork and into the study reach of Island Creek upstream of the project. This increases velocity and, in turn, increases the amount of material that each reach can transport at a given flow.

e. Conclusions. The completed study indicates that there will be minimal change in the sedimentation patterns of the project area after construction of the channel modification. However, a slight possibility exists for some localized erosion in the mouth of Copper's Mine Fork and on Island Creek just above the project. Currently, an estimated 1,500 yd^3 of material is being deposited annually in the project area. It is expected that this trend will continue after construction. Therefore, 1,500 yd^3 will have to be removed on a average annual basis to maintain the design cross section. In order for the required maintenance dredging to be accomplished, access to the modified channel will be provided through right-of-way easements and a constructed stream crossing access at station 31+20.



Drainage Area - 10.9 Sq. Mi.
L - 6.1 Mi.
Lca - 2.5 Mi.
tp - 4.5 Hr.
Qp - 687 C.F.S.
Ct - 1.99
640 Cp - 283.6
3-HOUR UNIT HYDROGRAPH
WHITMAN CREEK AT WHITMAN, WV
US ARMY CORPS OF ENGINEERS
HUNTINGTON DISTRICT
HUNTINGTON, WV
687 C.F.S.
0
6
12
18
24
30
36
TIME IN HOURS
0
200
400
600
DISCHARGE IN C.F.S.
EXHIBIT NO.


Drainage Area - 55.7 Sq. Mi.
L - 23 Mi.
Loa - 13 Mi.
tp - 9 Hr.
Qp - 2350 C.F.S.
Ct - 1.63
640 Cp - 380
3-HOUR UNIT HYDROGRAPH
JOHNS CREEK NEAR META, KY
US ARMY CORPS OF ENGINEERS
HUNTINGTON DISTRICT
HUNTINGTON, WV
2350 C.F.S.
2500
2000
1500
1000
500
0
0
12
24
36
48
60
TIME IN HOURS
DISCHARGE IN C.F.S.
EXHIBIT NO.


STANDARD PROJECT FLOOD
ISLAND CREEK AT MOUTH
D.A. - 104.6 SQ. MI.
U.S. ARMY CORPS OF ENGINEERS
HUNTINGTON DISTRICT
HUNTINGTON, WV
49,000 C.F.S.
TIME IN HOURS
DISCHARGE IN THOUSAND C.F.S.
46 1970

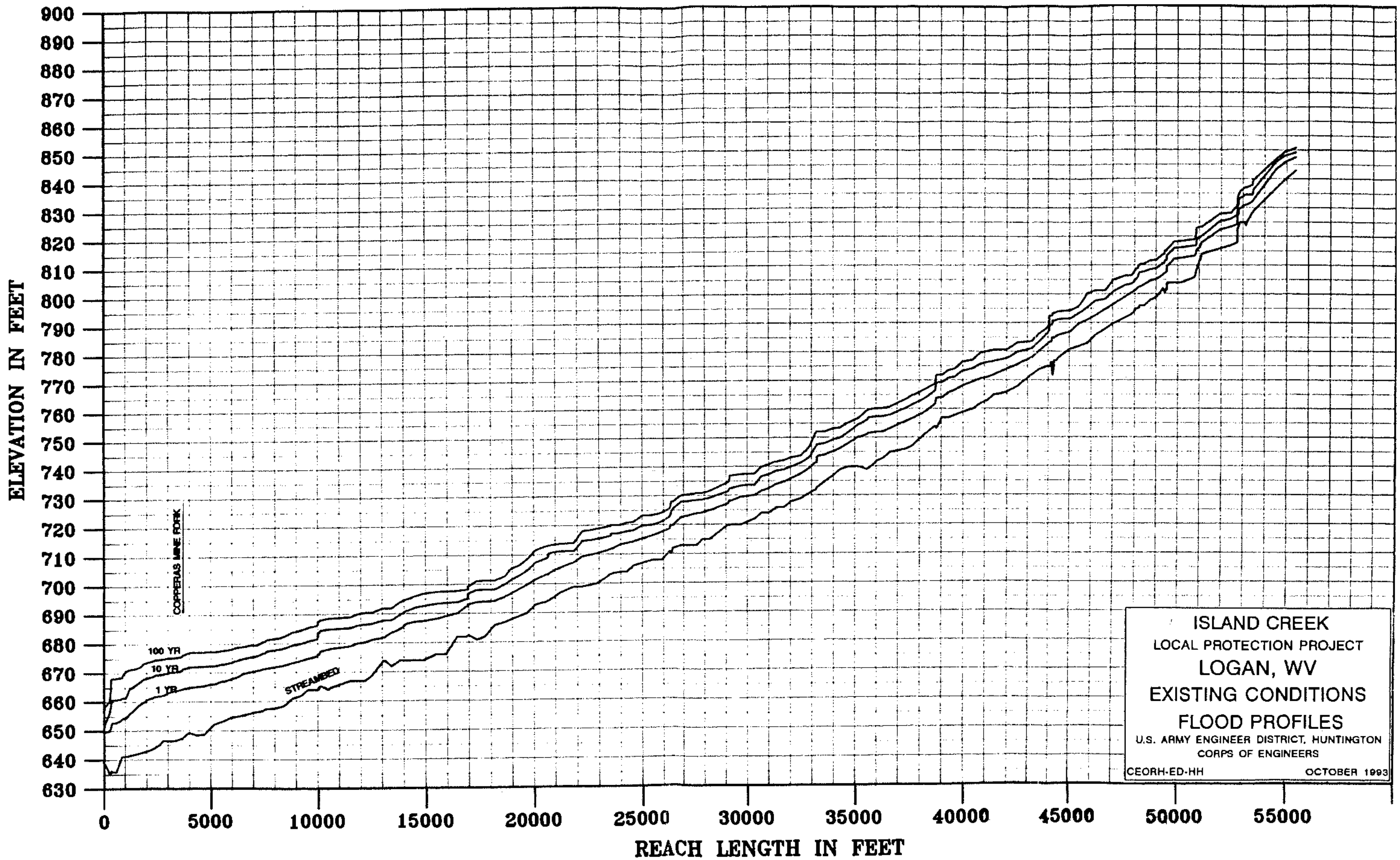


EXHIBIT NO. A-II-4

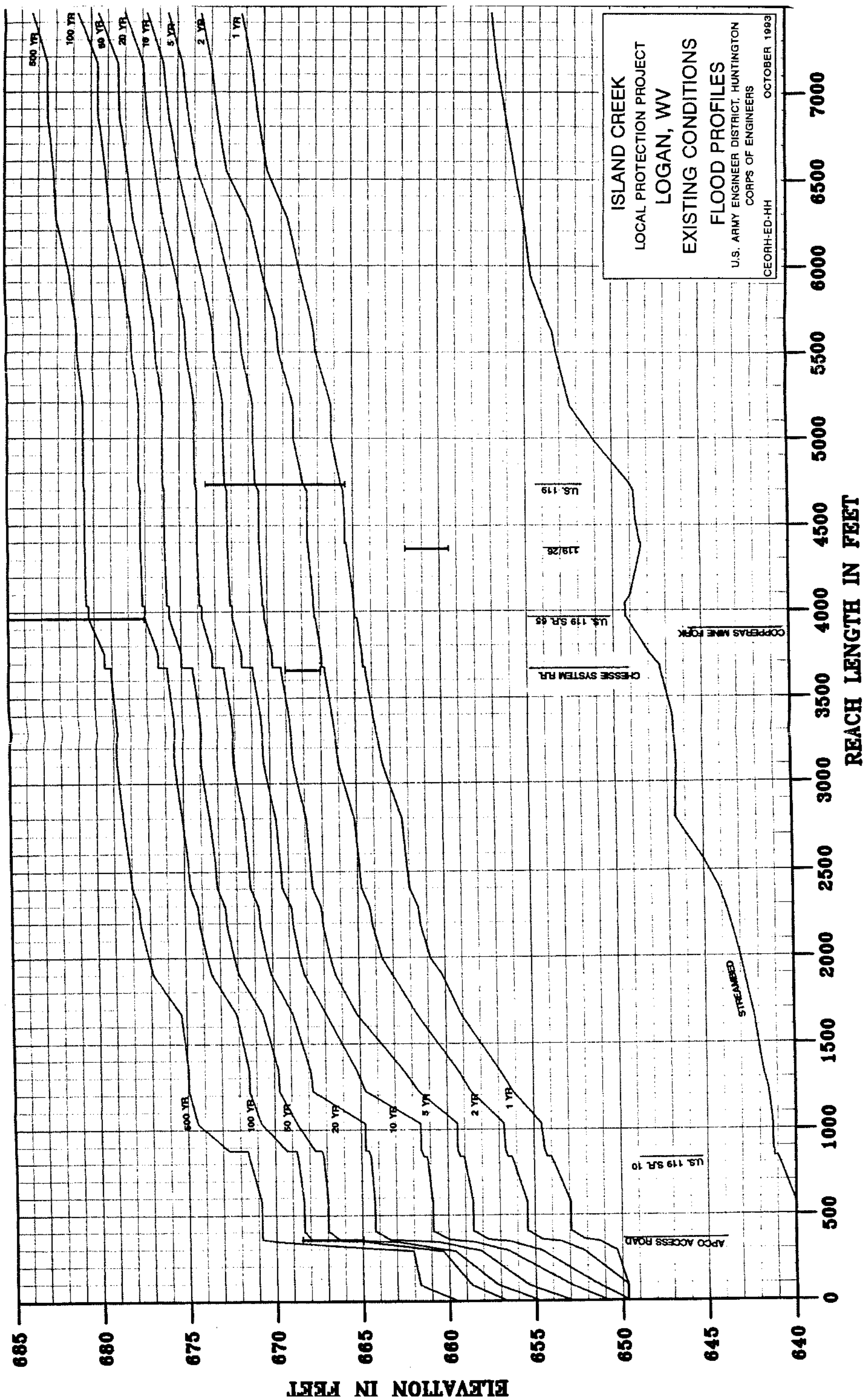


EXHIBIT NO. A-II-5

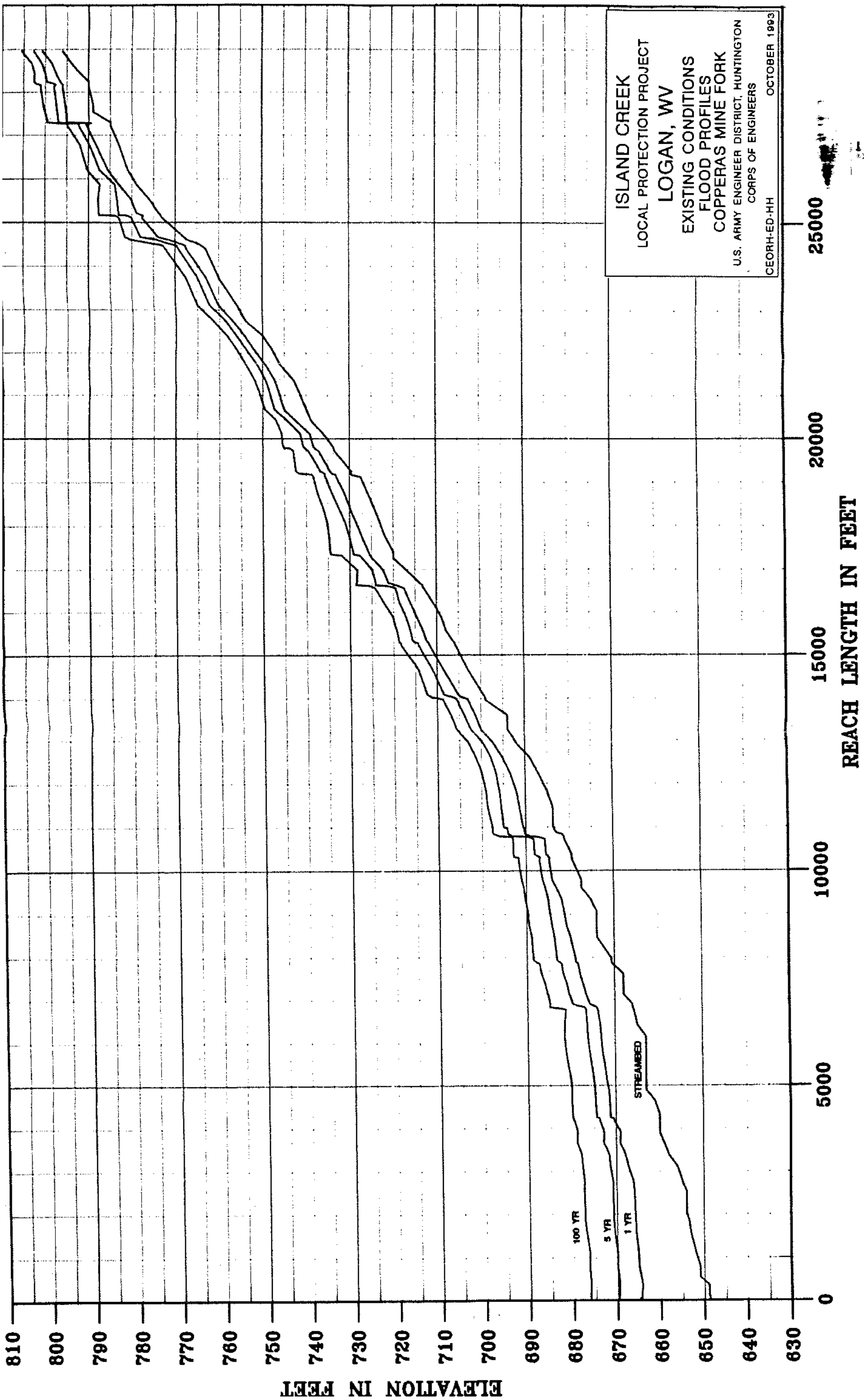
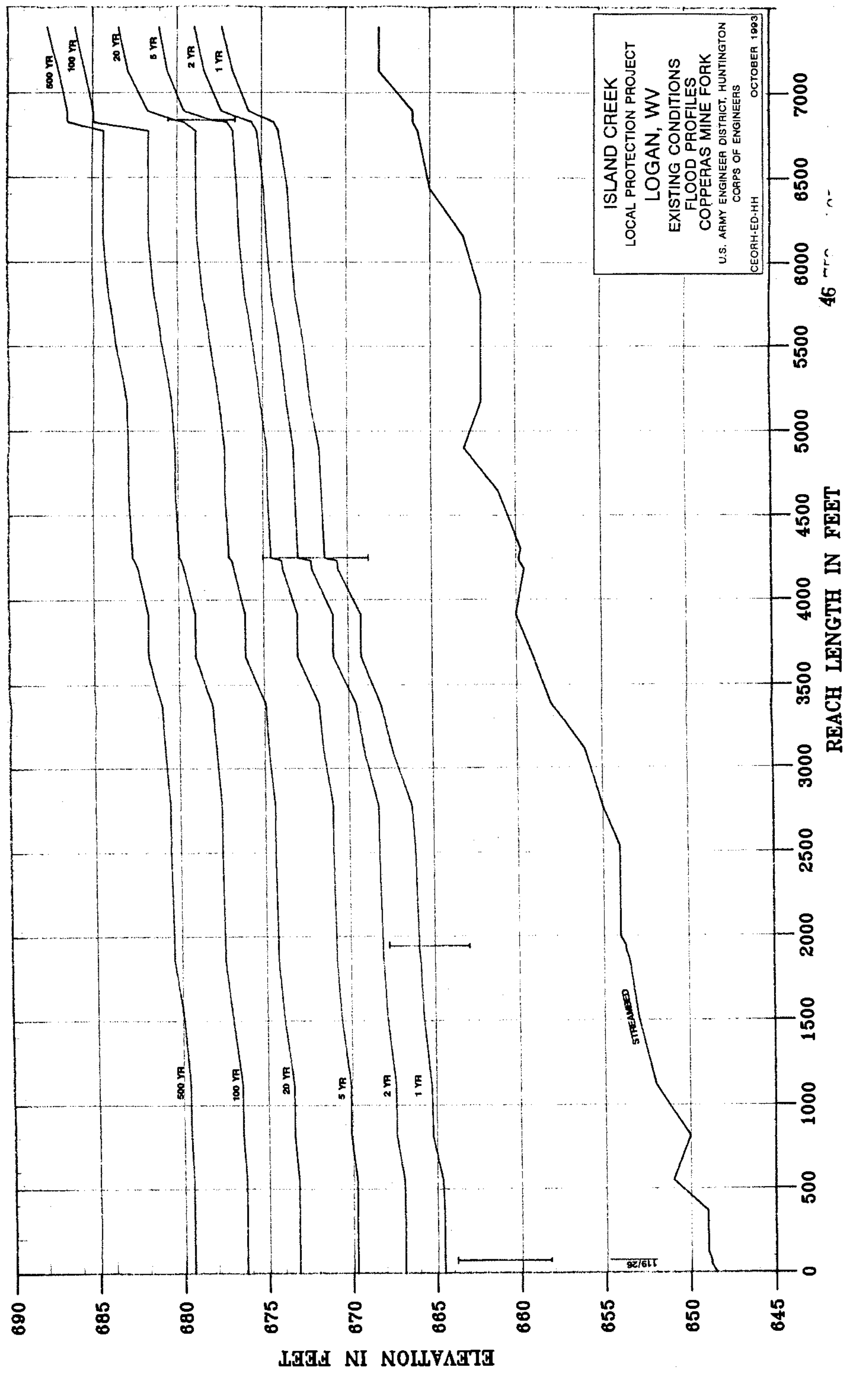


EXHIBIT NO. A-II-6



46

EXHIBIT NO. A-II-7

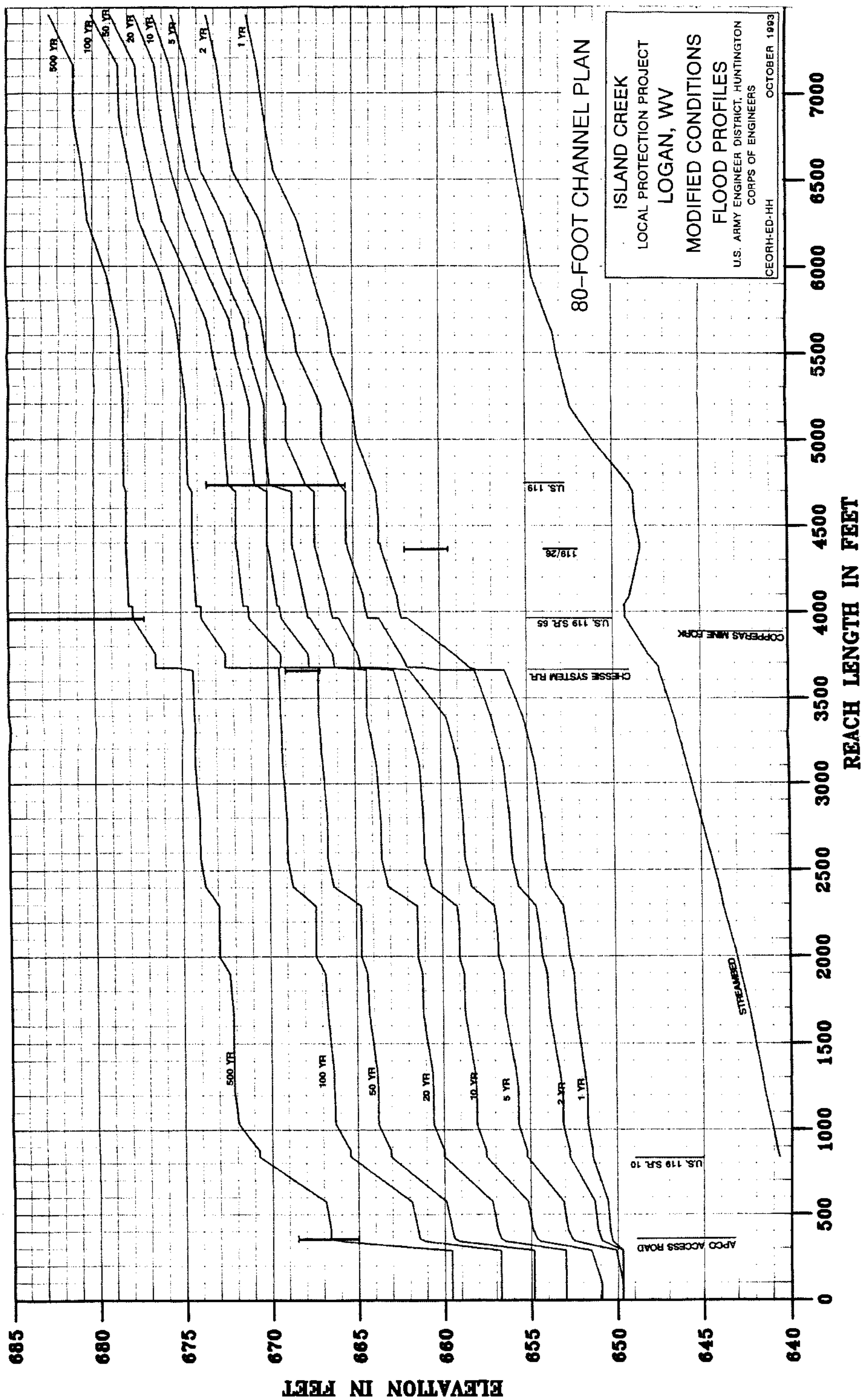


EXHIBIT NO. A-II-8

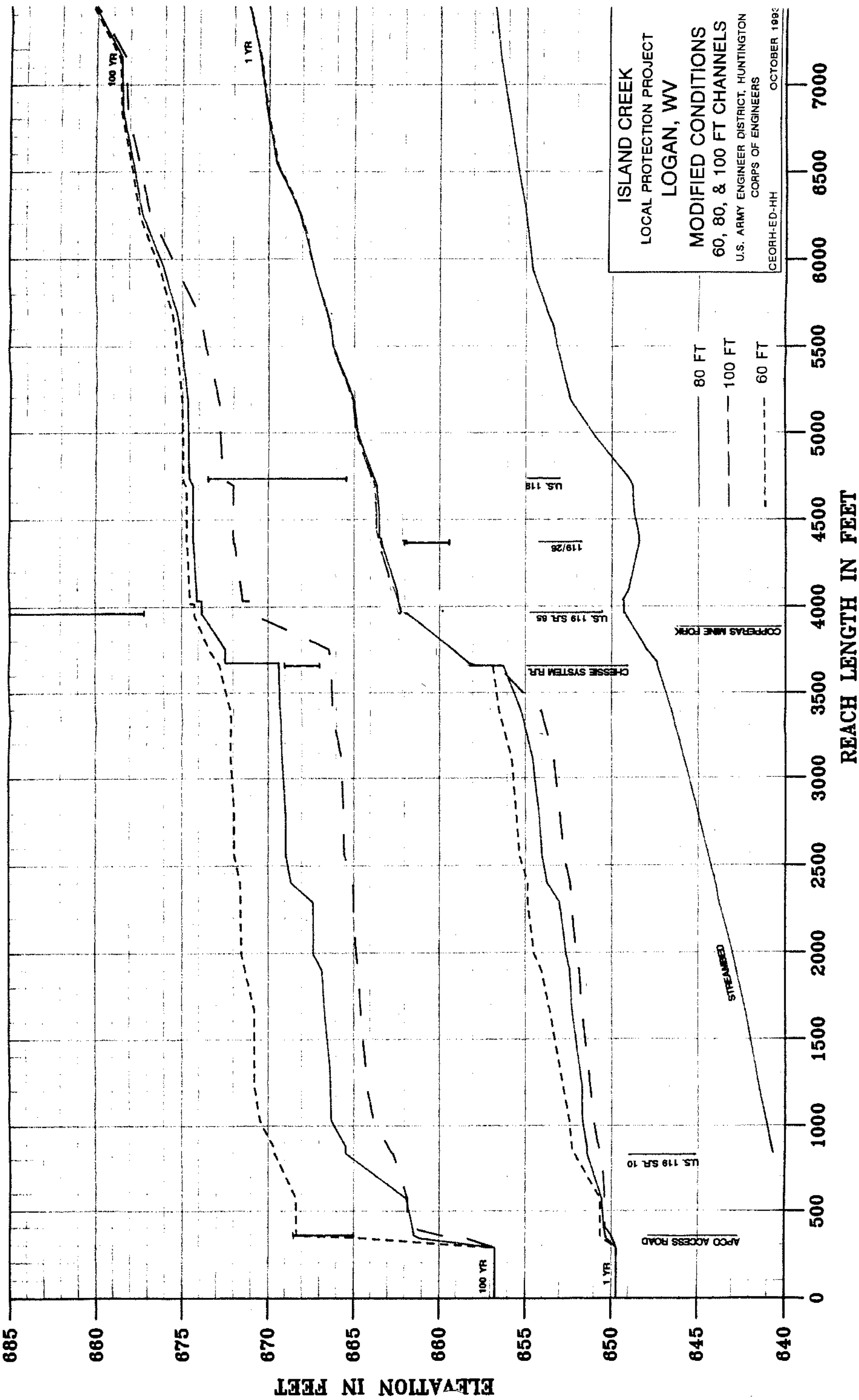


EXHIBIT NO. A-II-9

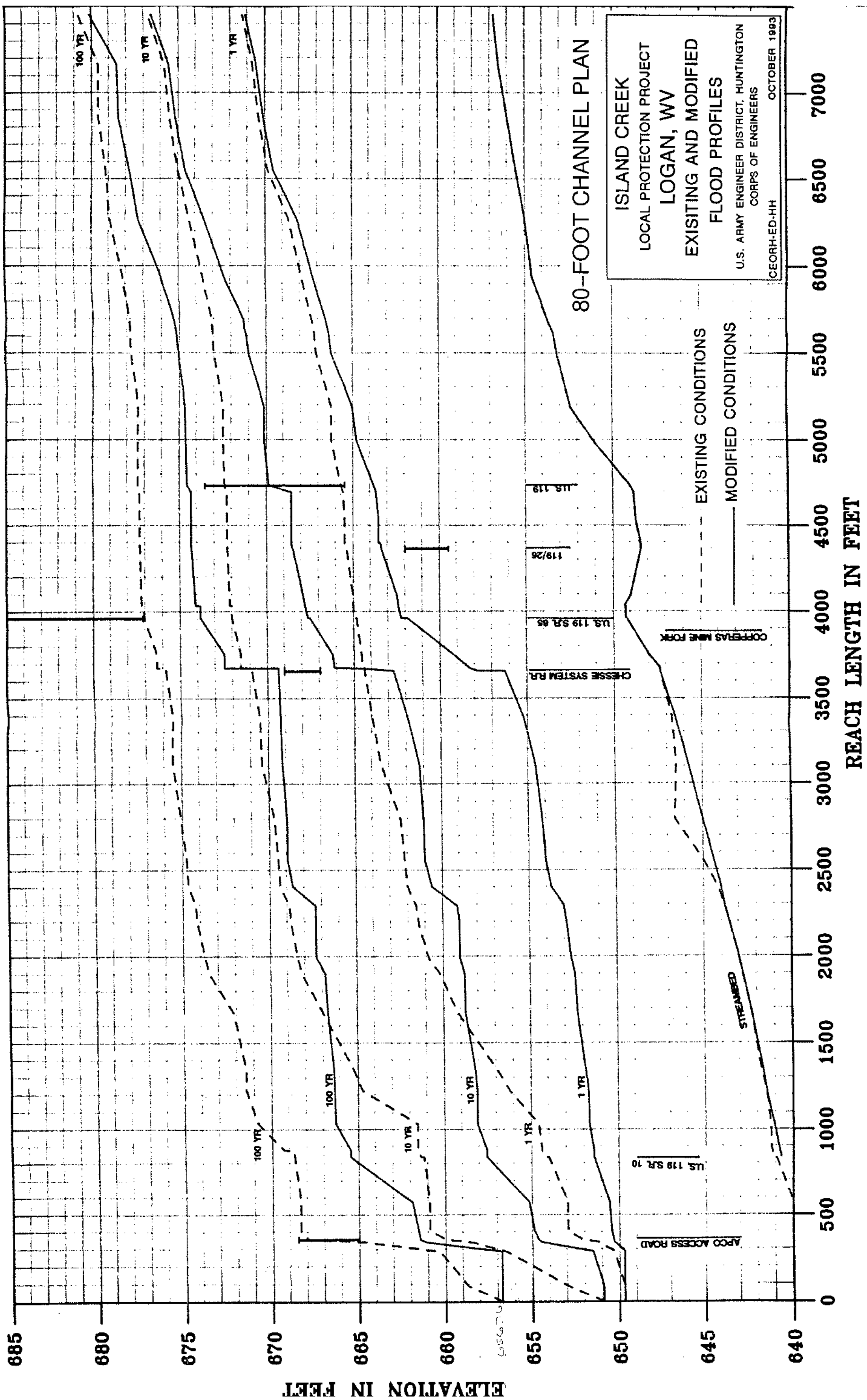
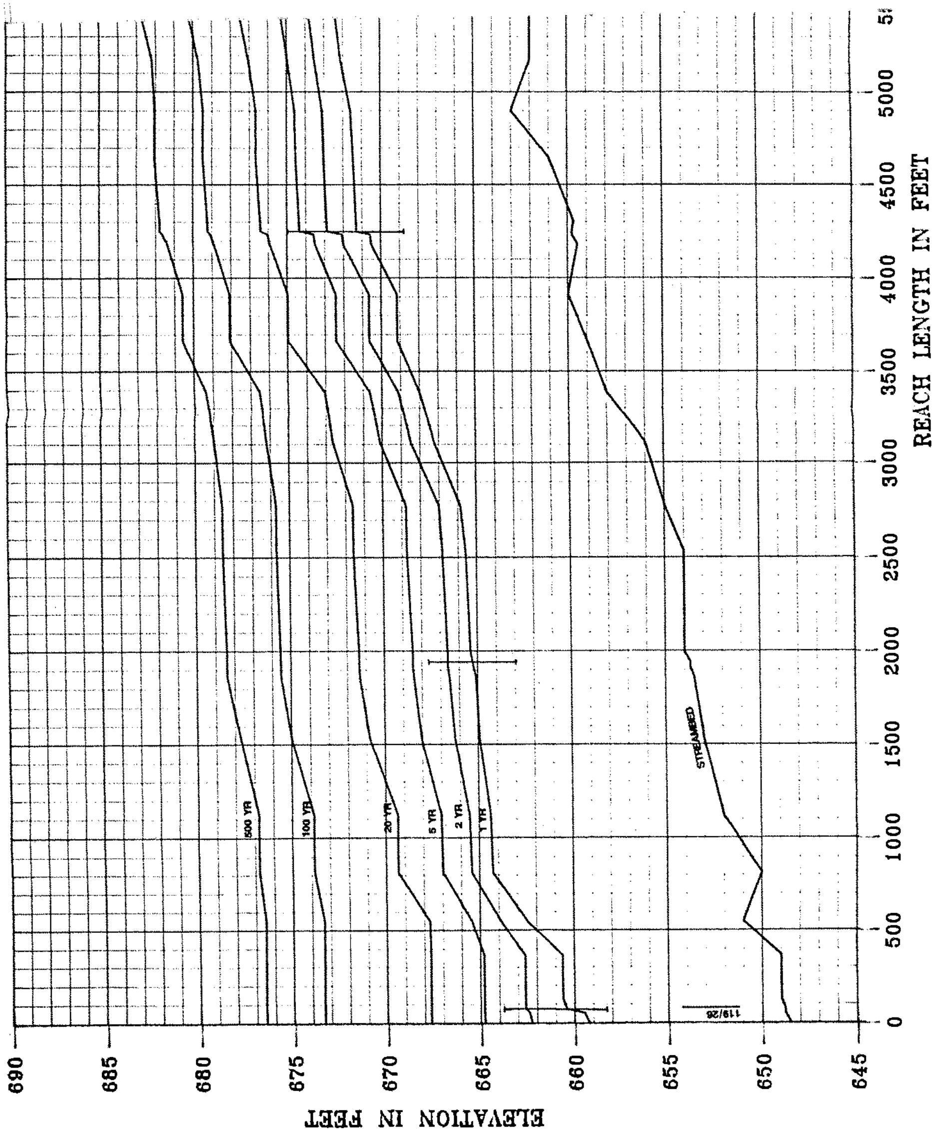


EXHIBIT NO. A-II-10


ELEVATION IN FEET
690
685
680
675
670
665
660
655
650
645
REACH LENGTH IN FEET
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
500 YR
100 YR
20 YR
5 YR
2 YR
1 YR
STREAMBED
119/26

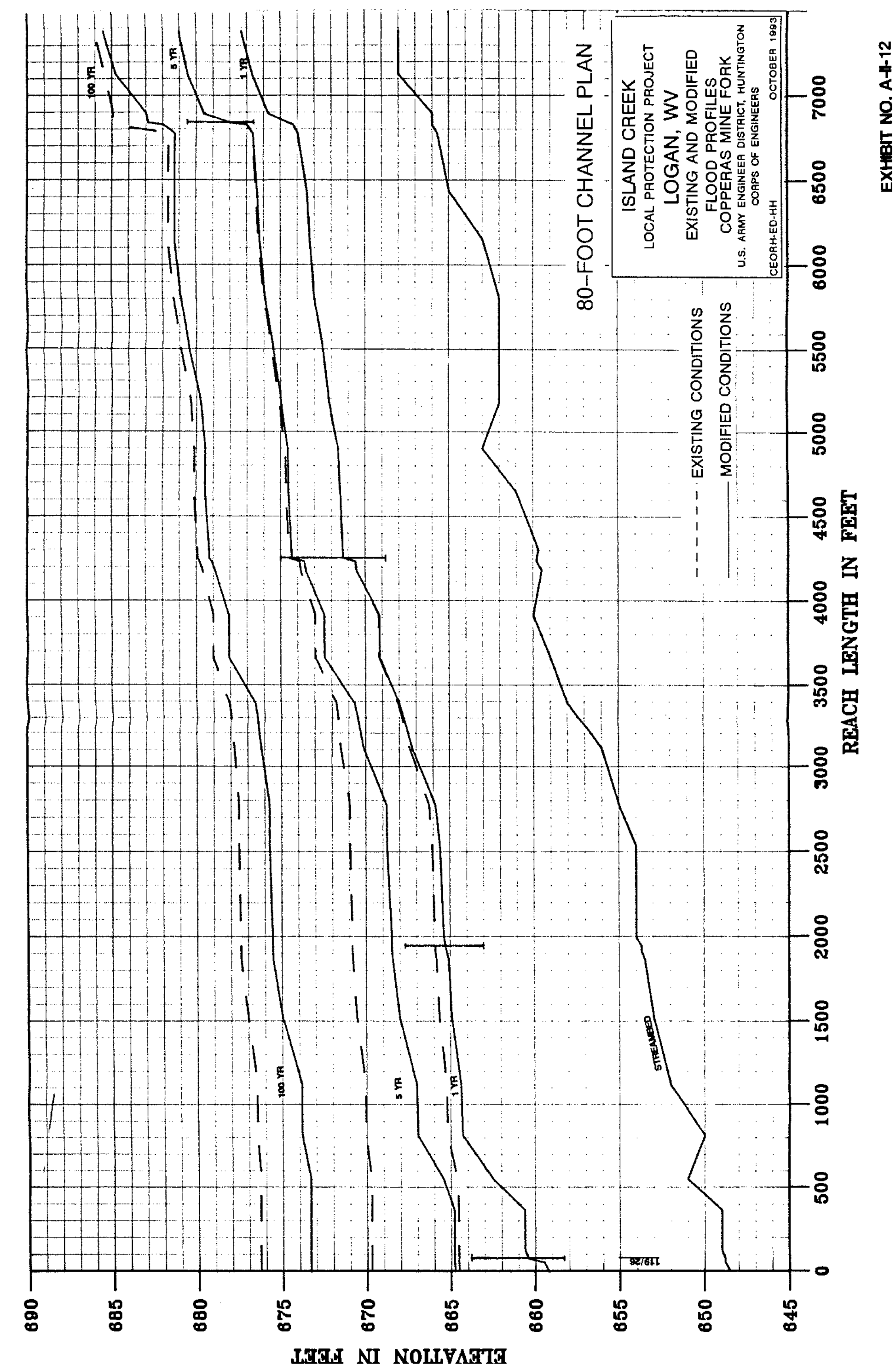


EXHIBIT NO. A-II-12

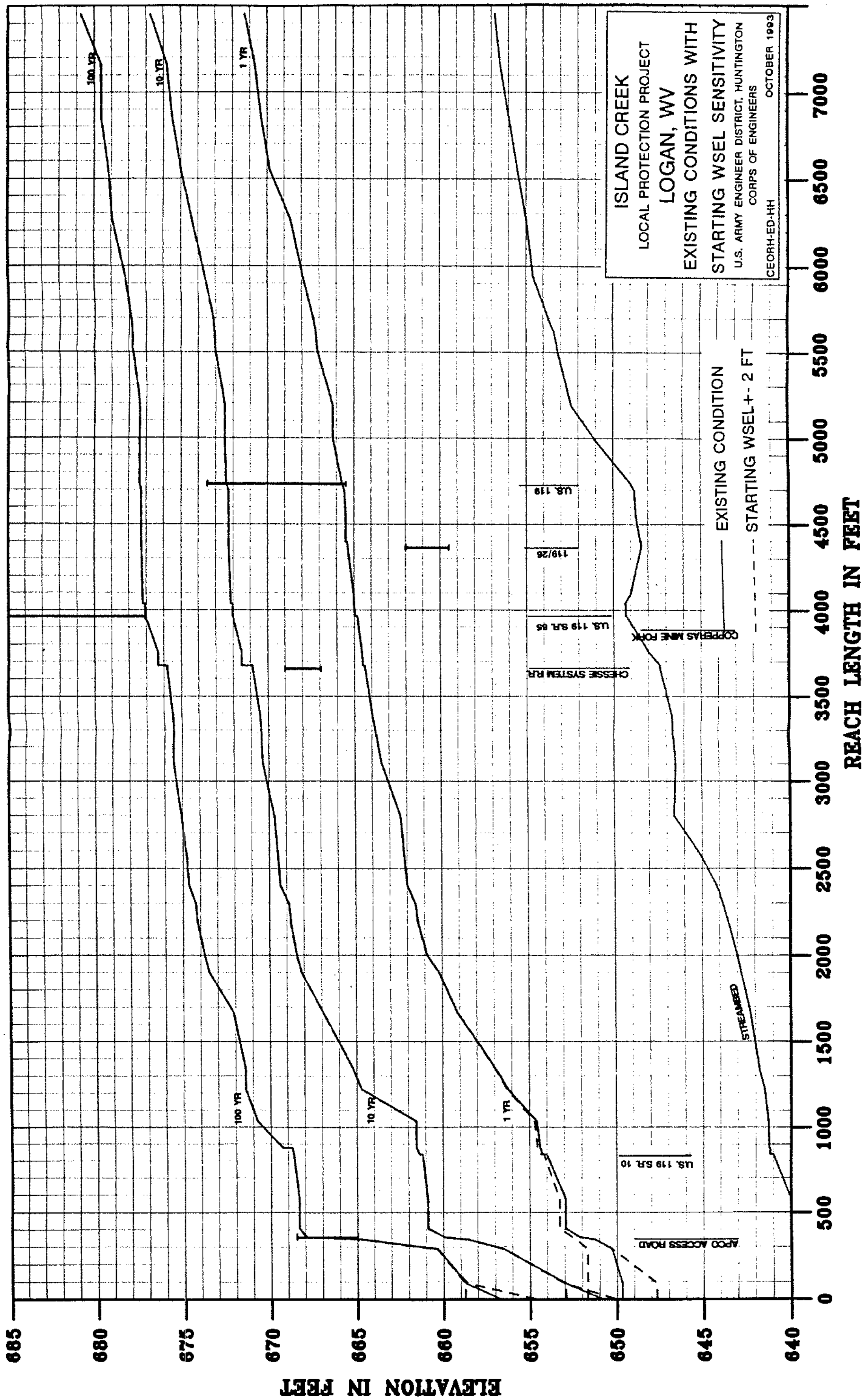


EXHIBIT NO. A-4-13

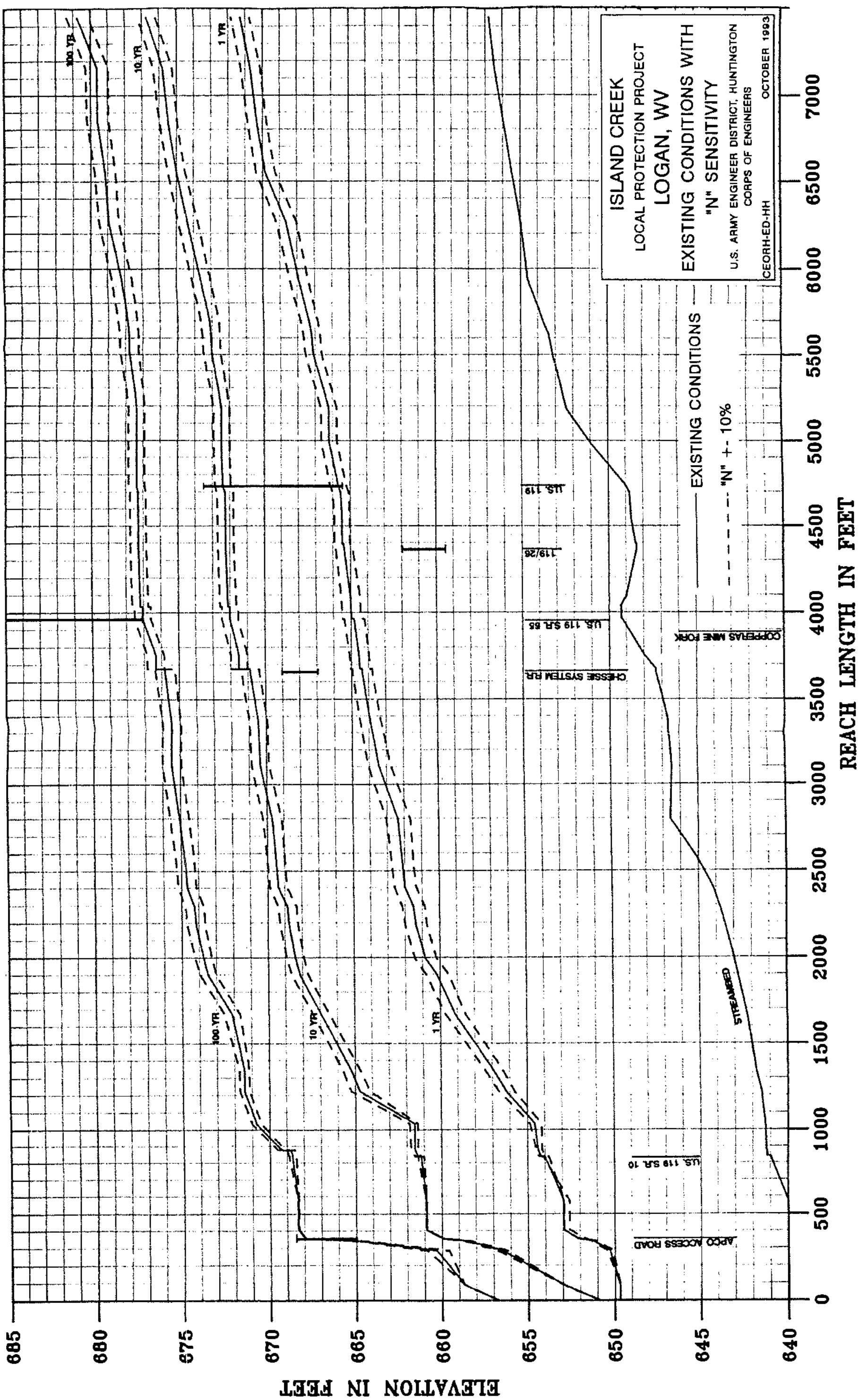


EXHIBIT NO. A-II-14

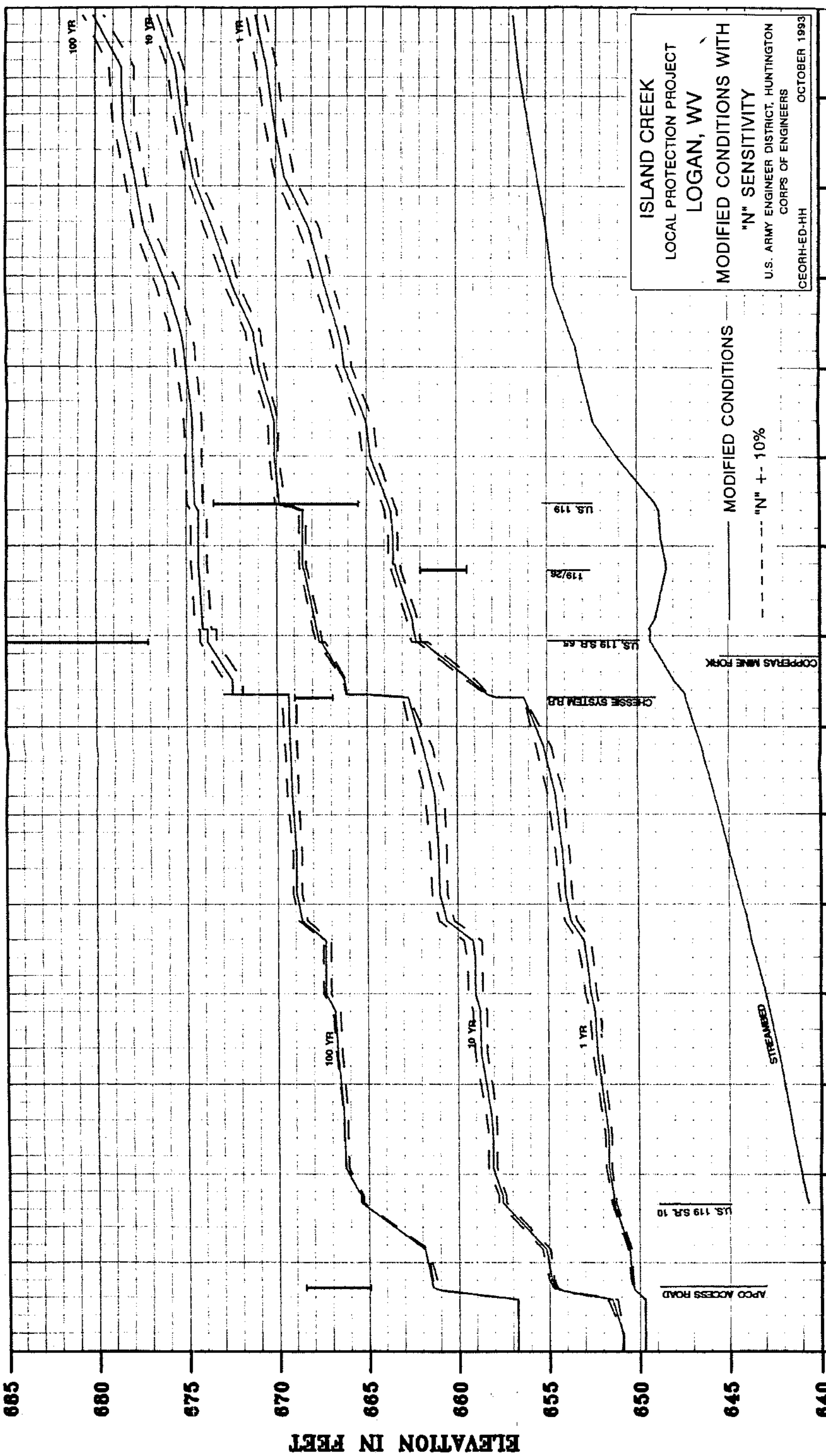


EXHIBIT NO. A-II-15

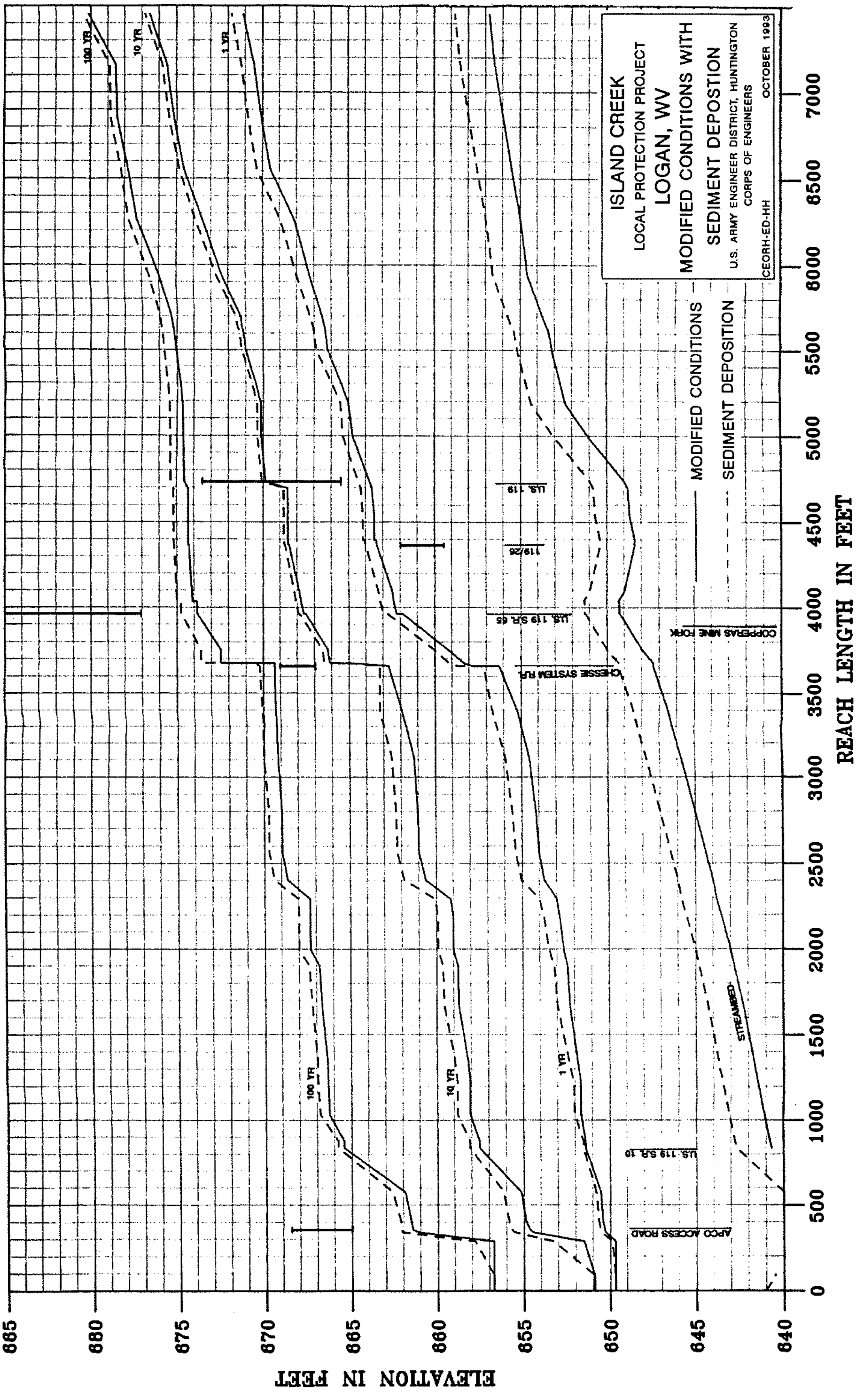
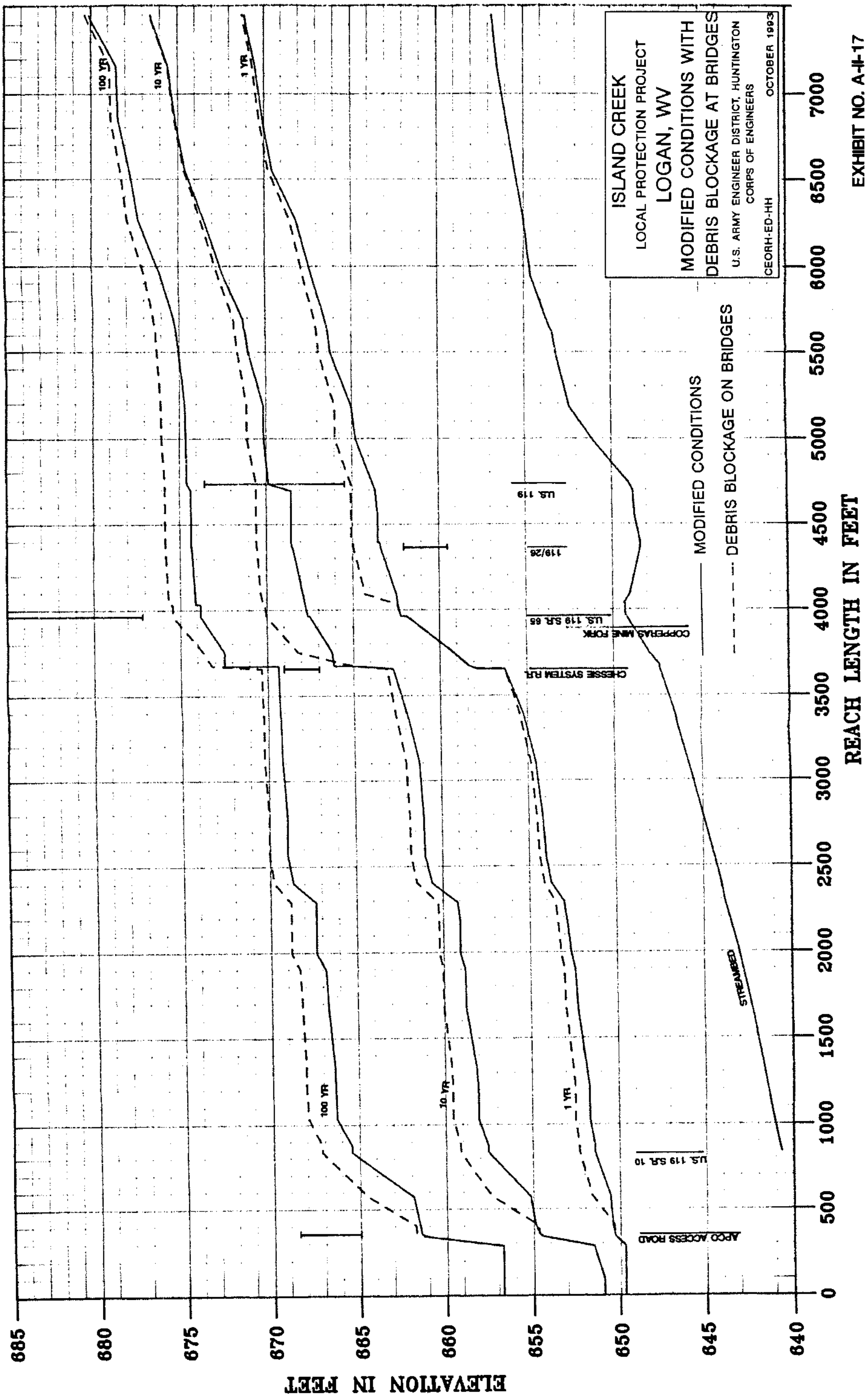
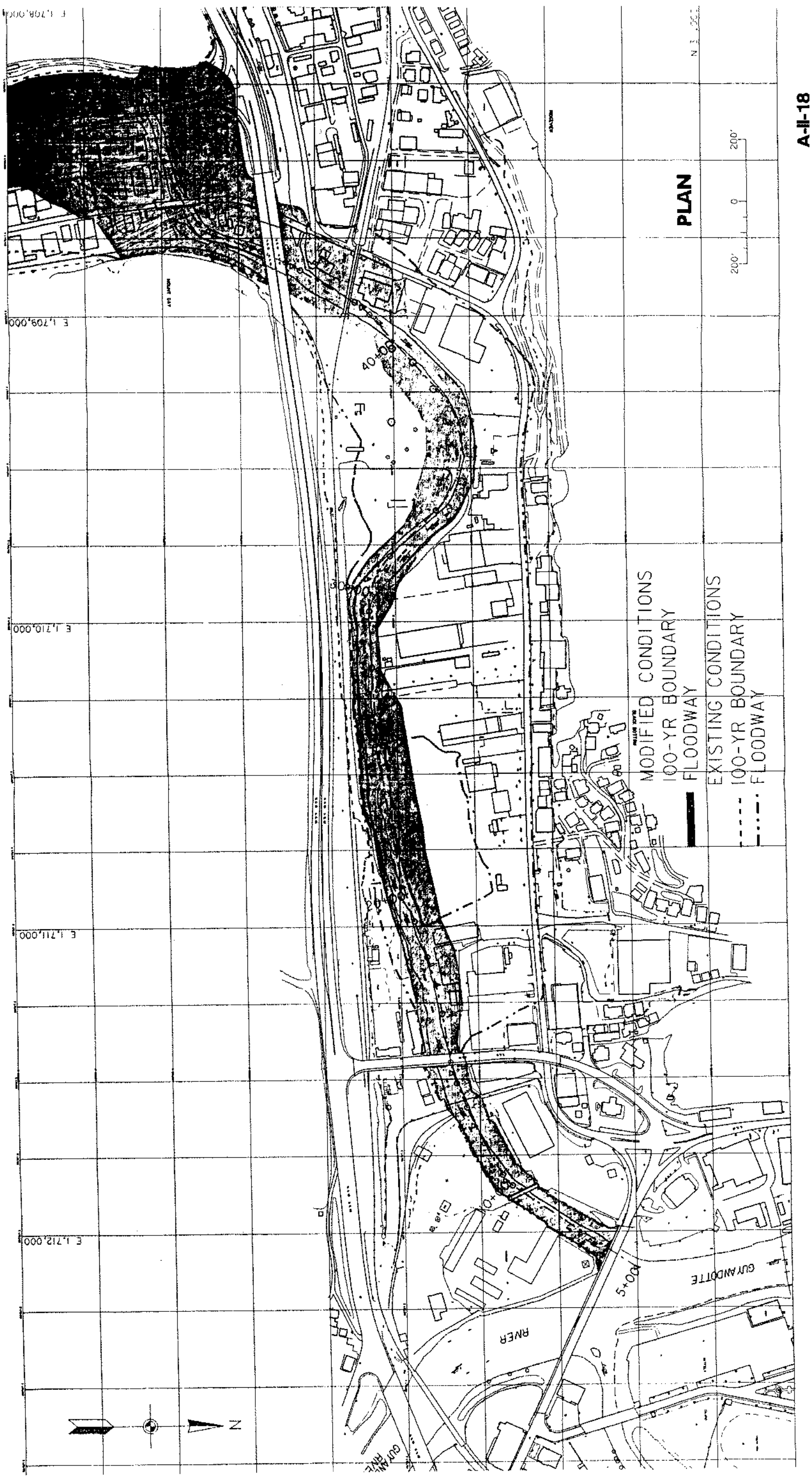


EXHIBIT NO. A-II-16


ISLAND CREEK
LOCAL PROTECTION PROJECT
LOGAN, WV
MODIFIED CONDITIONS WITH
DEBRIS BLOCKAGE AT BRIDGES
U.S. ARMY ENGINEER DISTRICT, HUNTINGTON
CORPS OF ENGINEERS
CEORH-ED-HH
OCTOBER 1993
MODIFIED CONDITIONS
DEBRIS BLOCKAGE ON BRIDGES
100 YR
10 YR
1 YR
STREAMBED
APCO ACCESS ROAD
U.S. 119 S.R. 10
CHESSIE SYSTEM R.R.
COPPERAS MINE FORK
U.S. 119 S.R. 65
119/26
U.S. 119
ELEVATION IN FEET
685
680
675
670
665
660
655
650
645
640
REACH LENGTH IN FEET
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
7000
EXHIBIT NO. A-II-17


PLAN
200'
0
200'
A-II-18
MODIFIED CONDITIONS
100-YR BOUNDARY
FLOODWAY
EXISTING CONDITIONS
100-YR BOUNDARY
FLOODWAY
E 1,708,000
E 1,709,000
E 1,710,000
E 1,711,000
E 1,712,000
40+00
30+00
5+00
GUYANDOTTE
RIVER
N

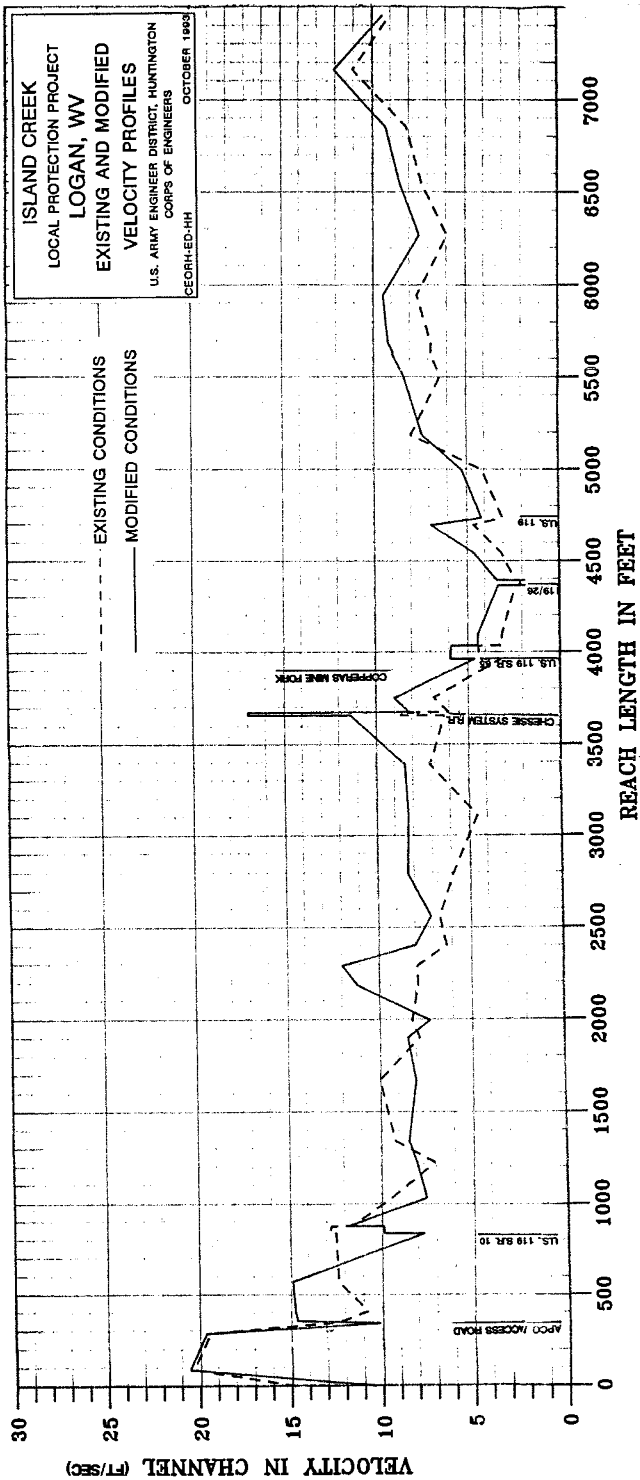


EXHIBIT NO. A-II-19

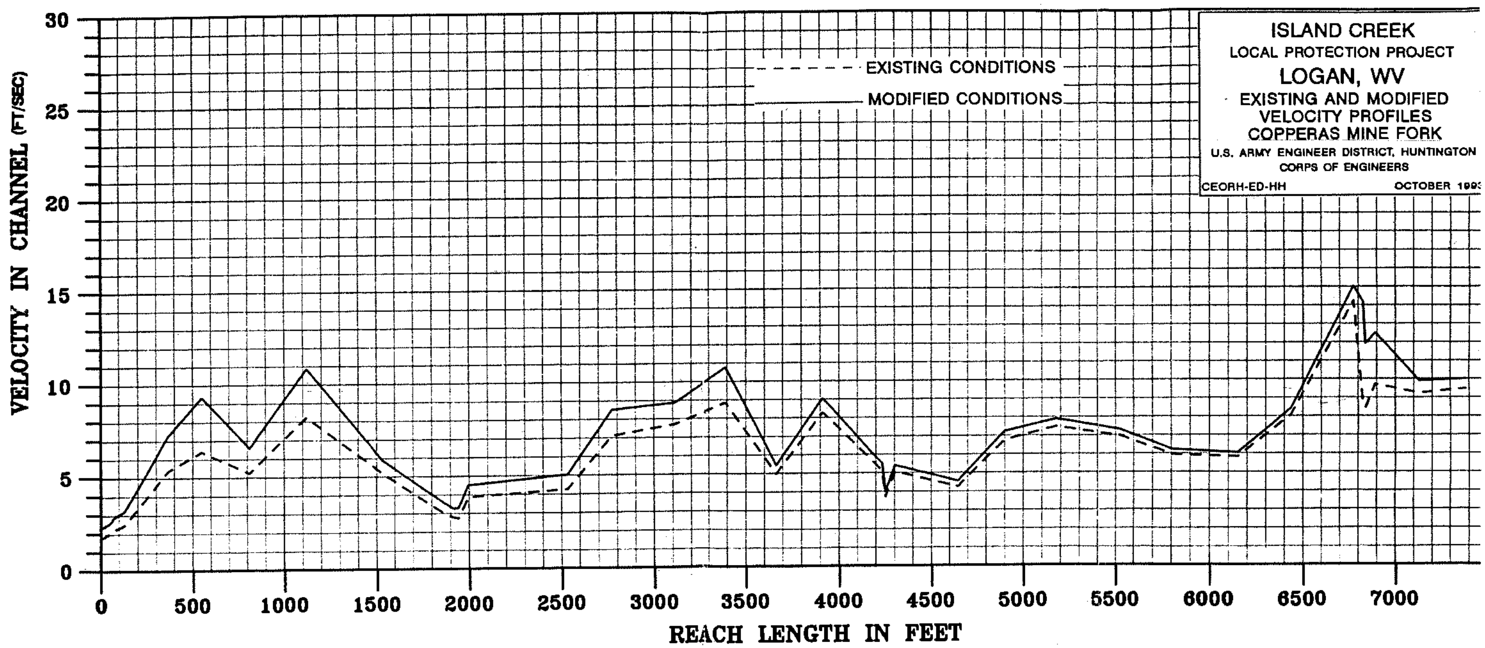


EXHIBIT NO. A-II-20

```
*****************************************************
*                                                   *
*     HYDRAULIC DESIGN PACKAGE FOR FLOOD CONTROL    *
*                  CHANNELS (SAM)                   *
*                                                   *
*              HYDRAULIC CALCULATIONS               *
*                                                   *
*    VERSION 3.06                  31 March 1993    *
*                                                   *
*                 A Product of the                  *
*     Flood Control Channels Research Program       *
*Hydraulics Laboratory, Waterways Experiment Station*
*****************************************************
```

STATION NO. 25+OO

```
TABLE  1.  LIST INPUT DATA.

TI ISLAND CREEK RIPRAP COMPUTATIONS  STATION NO. 25+00
F# 45678 2345678 2345678 2345678 2345678 2345678 2345678 2345678 2345678 234567
RS 11.64   18.64     2.5              1.5
RR  2.65     0.                0.              0.3
$$END

INPUT IS COMPLETE.


...CAUTION...  NO WATER TEMPERATURE PRESCRIBED.
               PROGRAM USED THE DEFAULT, DEG F. =    60.00


   TABLE  0-3.  PROPERTIES OF THE WATER

 #  TEMP     RHO    VISCOSITY  UNIT WT
    DEG F  #-S/FT4   SF/SEC    WATER
                     *100000   #/FT3

 1   60.    1.938     1.216   62.369


RIPRAP SIZE FOR A GIVEN VELOCITY AND DEPTH


       USING GRADED RIPRAP TABLES FROM EM 1110-2-1601

 LAYER  D30CR  DMAXRR    D30    D50    D90    WIDTH    CY/FT  TONS/FT    $/FT
   #     FT     IN       FT     FT     FT      FT
   3     .65   18.00    .73    .88   1.06    50.19    4.182     .214     .00


RIPRAP SIZE       = LAYER#  3            DMAX, INCHES         =       18.
  VELOCITY, FT   =       11.64           VSS/VAVG             =     1.000
  BEND RADIUS,FT =          0.           TOP WIDTH, FT        =        1.
  R/W            =        .000           VERT VEL CORR, Cv    =     1.283
  LOCAL DEPTH, FT=       18.64           DESIGN DEPTH         =     14.91
  SAFETY FAC, Sf =        1.10           STABILITY COEF, Cs   =      .300
  THICKNESS, IN  =       27.00           THICKNESS COEF, Cv   =     1.500
  SIDE SLOPE     =        2.50           SIDE SLOPE CORR, K1=       1.060
  SP.GR. RIPRAP  =        2.65           POROSITY, %          =     38.00
  CHANNEL TYPE   =     NATURAL           COST PER FOOT,$/FT   =       .00
```

NOTE: RECOMMENDED 30-INCH LAYER THICKNESS

STATION NO. 25+00

OUTPUT FOR ALPHA METHOD
CORPS PROGRAM H7012-ALPHA METHOD
STATION 25+00

DEPTH CHOSEN-SLOPE CALCULATED
MANNING'S N CHOSEN-KS CALCULATED

WATER SURFACE ELEVATION = 661.40 FEET.

FLOW AREA COORDINATES

X	Y
40.64	661.40
87.60	642.80
163.80	642.80
166.80	646.00
183.80	660.00
185.62	661.40

SECTIONAL DATA

SECTION NUMBER

	1	2	3	4	5
AREA-FT SQUARED	436.69	1417.32	51.00	142.80	1.27
MEAN DEPTH-FT	9.30	18.60	17.00	8.40	.70
VELOCITY-FPS	4.99	11.64	3.55	2.40	.47
WETTED PERIMETER-FT	50.51	76.20	4.39	22.02	2.30
TOPWIDTH-FT	46.96	76.20	3.00	17.00	1.82
HYDRAULIC RADIUS-SQ FT	8.65	18.60	11.63	6.48	.55
DISCHARGE-CFS	2178.61	16496.94	180.82	343.03	.59
CHEZY C	60.83	96.76	37.28	33.82	22.45
MANNING'S N	.035	.025	.060	.060	.060
BOUNDARY ROUGHNESS (KS)-FT	1.4362	.2442	10.1919	7.2564	1.3863
SHEAR VELOCITY-FPS.	.47	.69	.49	.38	.11
MEAN BOUNDARY SHEAR-PSF.	.425	.929	.461	.277	.023

STATION NO. 25+00

DATA FOR WHOLE CROSS SECTION

MAX. DEPTH (FT) = 18.60
HYDRAULIC DEPTH (FT) = 11.04
DISCHARGE (CFS) = 19200.00
MEAN VELOCITY (FPS) = 9.37
BOTTOM SLOPE (FT/FT) = .00078
MEAN BOUNDARY SHEAR (LB/SQ FT) = .834
TOTAL TOPWIDTH-FT = 185.62
LEFT BANK SLOPE = 2.52H:1V
RIGHT BANK SLOPE = 1.30H:1V
HYDRAULIC RADIUS (FT) = 13.18
WEIGHTED MEAN HYDRAULIC RADIUS (FT) = 17.19
FLOW AREA (SQ FT) = 2049.08
WETTED PERIMETER (FT) = 155.41
FROUDE NUMBER = .50
EFFECTIVE MANNING'S N = .0295
EFFECTIVE MANNING'S N (HORTON'S METHOD) = .0358
EFFECTIVE CHEZY C = 80.96
EFFECTIVE ROUGHNESS (FT) = .685
ALPHA = 1.36
EFFECTIVE ROUGHNESS (ALPHA CONSIDERED) (FT) = .2644

```
*****************************************************
*                                                   *
*     HYDRAULIC DESIGN PACKAGE FOR FLOOD CONTROL    *
*                  CHANNELS (SAM)                   *
*                                                   *
*              HYDRAULIC CALCULATIONS               *
*                                                   *
*    VERSION 3.06                 31 March 1993     *
*                                                   *
*                 A Product of the                  *
*     Flood Control Channels Research Program       *
*Hydraulics Laboratory, Waterways Experiment Station*
*****************************************************
```

TABLE 1. LIST INPUT DATA. **STATION NO. 36+50**

```
TI ISLAND CREEK RIPRAP COMPUTATIONS  STATION NO. 36+50
F# 45678 2345678 2345678 2345678 2345678 2345678 2345678 2345678 2345678 234567
RS  9.75   18.95     2.5             1.5
RR  2.65      0.               0.              0.3
$$END
```

INPUT IS COMPLETE.

```
...CAUTION...  NO WATER TEMPERATURE PRESCRIBED.
               PROGRAM USED THE DEFAULT, DEG F. =    60.00
```

TABLE 0-3. PROPERTIES OF THE WATER

#	TEMP DEG F	RHO #-S/FT4	VISCOSITY SF/SEC *100000	UNIT WT WATER #/FT3
1	60.	1.938	1.216	62.369

RIPRAP SIZE FOR A GIVEN VELOCITY AND DEPTH

USING GRADED RIPRAP TABLES FROM EM 1110-2-1601

LAYER #	D30CR FT	DMAXRR IN	D30 FT	D50 FT	D90 FT	WIDTH FT	CY/FT	TONS/FT	$/FT
1	.42	12.00	.48	.58	.70	51.02	2.835	.145	.00

```
RIPRAP SIZE        = LAYER#  1             DMAX, INCHES          =        12.
  VELOCITY, FT'    =        9.75           VSS/VAVG              =     1.000
  BEND RADIUS,FT   =          0.           TOP WIDTH, FT         =        1.
  R/W              =        .000           VERT VEL CORR, Cv     =     1.283
  LOCAL DEPTH, FT=         18.95           DESIGN DEPTH          =     15.16
  SAFETY FAC, Sf   =        1.10           STABILITY COEF, Cs    =      .300
  THICKNESS, IN    =       18.00           THICKNESS COEF, Cv    =     1.000
  SIDE SLOPE       =        2.50           SIDE SLOPE CORR, K1=        1.060
  SP.GR. RIPRAP    =        2.65           POROSITY, %           =     38.00
  CHANNEL TYPE     =     NATURAL           COST PER FOOT,$/FT    =       .00
```

EXHIBIT NO. A-II-21 SHEET 4 OF 9

STATION NO. 36+50

OUTPUT FOR ALPHA METHOD
CORPS PROGRAM H7012-ALPHA METHOD
STATION 36+50

DEPTH CHOSEN-SLOPE CALCULATED
MANNING'S N CHOSEN-KS CALCULATED

WATER SURFACE ELEVATION = 665.45 FEET.

FLOW AREA COORDINATES

X	Y
-1.81	665.45
5.00	660.00
67.00	660.00
80.00	662.00
130.00	662.60
182.00	662.00
193.00	660.00
200.00	650.00
201.00	649.50
205.00	646.50
284.40	646.50
331.77	665.45

SECTIONAL DATA

SECTION NUMBER	1	2	3	4	5	6	7	8	9	10	11
AREA-FT SQUARED	18.56	337.90	57.85	157.50	163.80	48.95	73.15	15.70	69.80	1504.63	448.88
MEAN DEPTH-FT	2.73	5.45	4.45	3.15	3.15	4.45	10.45	15.70	17.45	18.95	9.48
VELOCITY-FPS	1.42	2.66	2.31	1.85	1.85	2.30	2.84	4.01	7.98	9.75	4.19
WETTED PERIMETER-FT	8.72	62.00	13.15	50.00	52.00	11.18	12.21	1.12	5.00	79.40	51.02
TOPWIDTH-FT	6.81	62.00	13.00	50.00	52.00	11.00	7.00	1.00	4.00	79.40	47.37
HYDRAULIC RADIUS-SQ FT	2.13	5.45	4.40	3.15	3.15	4.38	5.99	14.04	13.96	18.95	8.80
DISCHARGE-CFS	26.42	900.40	133.62	291.19	302.84	112.72	207.66	62.90	557.14	14723.99	1881.10
MANNING'S N	.040	.040	.040	.040	.040	.040	.040	.050	.025	.025	.035
BOUNDARY ROUGHNESS (KS)-FT	1.3239	2.0462	1.8660	1.6028	1.6028	1.8622	2.1284	6.5713	.2522	.2435	1.4433
SHEAR VELOCITY-FPS.	.18	.32	.28	.24	.24	.28	.28	.49	.48	.58	.39
MEAN BOUNDARY SHEAR-PSF.	.065	.193	.155	.112	.112	.154	.157	.466	.450	.653	.298

STATION NO. 36+50

DATA FOR WHOLE CROSS SECTION

MAX. DEPTH (FT) = 18.95
HYDRAULIC DEPTH (FT) = 8.73
DISCHARGE (CFS) = 19200.00
MEAN VELOCITY (FPS) = 6.63
BOTTOM SLOPE (FT/FT) = .00054
MEAN BOUNDARY SHEAR (LB/SQ FT) = .546
TOTAL TOPWIDTH-FT = 331.77
LEFT BANK SLOPE = 1.25H:1V
RIGHT BANK SLOPE = 2.50H:1V
HYDRAULIC RADIUS (FT) = 8.38
WEIGHTED MEAN HYDRAULIC RADIUS (FT) = 16.32
FLOW AREA (SQ FT) = 2896.72
WETTED PERIMETER (FT) = 345.81
FROUDE NUMBER = .40
EFFECTIVE MANNING'S N = .0334
EFFECTIVE MANNING'S N (HORTON'S METHOD) = .0359
EFFECTIVE CHEZY C = 70.78
EFFECTIVE ROUGHNESS (FT) = 1.337
ALPHA = 1.77
EFFECTIVE ROUGHNESS (ALPHA CONSIDERED) (FT) = .2572

```
*****************************************************
*                                                   *
*     HYDRAULIC DESIGN PACKAGE FOR FLOOD CONTROL    *
*                  CHANNELS (SAM)                   *
*                                                   *
*              HYDRAULIC CALCULATIONS               *
*                                                   *
*    VERSION 3.06                 31 March 1993     *
*                                                   *
*                A Product of the                   *
*     Flood Control Channels Research Program       *
*Hydraulics Laboratory, Waterways Experiment Station*
*****************************************************
```

TABLE 1. LIST INPUT DATA. **STATION NO. 42+00**

```
TI ISLAND CREEK RIPRAP COMPUTATIONS  STATION NO. 42+00
F# 45678 2345678 2345678 2345678 2345678 2345678 2345678 2345678 2345678 234567
RS 16.90   22.10    2.0            1.
RR  2.65     0.             1.             0.3
$$END
```

INPUT IS COMPLETE.

```
...CAUTION...  NO WATER TEMPERATURE PRESCRIBED.
               PROGRAM USED THE DEFAULT, DEG F. =    60.00
```

TABLE 0-3. PROPERTIES OF THE WATER

#	TEMP DEG F	RHO #-S/FT4	VISCOSITY SF/SEC *100000	UNIT WT WATER #/FT3
1	60.	1.938	1.216	62.369

RIPRAP SIZE FOR A GIVEN VELOCITY AND DEPTH

USING GRADED RIPRAP TABLES FROM EM 1110-2-1601

LAYER #	D30CR FT	DMAXRR IN	D30 FT	D50 FT	D90 FT	WIDTH FT	CY/FT	TONS/FT	$/FT
12	2.00	54.00	2.19	2.63	3.17	49.42	8.236	.422	.00

```
RIPRAP SIZE        = LAYER# 12           DMAX, INCHES           =       54.
  VELOCITY, FT     =       16.90         VSS/VAVG               =     1.000
  BEND RADIUS,FT   =          0.         TOP WIDTH, FT          =        1.
  R/W              =        .000         VERT VEL CORR, Cv      =     1.283
  LOCAL DEPTH, FT=         22.10         DESIGN DEPTH           =     17.68
  SAFETY FAC, Sf   =        1.10         STABILITY COEF, Cs     =      .300
  THICKNESS, IN    =       54.00         THICKNESS COEF, Cv     =     4.500
  SIDE SLOPE       =        2.00         SIDE SLOPE CORR, K1=         1.180
  SP.GR. RIPRAP    =        2.65         POROSITY, %            =     38.00
  CHANNEL TYPE     =   TRAPEZOID         COST PER FOOT,$/FT     =       .00
```

STATION NO. 42+00

OUTPUT FOR ALPHA METHOD
CORPS PROGRAM H7012 - ALPHA METHOD
STATION NO. 42+00

DEPTH CHOSEN-SLOPE CALCULATED
MANNING'S N CHOSEN-KS CALCULATED

WATER SURFACE ELEVATION = 669.46 FEET.

FLOW AREA COORDINATES

X	Y
.07	669.46
.10	660.00
10.38	658.01
20.68	652.67
23.26	651.96
35.96	648.11
54.64	647.36
66.80	649.32
76.10	650.61
76.50	659.00
80.30	660.00
124.30	668.00
140.30	669.20
142.57	669.46

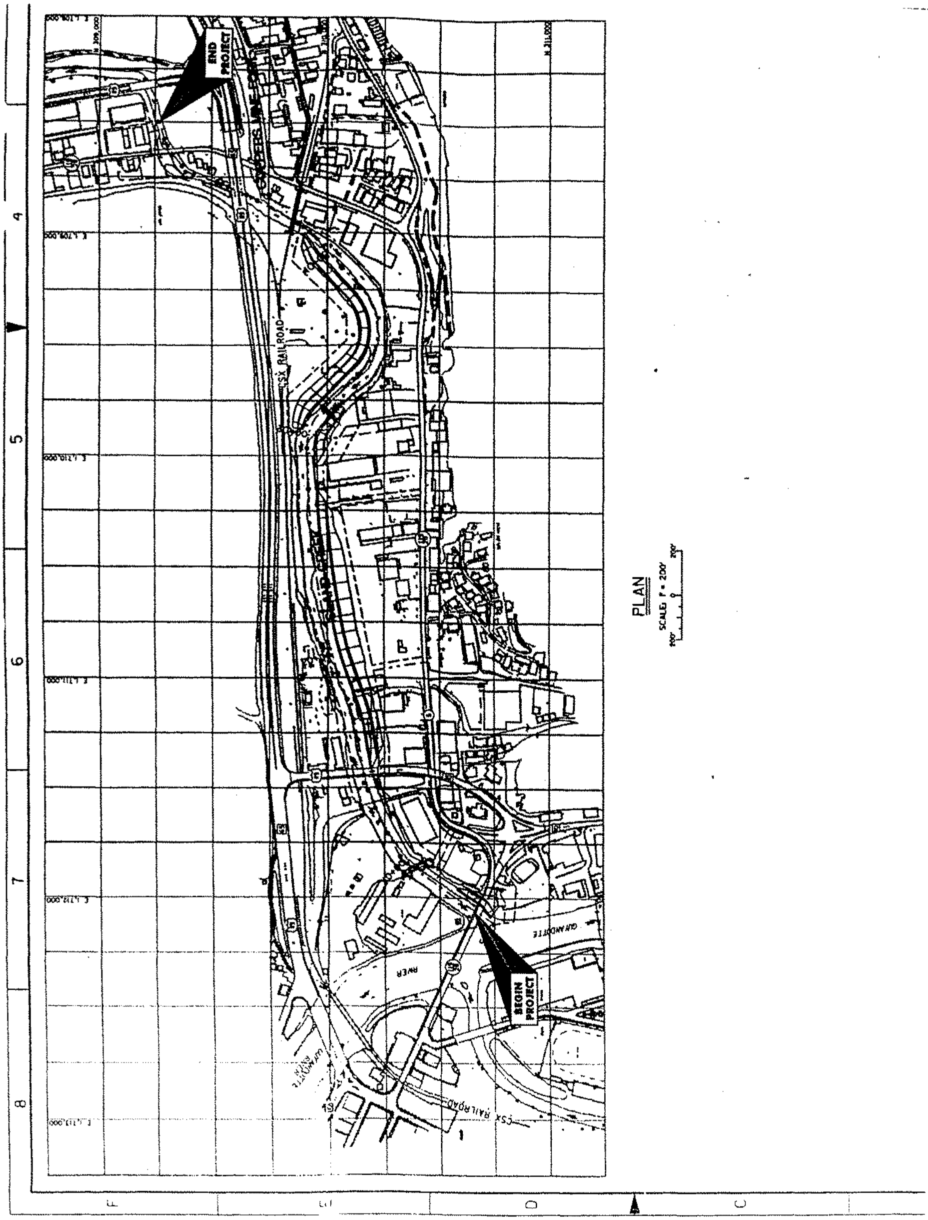
SECTIONAL DATA

SECTION NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13
AREA-FT SQUARED	.15	107.48	145.44	44.23	246.70	405.82	256.82	181.30	5.86	37.85	240.24	13.76	.30
MEAN DEPTH-FT	4.73	10.45	14.12	17.14	19.42	21.73	21.12	19.49	14.85	9.96	5.46	.86	.13
VELOCITY-FPS	.10	7.69	7.03	8.45	9.14	16.90	16.45	15.63	1.28	5.90	4.00	1.18	.33
WETTED PERIMETER-FT	9.46	10.47	11.60	2.68	13.27	18.70	12.32	9.39	8.40	3.93	44.72	16.04	2.29
TOPWIDTH-FT	.03	10.28	10.30	2.58	12.70	18.68	12.16	9.30	.40	3.80	44.00	16.00	2.27
HYDRAULIC RADIUS-SQ FT	.02	10.26	12.54	16.53	18.59	21.71	20.85	19.31	.70	9.63	5.37	.86	.13
DISCHARGE-CFS	.02	826.63	1022.41	373.95	2255.34	6856.92	4224.37	2833.43	7.51	223.21	959.95	16.18	.10
MANNING'S N	.040	.040	.050	.050	.050	.030	.030	.030	.040	.050	.050	.050	.050
BOUNDARY ROUGHNESS (KS)-FT	.0517	2.6158	6.2358	7.0706	7.4419	.7673	.7664	.7641	.7193	5.4977	4.0733	1.3522	.3543
SHEAR VELOCITY-FPS.	.00	.81	.87	1.03	1.09	1.18	1.15	1.11	.09	.79	.59	.24	.10
MEAN BOUNDARY SHEAR-PSF.	.000	1.283	1.484	2.057	2.302	2.691	2.575	2.388	.017	1.206	.684	.113	.018

STATION NO. 42+00

DATA FOR WHOLE CROSS SECTION

MAX. DEPTH (FT)= 22.10
HYDRAULIC DEPTH (FT)= 11.82
DISCHARGE (CFS) = 19600.00
MEAN VELOCITY (FPS)= 11.63
BOTTOM SLOPE (FT/FT)= .00192
MEAN BOUNDARY SHEAR (LB/SQ FT)= 2.253
TOTAL TOPWIDTH-FT= 142.57
LEFT BANK SLOPE = .00H:1V
RIGHT BANK SLOPE = 8.75H:1V
HYDRAULIC RADIUS (FT)= 10.33
WEIGHTED MEAN HYDRAULIC RADIUS (FT)= 18.79
FLOW AREA (SQ FT)= 1685.94
WETTED PERIMETER (FT)= 163.27
FROUDE NUMBER= .60
EFFECTIVE MANNING'S N= .0396
EFFECTIVE MANNING'S N (HORTON'S METHOD)= .0437
EFFECTIVE CHEZY C= 61.13
EFFECTIVE ROUGHNESS (FT)= 3.046
ALPHA=1.56
EFFECTIVE ROUGHNESS (ALPHA CONSIDERED) (FT)= 1.0400



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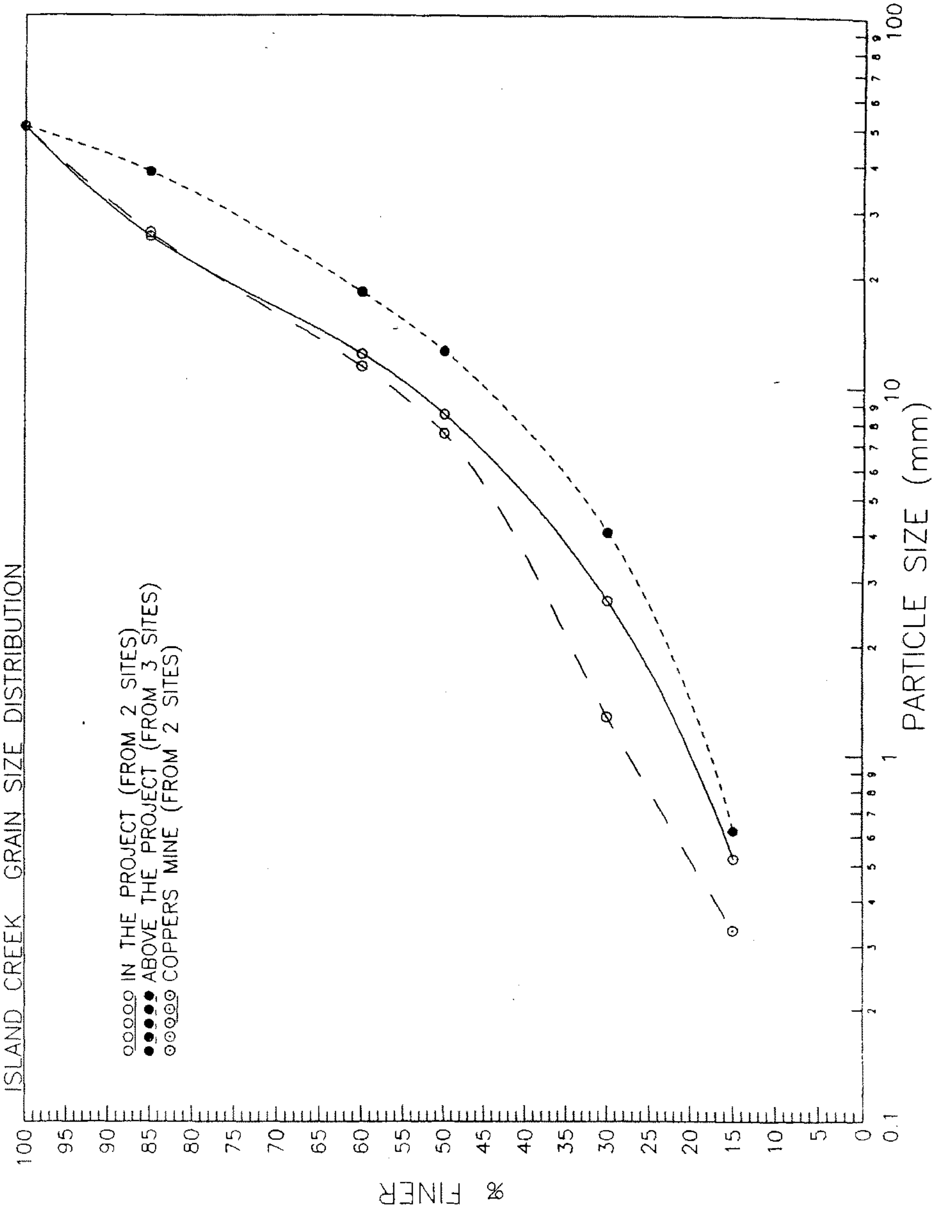

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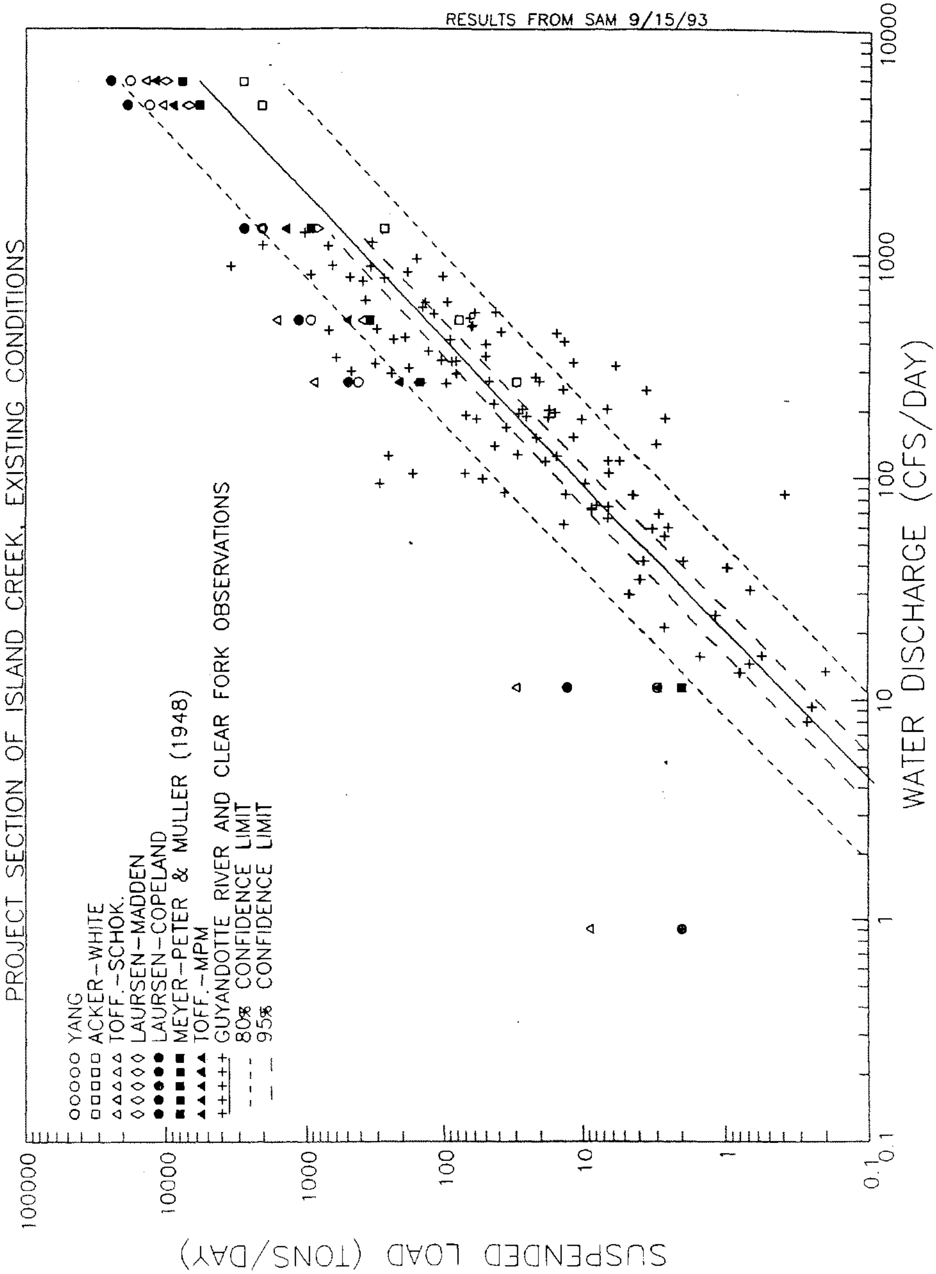
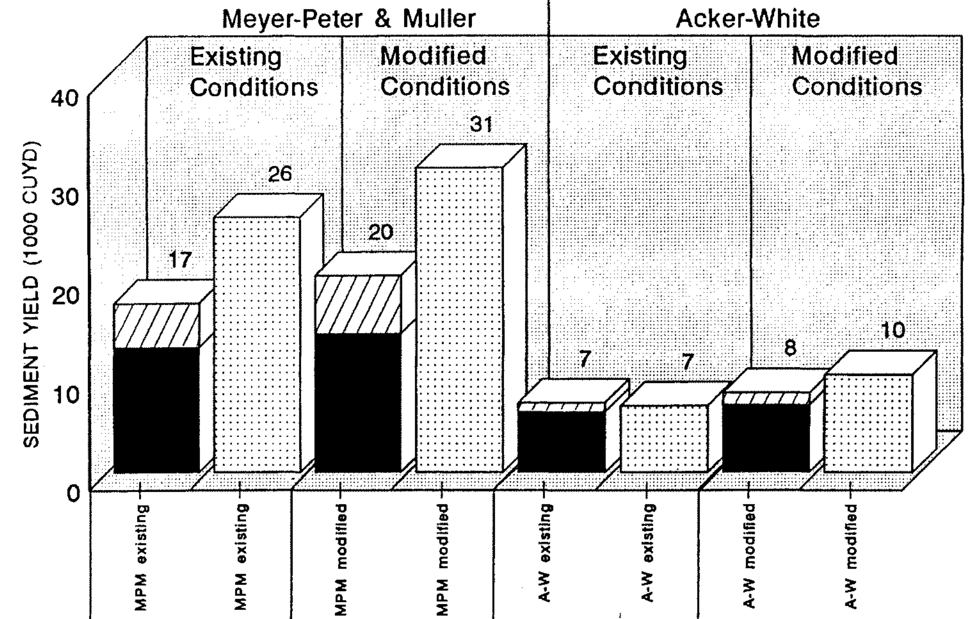


EXHIBIT NO. A-II-24

ISLAND CREEK

Transport Capacity in a Year



IN PROJECT		26		31		7		10
ABOVE PROJECT	4		6		1		1	
COPPER'S MINE FORK	13		14		6		7	

EXHIBIT NO. A-II-25

ISLAND CREEK

LOCAL PROTECTION PROJECT

ENGINEERING TECHNICAL APPENDIX

TO THE

GENERAL REEVALUATION REPORT

TAB II

HYDROLOGY AND HYDRAULICS

SECTION B – FLOOD WARNING SYSTEM

Department of the Army
Huntington District, Corps of Engineers
Huntington, West Virginia

GUYANDOTTE RIVER BASIN
LOGAN COUNTY, LOGAN WV
ISLAND CREEK FLOOD WARNING SYSTEM (FWS)

AUTHORIZATION Refer to the main text of the ETA for a more detailed description of the authorization for this project.

OVERVIEW OF RECOMMENDED FWS Island Creek is located in Logan County West Virginia. It is a tributary of the Guyandotte River at Logan WV. Normally, Flood Warning Systems are designed and implemented within a short period from the time of authorization. The recommended system would be a state-of-the-art integration of new and upgraded river and precipitation gages, radio repeater sites and dedicated computer workstations running software with forecast capability. Advanced warning times would be enhanced significantly with the installation of a Flood Warning System. Operation and Maintenance (O&M) of the completed system will be the responsibility of the Logan County Commission (Sponsor). The estimated cost of the O&M Is approximately $5,400 per gage per year. The warranty on these gages will cover the cost for the first three years. After this period, the Sponsor will be responsible for O&M costs.

RECOMMENDED FWS The recommended FWS will meet the basin-wide requirement of providing flood warning to Logan County. IFLOWS is a wide-area computer network of river and rain gages with enhanced, full, two-way radio, microwave, and satellite and telephone line communications. The primary responsibility for flood forecasting will remain with the National Weather Service (NWS). The real-time data from each of the gages in the proposed system would be relayed to the NWS forecasting center in Cincinnati, Ohio, where it would be processed by existing software to develop flood forecasts. The reliability of flood height predictions and warning times for the project area would be considerably improved over the current capability, based on the inclusion of stream-gage data into the forecast model. Under this plan, the OES Directors of Logan County, (located in local communities) would be equipped with new personal computers and software capable of accessing and querying the individual system gages and receiving the forecast data from the NWS. The local OES representatives will have access to the NWS Flood Analysis and River Emulator (FLARE) flood-forecasting model through these IFLOWS computer workstations. There has been considerable effort by the NWS to purchase software from Diad Incorporated. This software collects, disseminates and displays weather data. Some of the Storm Watch features are One-second time resolution for incoming event data, facilitates data using standard definitions, rating tables and equations, define basins and track rainfall rates and accumulations by catchments, define multiple alarms for any sensor, including high, low, rate of change, digital status, forecast and flash flood guidance, choose optional paging and/or custom notification for each alarm. The IFLOWS computer workstations can also function as stand-alone ALERT (Automatic Local Evaluation in Real Time) base stations in the event of problems with the network.

A Maximum of Ten (10) sites were investigated for installing new river gages. All gages would be installed to for-cast flooding upstream of Logan. TABLE 1 lists all the proposed sites, which would comprise the IFLOWS river gage locations for Island Creek in the Guyandotte River Basin (See site plan enclosed at the end of this section for the location of the proposed sites). The Equipment will handle all functions including satellite, data collection, telephone, and IFLOWS transmission capabilities that the Corps of Engineers, USGS, NWS, and local county OES offices need.

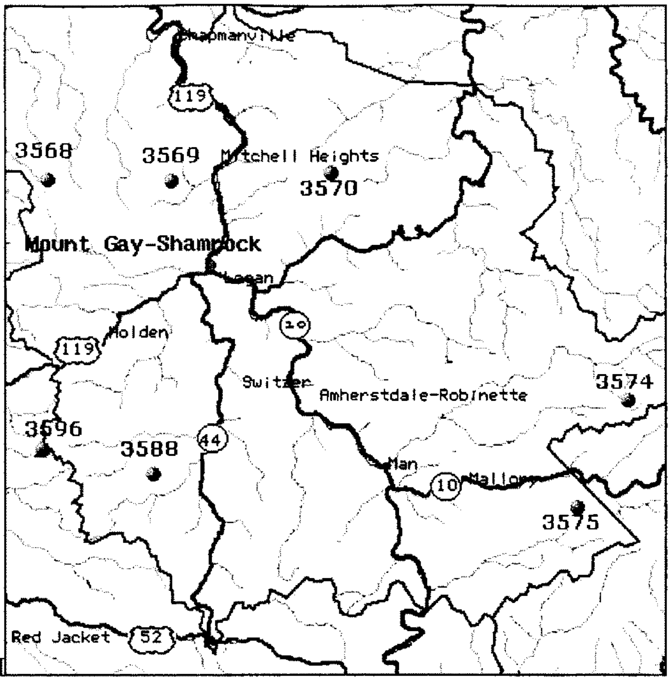
TABLE 1
IFLOWS RIVER GAGE
INSTALLATION LOCATIONS

Site	Location	Latitude	Longitude	Elevation
1	Island Creek @ Shamrock	37°50'42"	82°00'36"	
2	Island Creek above Rossmore, WV	37°48'12"	81°58'58"	
3	Island Creek @ Chauncey, WV	37°46'01"	81°59'19"	
4	Island Creek @ Omar, WV	37°45'33"	81°59'49"	
5	Copperas Mine Fork @ Cora, WV	37°50'10"	82°01'43"	
6	Copperas Mine Fork @ Trace Junction	37°49'41"	82°02'52"	
7	Copperas Mine Fork @ Holden, WV	37°49'30"	82°03'36"	
8	Trace Fork @ Holden, WV	37°49'23"	82°03'33"	
9	Mud Fork @ Hedgeview	37°50'47"	82°50'47"	
10	Guyandotte River @ Logan, WV*	37°50'32"	81°58'37"	640.49 ft
New sites are located at highway bridges and maintained by the State of West Virginia Department of Highways				

*It is anticipated that the existing Guyandotte River Gage will be automated.

Computer and radio field path studies will have to be completed to determine if additional repeater sites would be required to provide viable radio paths between all existing and new stream flow gages. Rain gages will be installed at the river gage sites to provide additional rainfall coverage of the county. TABLE 2 lists the NWS IFLOWS repeater/rain gage locations that are currently being reported on the NWS Web site.

Table II



Current Rain Gage Site
Logan County, WV

GAGE NAME	ID	15 MIN	30 MIN	1 HOUR	3 HOUR	6 HOUR	12 HOUR	24 HOUR
Lomi	3568	-	-	-	-	-	-	-
Boardhse Hollow	3569	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dark Hollow	3570	-	-	-	-	-	-	-
Lorado	3574	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Stone Coal	3575	-	-	-	-	-	-	-
Cow Creek	3588	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Last Updated: Friday June 02, 2000 at 15:30:54 PM EDT
Missing gage reports are indicated by dashes (-).
Current Rainfall Data for Logan County, West Virginia

Logan County will receive IFLOWS data through local computer workstations located at the county OES offices, with the possibility of one additional base station in the immediate Island Creek Basin. The platform requirements necessary to receive IFLOWS data consists of Windows 95/98 or NT 4.0 (SP4). Minimum hardware configuration consists of a Pentium, 64 MB RAM, 500 MB available disk space and Microsoft Access 97/2000. The ideal hardware configuration is 400+ MHz, 128+ MB RAM, 10+ GB disk, and Internet connectivity. Local data can be accessed with a scanner. To complete the installation: coaxial cable, antenna, and other miscellaneous connectors would be needed.

TABLE 3
LOCATION OF COUNTY FLOOD WARNING WORKSTATIONS

COUNTY	LOCATION
Logan, 911 Office	Logan, West Virginia
Logan	Logan, West Virginia

COST OF RECOMMENDED FWS The total cost to the federal government to acquire and install the recommended system would be approximately $226,692. A summary of these costs is listed in TABLE 4.

TABLE 4
GUYANDOTTE RIVER BASIN
FWS COST ESTIMATE

Phase I	**Number**	**Unit Cost**	**Install Gage**	**Total**
Repeater/Rain Gage	1	$2,000	$1,000	$3,000
River Gages				
Guyandotte Logan, WV				
Island Creek	4	$8,000	$3,200	$44,800
Copperas Mine Fork	3	$8,000	$3,200	$33,600
Mud Fork	1	$ 8,000	$3,200	$11,200
Trace Fork	1	$8,000	$3,200	$11,200
Subtotal-Phase I				$100,800
Misc. Equipment to Install 5%				$5,402
Phase II				
Computer/IFLOWS	2		$ 5,000	$10,000
Installation	2		$ 1,000	$ 2,000
Software	2		$ 7,000	$14,000
Analysis	2		$500	$1,000
Miscellaneous	2		$500	$1,000
Path Studies for Island Creek Basin				$ 4,000
Subtotal-Phase II				$32,000
Phase III				
Establish Gage Ratings				$12,000
Estimated Cost Phase I, II, III				$157,452
20% Contingencies				$31,490
Environmental Assessment				$20,000
Final Report				$25,000
Total Estimated Cost				**$226,692**

OPERATION AND MAINTENANCE: Maintenance of all stream gages and dedicated computer workstations would be the responsibility of the Sponsor with the provisions set forth in a Project Cooperation Agreement (PCA). The National Weather Service would operate and maintain the existing radio repeater and precipitation gage network.

The Huntington District requested the United States Geological Survey (USGS) provide an estimate of typical annual Operation and Maintenance (O&M) costs for the kind of river gages to be installed for the FWS. The USGS office in Charleston, WV currently performs O&M for approximately 90 such gages in the State of West Virginia as part of the Cooperative Stream Gaging Program. The total annual per gage costs are estimated as follows:

Maintain stage sensor Field inspection at 6-8 week intervals; reset stage sensor to outside reference (staff gage) as needed.	$2,800
Verify rating Two discharge measurements per year to verify the stability of the stage-discharge rating.	$1,100
Service telemetry Clean, adjust, and calibrate the pressure transducer subsystem and related equipment, the satellite, radio and telephone transmitter subsystems, and the batteries and solar panel.	$1,500
Total Annual Cost Per Gage	**$5,400**

The Sponsor will be responsible for all equipment repair and replacement costs due to wear or damage caused by flooding, vandalism or other unforeseen occurrences.

With the advance flood warning information provided by a warning system, local response plans would be required. The community of Logan currently has a flood response plan that specifies information needed from local observers upstream in the Island Creek Basin. An operation and utilization plan will be needed for any participating community. This will include personnel from the police, fire, engineering, and public works departments, in response to the real-time data provided by the warning system. Alert and mobilization stages will be implemented when the NWS issues a bulletin for Guyandotte River or the Island Creek Basin, or when an alarm warning parameter is exceeded in the FWS. The NWS bulletin is typically issued when meteorological conditions exist that could result in severe rainfall. Thus, appropriate personnel will have been placed on alert prior to the beginning of any severe storm and potential flood situation.

Existing flood response planning for the Logan County Basin is the responsibility of the State and County OES in West Virginia. The existing plan consists of siren signals and public notification by police, fire fighters, and other designated groups and individuals. Flood warning will be based on a series of gage readings and predictions, weather forecasts, and local observations. Because the potential for flash flooding in the Island Creek Basin is a possibility and the potential need to evacuate exists, the current warning plan can easily be incorporated into an overall plan to provide flood warning for the entire basin.

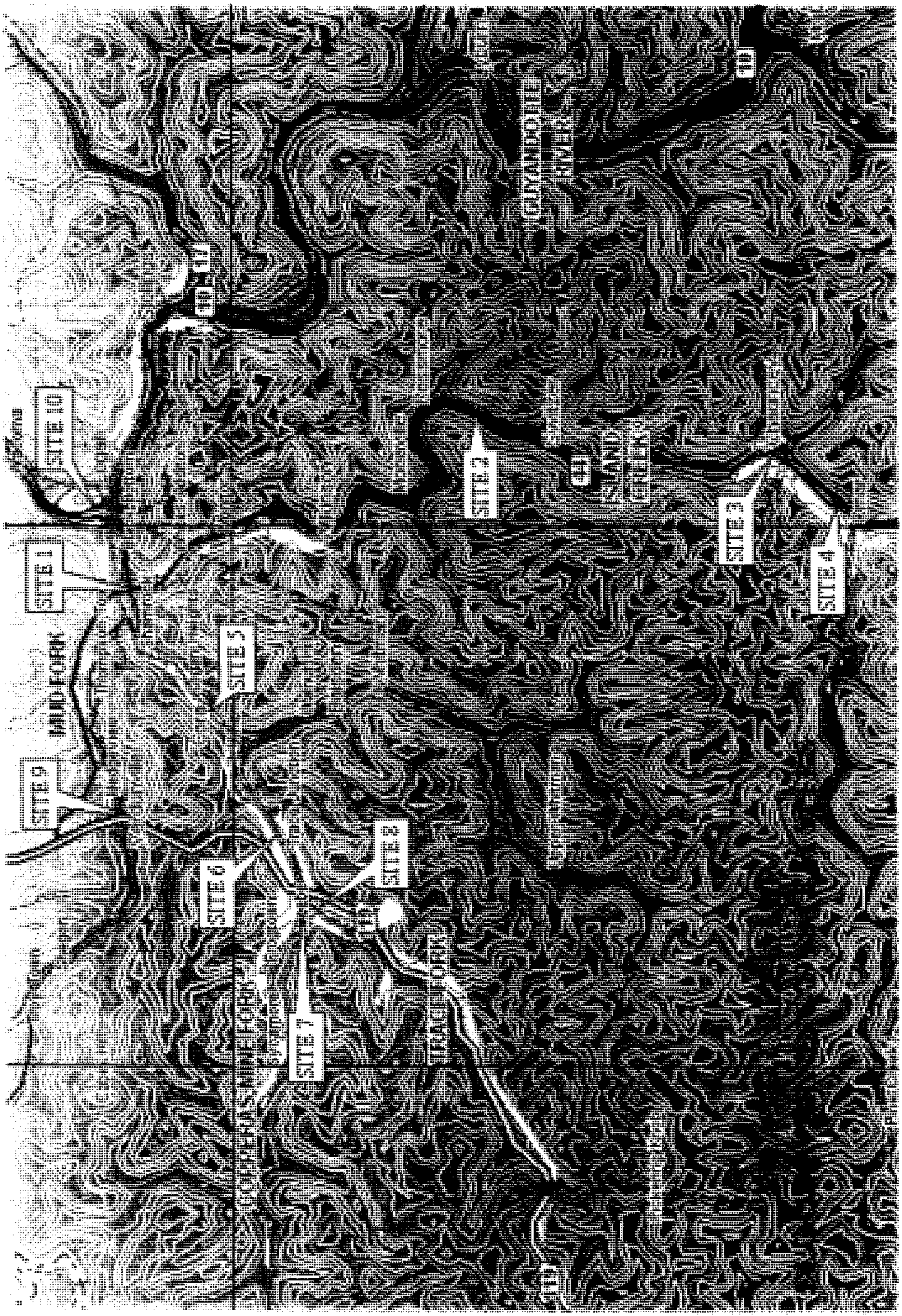
The appropriate actions that are considered necessary to develop an effective FWS for the Island Creek Basin will need to be coordinated and agreed upon by the agencies involved. There is a significant level of inter-agency coordination required in the operation of the proposed system. The NWS and the COE can develop and coordinate all appropriate linkages between the automated gages and the final agreed upon FWS. The OES in each County is responsible for flood response planning. The COE will work with the NWS to develop and improve forecast models for incorporation, if necessary, into the FWS. The NWS will continue to be responsible for all forecasts and issuance of flood warnings for the Guyandotte River Basin. Installation of the equipment will be performed by the COE. Table 5 summarizes the division of responsibilities associated with accomplishing the primary requirements involved in establishing the recommended FWS.

TABLE 5
DIVISION OF RESPONSIBILITIES

REQUIRED ACTIVITY	**RESPONSIBLE AGENCY**
DEVELOP FLOOD WARNING PLAN	NWS, COE
INSTALL GAGES & WORKSTATIONS	COE
DEVELOP FORECAST SOFTWARE	NWS, COE
OPERATE AND MAINTAIN GAGES	LCC
OPERATE AND MAINTAIN WORKSTATIONS	LCC
PERFORM FLOOD FORECAST	NWS
SPONSOR	LCC
DEVELOP/UPDATE FLOOD EVACUATION PLANNING AND OPERATION MANUALS	COE-WV, OES
DAILY MONITORING OF FLOOD WARNING SYSTEM	NWS, WV-OES, LCC

COE . . . . Huntington District Corps of Engineers
WV-OES . . . . . State of West Virginia OFFICE OF EMERGENGY SERVICES
NWS . . . . National Weather Service Charleston, West Virginia
LCC . . . . Logan County Commission (Sponsor)

REAL ESTATE PLAN - Refer to ETA TAB V - Real Estate Plan for a discussion of the real estate issues.


SITE 10
SITE 1
MUD FORK
SITE 9
SITE 5
SITE 6
SITE 7
SITE 8
SITE 2
SITE 3
SITE 4
GUYANDOTTE
RIVER

ISLAND CREEK

LOCAL PROTECTION PROJECT

ENGINEERING TECHNICAL APPENDIX

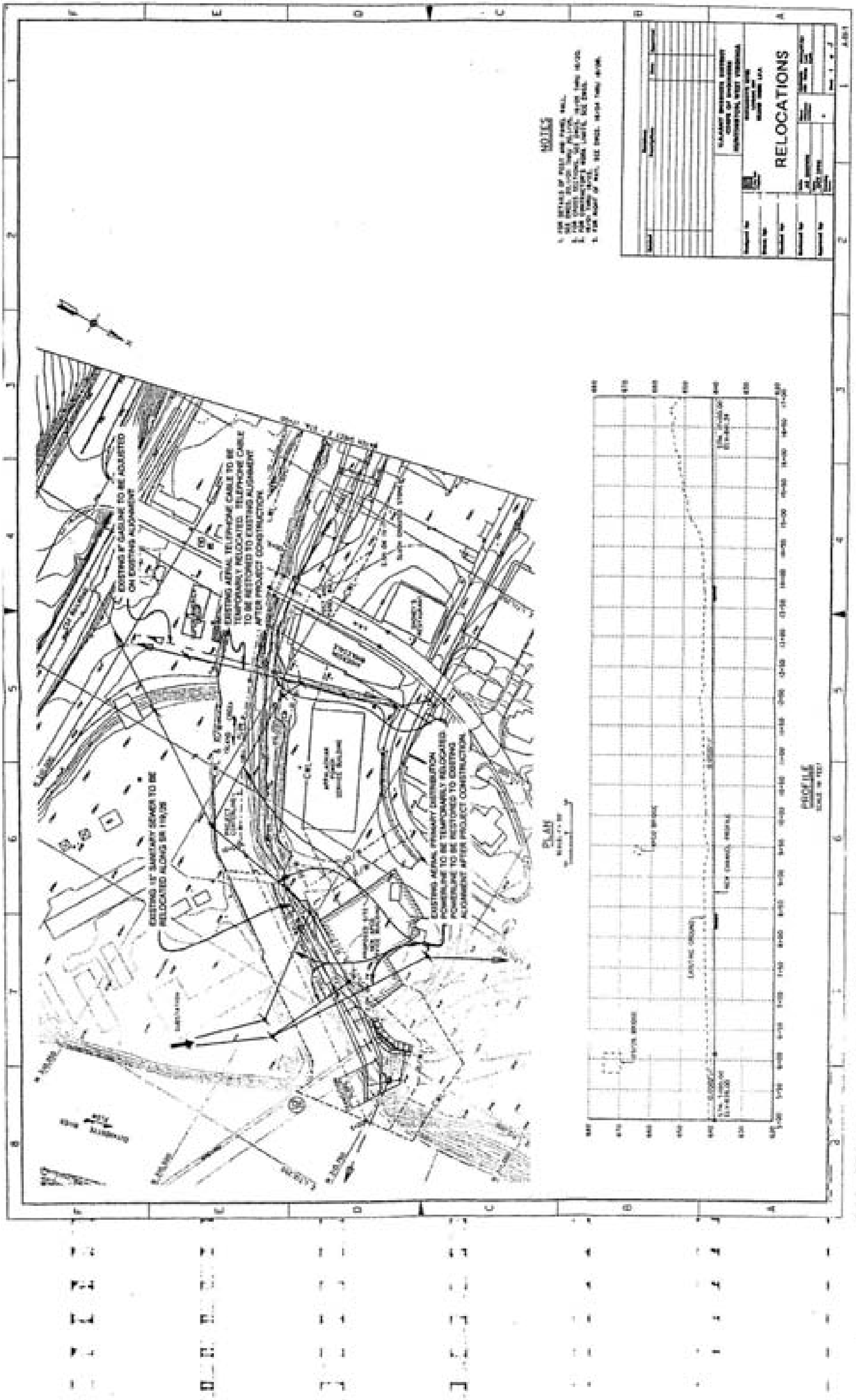
TO THE

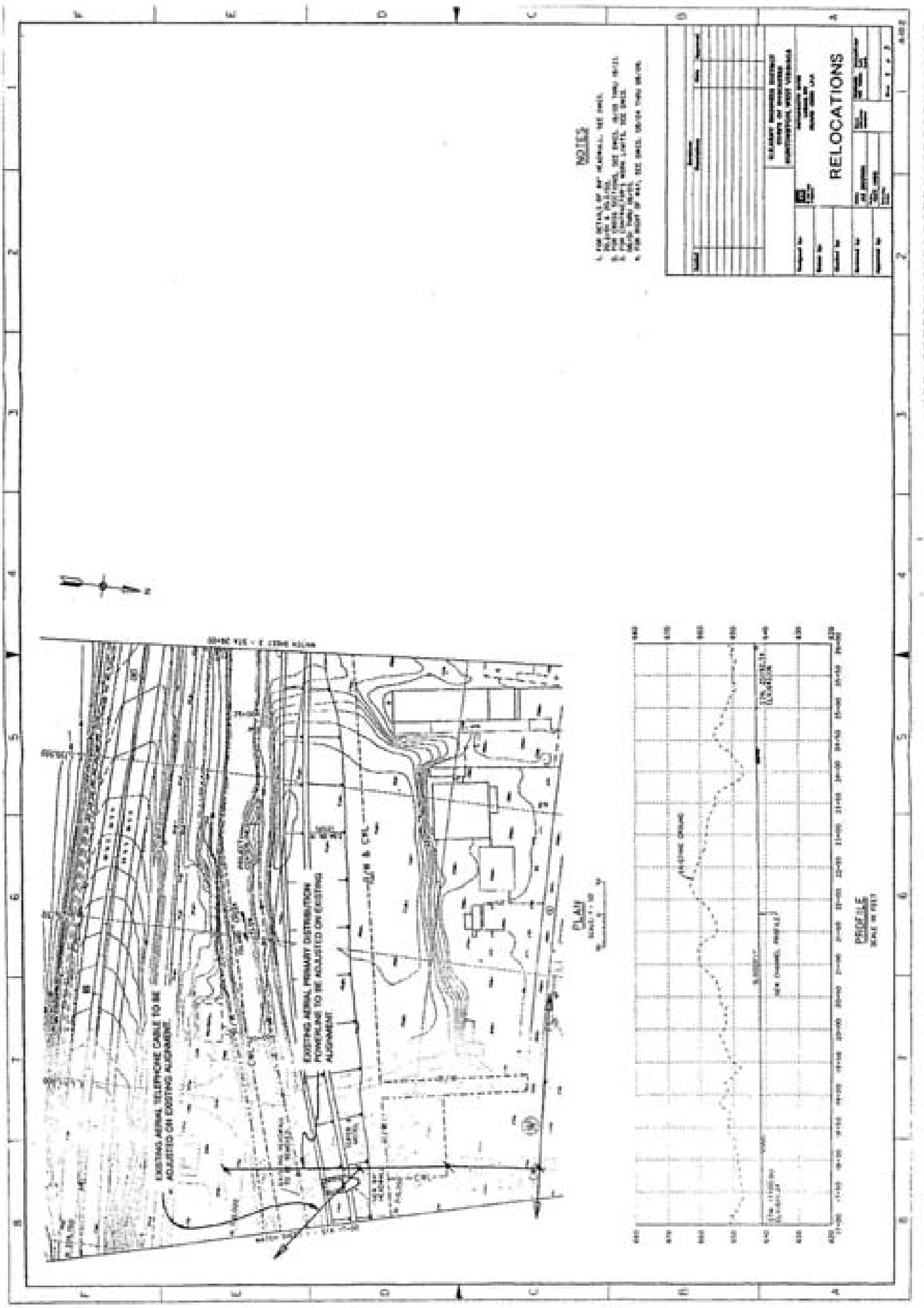
GENERAL REEVALUATION REPORT

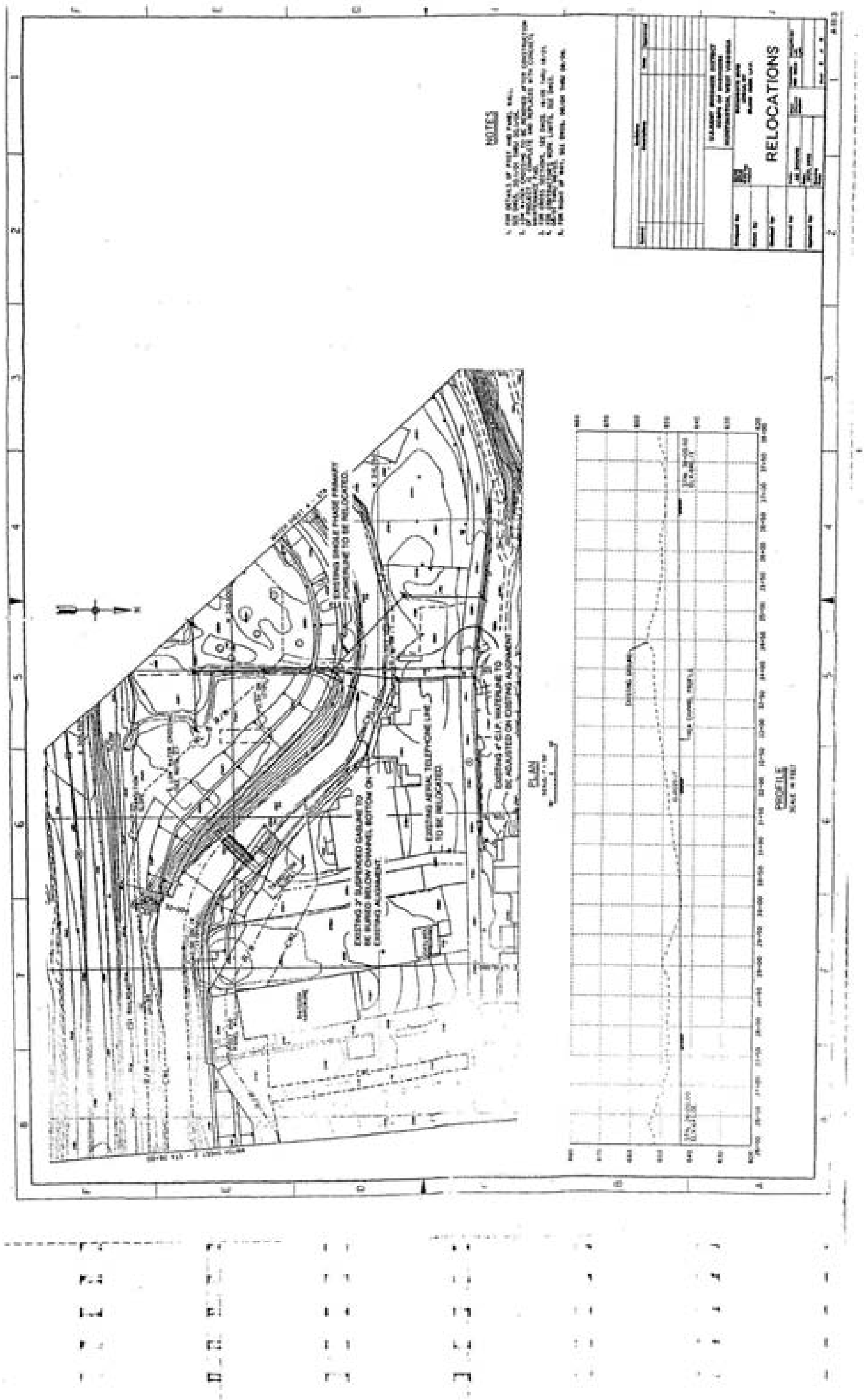
TAB III

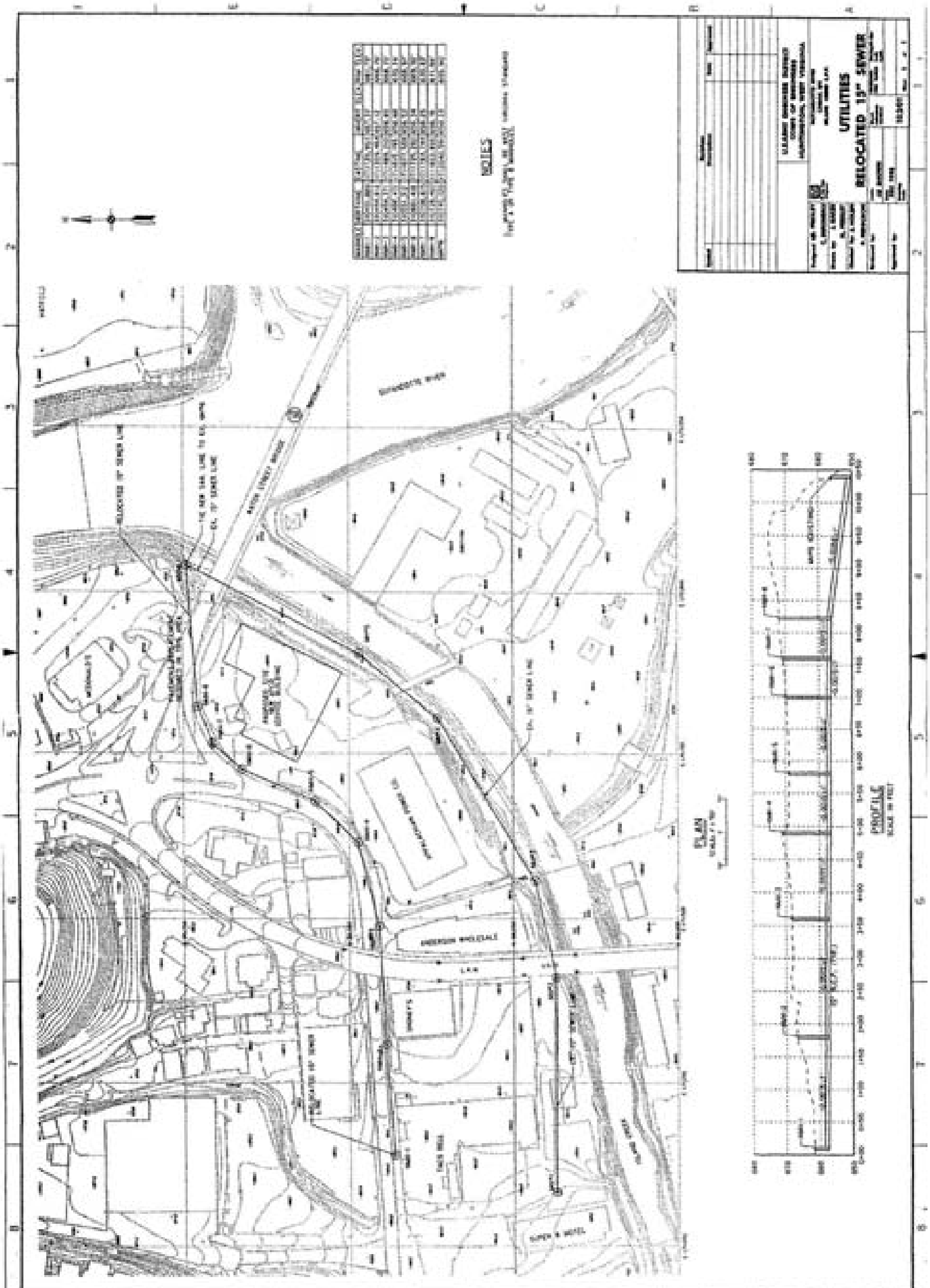
RELOCATIONS

Department of the Army
Huntington District, Corps of Engineers
Huntington, West Virginia


RELOCATIONS
NOTES
PLAN
PROFILE


NOTES
RELOCATIONS
EXISTING AERIAL TELEPHONE CABLE TO BE ADJUSTED ON EXISTING ALIGNMENT
EXISTING AERIAL PRIMARY DISTRIBUTION POWERLINE TO BE ADJUSTED ON EXISTING ALIGNMENT
PLAN
PROFILE


RELOCATIONS
NOTES
PLAN
PROFILE


NOTES
PLAN
PROFILE
UTILITIES
RELOCATED 15" SEWER

ISLAND CREEK

LOCAL PROTECTION PROJECT

ENGINEERING TECHNICAL APPENDIX

TO THE

GENERAL REEVALUATION REPORT

TAB IV

GEOTECHNICAL

Department of the Army
Huntington District, Corps of Engineers
Huntington, West Virginia

Island Creek Local Protection Project
Logan, West Virginia

TAB IV - GEOTECHNICAL

CONTENTS

EXHIBITS

ISLAND CREEK LOCAL PROTECTION PROJECT
LOGAN, WV

TAB IV - GEOTECHNICAL

1. GENERAL DESCRIPTION OF THE PROJECT. The Island Creek project is located in Logan, W.VA. The project begins at the mouth of Island Creek and extends upstream from the Guyandotte River, approximately 0.7 mile. Although several alternatives were studied for this report, this geotechnical analysis considers only the selected 80' channel. Increased channel capacity will be obtained by widening the existing channel while either excavating slopes to 1V:2.5H or by constructing post and panel walls.

2. TOPOGRAPHY AND PHYSIOGRAPHY. The Island Creek project is located in the Kanawha Section of the Appalachian Plateau Physiographic Province. This section is characterized by maturely-dissected unglaciated plateau with deep, steep-sided valleys and narrow winding ridges. This present landscape was developed as a plateau of very little relief, was uplifted and subsequently eroded by the downcutting of streams, which were rejuvenated by the uplift. The region has a dendritic drainage pattern with the primary river being the Guyandotte. At the project site the stream flows in a narrow, steep-walled channel about 40 feet wide. The floodplain is narrow, 800 feet wide, and relatively flat, at elevations 665 to 680 msl. The valley walls rise steeply from the floodplain to the ridge line at elevation 1700, giving an approximate 1000-foot relief. This geometric configuration alone, therefore severely restricts the work limits and construction sequence. In addition to the geometric consideration, the project area is a part of the Logan central business district and is subject to heavy traffic. Because of these restrictions, special design and construction considerations will be required in the final design.

3. REGIONAL GEOLOGY.

a. Stratigraphy. The regional rock types were formed by sedimentary processes during the Pennsylvanian age. Sedimentation took place on a broad subsiding basin with thick horizontal beds of alluvial sediment deposited on a low-lying floodplain in shallow-fresh-water, swampy, or meandering stream depositional environments with few marine transgressions. These conditions lead to rocks that are subject to either gradational or abrupt changes in both horizontal and vertical directions. The exposed bedrock units in the region, listed in descending geologic order, consist of the Allegheny Formation and the Kanawha and New River Formations of the Pottsville Group. The rock types contained in these formations are: sandstone, shale, siltstone, claystone, thin limestone members, and numerous coal seams. The Allegheny Formation does not exist at full thickness in the region and erosion has left a remnant exposed only at higher elevations, along the ridges. The Kanawha Formation is the predominant rock unit in the region, approximately 1600 feet thick, and is characterized by its numerous coal beds. All bedrock types encountered at the project site are members of the Kanawha Formation. The New River Formation is exposed in a limited area at lower elevations where the Warfield Anticline intersects the Guyandotte River.

b. Structural. Structurally the region is situated on the southern flank of the Appalachian Geosyncline. The axis of this basin extends from Southwestern Pennsylvania into Eastern Kentucky. At the close of the Paleozoic Era, horizontal pressures originating from the Appalachian Mountain Orogeny were exerted on the sediments deposited in the basin and caused gentle deformations resulting in local anticline-syncline structures generally trending from the northeast to the southwest. Locally the bedrock structure is influenced by the Warfield Anticline (to the northwest) and the Handley Syncline (to the southeast) which both have an approximate alignment of N 55° E. The bedrock, locally, dips into the southeast at a rate of 150 feet per mile. Another structural feature is the Warfield Fault, which is located approximately 7 miles west of the project. This fault is located immediately south of, and has a parallel strike with, the axis of the Warfield Anticline. This fault has a vertical dip and a maximum displacement of 100 feet with the downthrown block being to the northwest.

c. Seismic. Ground motion values were determined from available site data and published seismic zone maps as suggested in ER 1110-2-1806 titled "Earthquake Design and Evaluation for Civil Works Projects." The project lies in a relatively inactive seismic area, designated as seismic zone 1. Review of existing literature indicates that there are no local faults or structural features capable of being a seismic source which would alter selected ground motion values derived from published seismic zone maps. The nearest structural features to the project are the Warfield Anticline, located approximately 5 miles northwest, and the Coalburg Syncline, located approximately two miles southeast. Both features trend to the northeast and have been essentially dormant since the late Paleozoic Era and are not considered capable of generating seismic activity.

The Island Creek Project does not have critical hazard potential since failure is unlikely to cause a significant danger to life. Therefore, the project will not be designed to withstand the Maximum Credible Earthquake, and a smaller Maximum Design Earthquake can be used.

The progressive seismic analysis requirements in ER 1110-2-1806 indicate that a seismic coefficient method of analysis is suitable for a feasibility level study for projects located in seismic zone 1. A seismic coefficient value of 0.05 is attributed to the site from information presented in Miscellaneous Paper S-73-1 "State-of-the-Art for Assessing Earthquake Hazards in the United States." This value is considered appropriate for analysis by the seismic coefficient method.

Additional ground motion data was obtained from spectral acceleration maps prepared by U. S. Geological Survey for the National Earthquake Hazard Reduction Program and included in ER 1110-2-1806. By extrapolating and converting data from these maps, estimated ground motions were obtained for an event having a 50 percent probability of exceedence during the 100-year service life of the project, which corresponds to a return period of 144 years. This event represents an Operational Basis Earthquake for the Island Creek Project. For this event, the maximum 0.3 second spectral response acceleration $S_{A(0.3)}$ is 0.07g, which corresponds to an effective peak acceleration Aa of 0.03g. The maximum 1.0 second spectral response acceleration $S_{A(1.0)}$ is 0.03g.

d. Overburden. The Island Creek basin is extremely narrow and the need for additional land for development has resulted in fill placement within the flood plain. The original deposits of overburden encountered in the Island Creek flood plain can generally be characterized as either alluvial (materials deposited by stream action) or colluvial (materials weathered and eroded from the valley walls). Total overburden depth within the flood plain varies from 18' at the upper project limits to approximately 35' near the confluence with the Guyandotte River. The deposition of natural overburden materials consists primarily of alternating layers of sands, gravels, clays and silts. Natural sand and gravel deposits vary in consistency from loose to dense. Fill materials placed above the natural ground surface consist of mixtures of coal, cinders, ash, and silty granular soils. Some of these fills contain zones of loose to very loose sands and gravels.

4. SUBSURFACE INVESTIGATIONS. Subsurface investigations consist of 13 exploratory borings drilled in two phases. The first phase of subsurface explorations was performed in 1990 by Rhodes and Associates, Inc. of Lexington, Kentucky, while remaining drilling was performed in 1993 by Law Engineering of Knoxville, Tennessee. Drilling and sampling was accomplished using standard penetration methods described in ASTM D 1586 and rotary core drilling methods through rock. One undisturbed sample was taken during the second phase of subsurface exploration.

a. Soils. Overburden samples were recovered with a 2" split spoon using standard penetration techniques while recording blow counts and groundwater elevations where applicable. The samples were then sealed in glass jars and shipped to the Ohio River Division Laboratory (ORDL) in Cincinnati, OH for testing. All samples were subjected to visual identification and selected samples were tested to obtain gradations, natural moisture content, and Atterberg Limits. Locations of exploratory borings, graphic logs, and gradation curves are shown in SECTIONS A, B, and C.

b. Rock. Bedrock core was retrieved from thirteen borings during the subsurface exploratory program. Approximately fifteen feet of NX-size core was recovered from each of seven borings, drilled during the first phase of subsurface explorations. Approximately thirty feet of 4-inch diameter core was recovered from each of six borings, drilled during the second phase of subsurface explorations. This rock coring was accomplished with a hydraulically-fed rotary drill rig using either an NX-size diamond-set bit with a 10-foot double-tube bottom-discharge core barrel, or a 4-inch diamond-set with a 5-foot double-tube split barrel. The recovered bedrock was measured in the field to determine loss encountered and the rock quality designation of the sample and a brief description of the rock encountered was recorded. A detailed description and final log of the core were then made by a District geologist. Selected samples from the 4-inch diameter core were sent to Ohio River Division Laboratory for appropriate rock testing, which included unconfined compressive strength, direct shear strength, and pull-out bond strength tests.

5. BRIDGE FOUNDATIONS. A total of six bridges exist within the project area. These bridges have been investigated using information furnished by the controlling agency. Each bridge was investigated to determine the potential effects the channel widening would have on the bride piers, foundations and abutments.

a. SR 119/26 North Bridge. This bridge is located at the mouth of Island Creek and the Guyandotte River. The left abutment of the bridge is founded on the right descending bank of the Guyandotte River and the right abutment is founded on the right ascending bank of Island Creek. West Virginia Department of Highways (WVDOH) information shows that the right abutment is founded on rock and protected with a series of buttress sections. The proposed post and panel wall will be connected to these bridge buttresses.

b. American Electric Power (AEP) Bridge. This bridge is located at sta. 9+50. The bridge is owned by AEP and provides access to their substation. Both the left and right abutments appear to be founded above rock. AEP could not locate any information concerning the bridge, abutments, or piers. Since the SR 119/26 and US 119/SR 10 bridges just upstream are either founded on rock or setting on piles, this study assumes that this bridge is protected in the same manner. Prior to final design, field investigations will be performed to confirm these assumptions. If abutment and wing walls are founded on rock then no problems are anticipated with the current design. However, if abutments are supported with piles and wing walls are founded on overburden, the existing design must be modified to extend the post and panel wall beneath the bridge. Stability of the right pier is also in question. This pier appears to be tilted towards the right ascending bank.

c. US 119 / SR 10 Bridge. This bridge is located at sta. 14+50. Information concerning these bridge foundations was obtained from the WVDOH. Geologic profiles show that only the stream piers are founded on rock. Most of remaining piers on each side of the stream are founded on piles extending to top of rock. Geologic information shows that bedrock consists primarily of shales. No problems are anticipated during post and panel wall construction planned beneath this bridge.

d. CSX Railroad Bridge. The CSX Bridge is located at the upper limits of the project at sta. 42+00. The selected design will not require any excavation in this area. Although drawings concerning this bridge have been received from the railroad, no information regarding founding materials for the left abutment and right pier have been obtained. Since this area will have the largest velocities within the project limits, channel slopes beneath the bridge will be protected with stone slope protection.

e. US 119 / SR 65 Bridge. This bridge is located just upstream of the CSX Bridge, at sta. 44+50. Design drawings obtained from the WVDOH show that bridge piers located within the stream channel are founded on rock. Excavation will not be required beneath the bridge for the selected plan.

f. SR 119 / 26 South Bridge. This bridge is located at sta. 48+50. As-constructed drawings of this bridge have not been received at this time. However, proposed work in this area consists only of a small amount of overburden removal. Therefore, no problems are anticipated.

6. SITE GEOLOGY.

a. Overburden. A review of the geologic sections shown in SECTION E indicate the original overburden within the floodplain consists of primarily alternating layers of sands, gravel clays and silts. As with most streams, overburden depths increase as you approach a stream confluence. In-place densities of natural sands and gravels fluctuate from loose to dense; however, several areas of very loose granular zones were encountered. In situ clay and silt deposits exhibited consistencies ranging from very stiff to very soft. Fill material placed above natural ground varied in consistency from loose to very loose. Groundwater recordings in the area are erratic at best. Groundwater levels generally fluctuate within in situ soil layers. No signs of streambank instability were observed within the project limits.

b. Bedrock. A geologic profile along the project's length suggests an apparent dip in the bedrock, toward the upstream, at a rate of 46 feet per mile. Bedrock units encountered in the valley bottom are assigned to the Kanawha Formation and consist of an upper shale member, a sandstone member, and a lower shale member. The upper shale member is approximately 15 to 20 feet thick and is present in the upstream sections of the project, in the vicinity of the US 119 / SR 65 bridge at approximate station 44+50. The upper shale member was not sampled during recent subsurface explorations but has been described by the West Virginia DOH as being gray, moderately hard, and occasionally sandy. The sandstone member is approximately 20 to 30 feet thick and is exposed at the top of rock surface in the mid-sections of the project, approximately located from station 16+00 to 40+00. This sandstone member is light gray, moderately hard to hard, fine to medium grained, micaceous, with occasional thin shale lens and stringers. The lower shale member has a thickness in excess of 30 feet and is exposed at the top of rock surface in the lower sections of the project, approximately downstream of station 16+00. The recovered lower shale member is separated into three separate beds, which include, in descending order: (1) an upper, 20-foot thick, shale bed with numerous sandstone stringers and occasionally interbedded with thin sandstone seams, (2) a middle, 10-foot thick, shale bed with only occasional sandstone stringers, (3) a lower, 10 to 15-foot thick, carbonaceous shale bed. The upper two beds of shale are gray to dark gray, moderately hard to hard and silty. The lower-most carbonaceous shale bed is dark gray to black, soft, and clayey.

7. DESIGN VALUES.

a. Overburden. Using lab classifications and blow count data, foundation materials were divided into zones exhibiting similar physical properties. These material zones are reflected on the geologic sections, shown in SECTION E. A total of 378 feet of overburden materials were sampled within the project reach. Lab results indicate that about 90% of the materials sampled were sands and gravels and the remaining 10% of the samples were clays and silts. Atterberg Limits tests performed on 10% of the fine-grained samples yielded an average Plasticity Index (PI) of 15, which corresponds to a medium plasticity. One undisturbed tube sample was obtained near boring C-93-14, but triaxial tests could not be performed due to high sand content. Based on material classification, penetration resistance, and water content of the material zones, bulk densities were estimated using Table 3.3 included in Section D of TAB IV. Bulk density is defined as the in-place density and is generally equal to moist unit weight. Consolidated Undrained (CU) and Consolidated Drained (CD) shear strength parameters were also selected using Table 5.7, which also included in Section D of TAB IV. Selected strength parameters were used in post and panel wall design. These parameters will be reviewed and confirmed as additional drilling, sampling, and testing programs are completed for final design.

i. Sand and Gravel Parameters. Effective stress shear strength parameters selected for sands and gravels ranged from 0 psf and $\phi = 35°$ for very dense materials to 0 psf and $\phi = 28°$ for loose to very loose materials. Unit weights of the sand and gravels materials were based on the material classification, water content and blow counts shown on Table 3.3 and ranged from 127 pcf for very dense to dense materials to 110 pcf for loose to very loose materials.

ii. Silt Parameters. CU strength parameters selected for silts ranged from 600 psf and 20° for hard or very stiff silts, to 300 psf and 10° for medium silts. CD shear strength parameters selected for silts found within the project limits are 0 psf and 30°. Unit weights of silt materials were based on the material classification, water content and blow counts shown on Table 3.3 and ranged from 132 pcf for hard or very stiff materials to 121 pcf for medium consistency silts.

iii. Clay Parameters. CU strength parameters selected for clays ranged from 1200 psf and 0° for hard or very stiff clays, to 200 psf and 0° for soft to very soft clays. CD shear strength parameters selected for clays found within the project limits are 0 psf and 30°. Unit weights for the materials ranged from 127 pcf for hard or very stiff materials to 116 pcf for soft to very soft clays.

iv. Soils Stiffness Coefficient. The CWALSSI program used for post and panel wall design uses soil stiffness coefficients for active and passive pressures. These values were obtained using tables from Harvard Soil Mechanic Series, NO. 51, "Evaluation of Coefficients of Subgrade Reaction" by Karl Terzaghi, Volume 5, 1955. Design parameters selected for sands and gravels are shown below. No additional testing for these values will be performed.

	Loose	Medium	Dense
Dry or moist sand, value l_h	2.9 pci	9.3 pci	23 pci
Submerged sand, value l_h	1.8	5.8	15

For clays and silts K_{sa} and K_{sp} values were correlated to values of k_{s1}, where k_{s1} equals the coefficient of subgrade reaction for a square plate 1'x1', or beam 1' wide resting on pre-compressed clays.

Consistency of clay	stiff	very stiff	hard
Proposed value, k_{s1}	85 pci	175 pci	347 pci

b. Bedrock. Preliminary design values for bedrock were determined from the visual examination of NX-size core recovered during the first phase of subsurface explorations. This core examination included careful descriptions of the rock characteristics, rock structural elements, rock quality designation, and other pertinent information. The sampled bedrock exhibited a high degree of weathering and intensity of rock structural elements from the top-of-rock surface to a four-foot depth. From this information it was determined that rock strengths in this four-foot interval would be negligible and should not be considered during design calculations. The preliminary design values were determined from the rock characteristics of the shale members because of the predominance of this member in the project area and the interbedded nature of the sandstone member. These preliminary design values are $\phi = 40°$ and c = 50 psi for a crossbed shear along a plane angled at 45°, 30 psi is to be used for bond strength for rock anchors, and the unconfined compressive strength is 3,000 psi. Final design values will be derived from laboratory testing of 4-inch diameter core sample obtained from the second phase of subsurface explorations, these tests include unconfined compressive strength, direct shear strength, and pull-out bond strength.

8. STABILITY ANALYSIS. Since the proposed channel slopes within the project area are equal to or flatter than the existing ground surface, a stability analysis is not appropriate at this time. Formal slope stability computations will be performed prior to completion of plans and specifications and included in the Design Documentation Report.

9. CONSTRUCTION PROCEDURE. Anticipated stream velocities dictate the use of stone slope protection beneath the CSX railroad bridge, for stream bank cuts and adjacent to the post a panel walls. The final slope protection criteria will be designed prior to the plans and specifications. In areas where it is not practical to excavate the bank to 1V:2H slopes, a post and panel wall will be constructed. The majority of excavated materials will be loose to very loose sand and gravel fill materials. No rock excavation is anticipated within the project limits based on the current design. Post and panel wall construction methods will be similar to those used at the Williamson LPP project. This method will employ the use of reinforced concrete panels installed between H piles.

Extreme care will be required in areas near existing structures to prevent failure of the overburden. In these areas excavation by hand between the H piles may be required. Random fill will be placed landward of the post and panel wall. Random fill materials will be obtained from the required channel excavation. During drilling phases, precautionary measures will be taken to ensure safe clearance between the drill boom and overhead electric lines and bridge decks in accordance with EM 385-1-1, Health and Safety Requirements Manual.

10. SOURCES OF STONE SLOPE PROTECTION. No limestone or other rock types suitable for stone slope protection are known to exist in the immediate vicinity of Logan, West Virginia so this material must be obtained from a commercial source. Several proven commercial producers of crushed limestone, suitable for stone slope protection, are in operation in Eastern Kentucky, Western Virginia, Southeast West Virginia and South-central Ohio. This material can be transported from the source to the project site by either truck or train, and could be transported from more distant sources with the combined use of river barge and land transportation.

11. INSTRUMENTATION. Instrumentation for the bridges between station 5+00 and sta. 15+00 will consist of surface displacement monuments placed on the corners of each deck.

Instrumentation for the post and panel wall in this area and the Baisden Hardware store will consist of alignment pins placed at the break points of the wall. Both surface displacement and alignment pins will be monitored continually during the construction period.

12. SPOIL AREA. Five possible spoil sites were investigated. The first site is located at Milkhouse Hollow just north of State Route 73 and approximately 0.5 miles from the upstream limits of the project. One home is located at this site with access via a 12-foot to 14-foot wide paved road. This site would be a valley fill and would require the clearing of 6 to 8 acres of trees. The second site investigated lies on a valley hillside overlooking Wilkinson, West Virginia. A mobile home, brick home, barn, and several junk automobiles were found on the site at that time. This site would also be a valley fill and would require clearing of 6 to 8 acres of trees. No permanent relocations would be required for this site, only temporary relocation of the access road and possibly a utility line. Access to the site is mostly on a one lane gravel road .25 miles long. The haul distance from the upstream project limits to Site 2 is 2.5 miles. The third site investigated in situated on a steep grade up Lynn Branch Hollow, approximately 4.5 miles from the upstream limits of the project. This site lacks adequate capacity to contain the estimated quantity of spoil materials. The fourth site investigated lies up Miller Branch Hollow in Chauncey, West Virginia, approximately 6.5 miles from the upstream project limits. Access to the site is limited to a jeep trail beginning at the head of Miller Branch Road. That portion of the site accessible during the reconnaissance lacked adequate capacity to contain the estimated quantity of spoil material. The fifth site is located at School House Hollow just north of State Route 73 and adjacent to the Milkhouse Hollow site. This site is also approximately 0.5 miles from the upstream limits of the project with access off State Route 73 via the same 12-foot to 14-foot wide paved access road as the Milkhouse site. This site was previously used as a spoil disposal site during the construction of U.S. Route 119 (Corridor G) and State Route 73 in the mid-1990s and therefore would not be classified as a valley fill since all new fill material would be placed on existing fill. Approximately 1.5 acres of trees would be cleared at this site and no residential or utility relocations would be required.

After reviewing these five sites we recommend Site 5 for use as the project spoil area because of its sufficient capacity, short haul distance, small amount of disruption to residents and the environment, mitigation capabilities, and lack of relocations requirements. The existing fill at this site was placed in two benches with fill slopes approximately 1V:2.5H. The upper bench is approximately 6.5 acres and the lower bench approximately 2.5 acres. Drilling and sampling have been recently completed through the existing fill material. Existing fill extends to depths of over 100 feet and consists of particles ranging in size from large boulders to silts and clays. Sampling showed that these fills were placed and compacted in a controlled manner that produced a dense, stable fill. New spoil from this project will be placed is a stable configuration on the upper bench at an approximate depth of 19 feet and will consist of predominantly granular material. The lower bench will be used for future spoil disposal of material dredged from the channel during annual maintenance. Engineering properties for both existing and planned fill material will be selected and used to determine final slope configurations that will ensure slope stability. This work will be completed during the next project phase.

13. STRUCTURAL SURVEY. A structural survey will be performed prior to construction on all existing structures within the 0.7-mile reach in order to document preconstruction conditions.

This survey will be used as a basis for any claims against the Government from damage due to construction operations. The survey will consist of photographs of existing buildings and structures and records of any existing cracks, settlement, and/or deformations noted prior to start of construction. There are currently approximately 30 buildings and six bridges within the project reach.

14. ADDITIONAL DESIGN WORK. Prior to completion of plans and specifications several items will need to be resolved. These items include:

a. Final channel configuration at the AEP bridge located at Station 9+50. Drilling will be needed to determine abutment founding conditions because as-constructed drawings cannot be located.

b. Final channel configuration along the AEP wall between Station 5+00 and Station 15+00 on the right descending bank. The stability of this wall must be assessed for new loading conditions imparted by planned channel excavation. As-constructed drawings for the wall are not available, so additional investigations are required.

c. Additional information concerning founding conditions for the CSX bridge abutments and piers located at Station 42+00. Drilling may be required to obtain this information.

d. Confirmation of engineering parameters of foundations and backfills selected for the design of proposed post and panel walls.

e. Final configuration of the spoil area based on stability analyses using parameters selected from recent drilling, sampling, and testing at the site.

ISLAND CREEK

LOCAL PROTECTION PROJECT

ENGINEERING TECHNICAL APPENDIX

TO THE

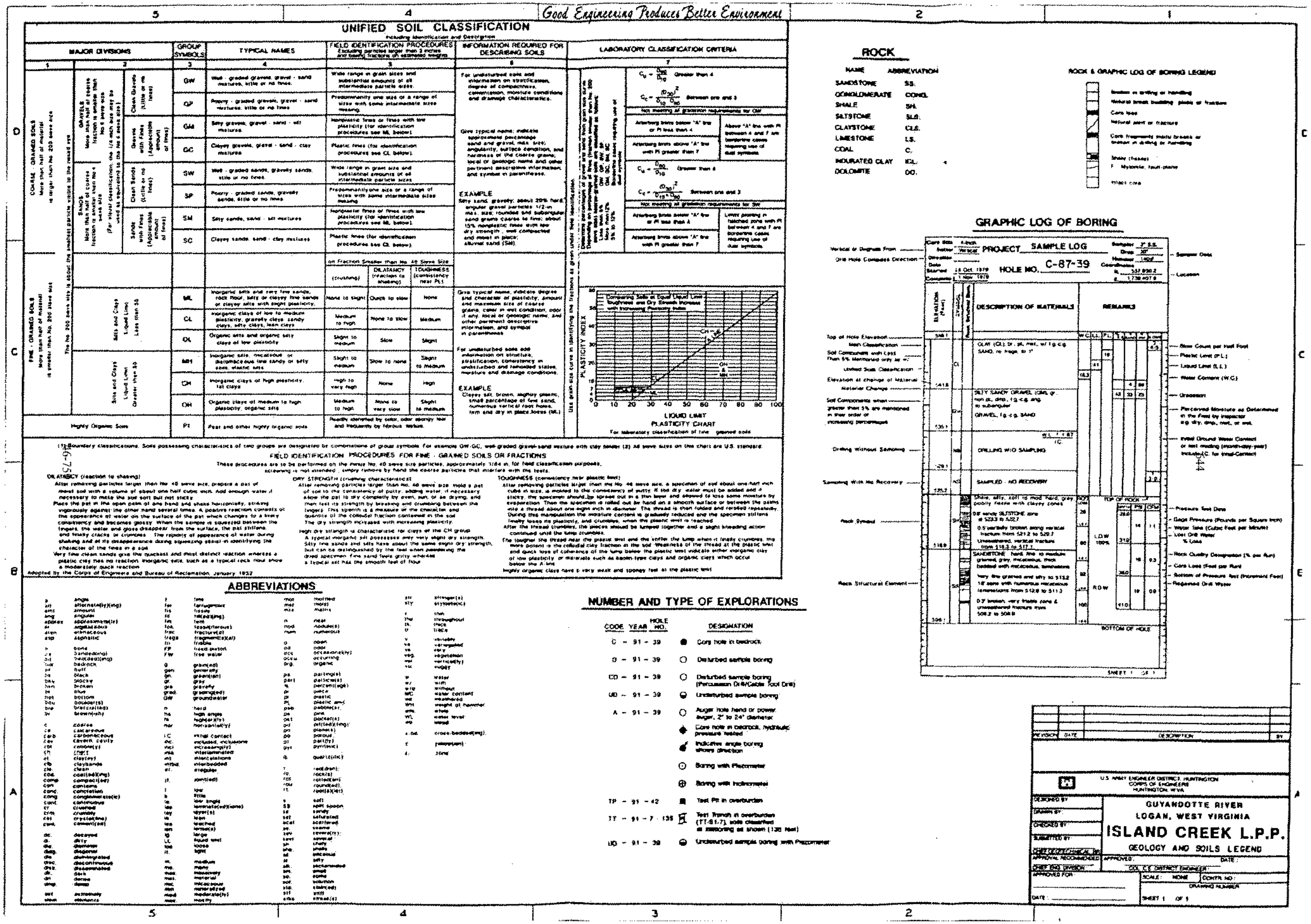
GENERAL REEVALUATION REPORT

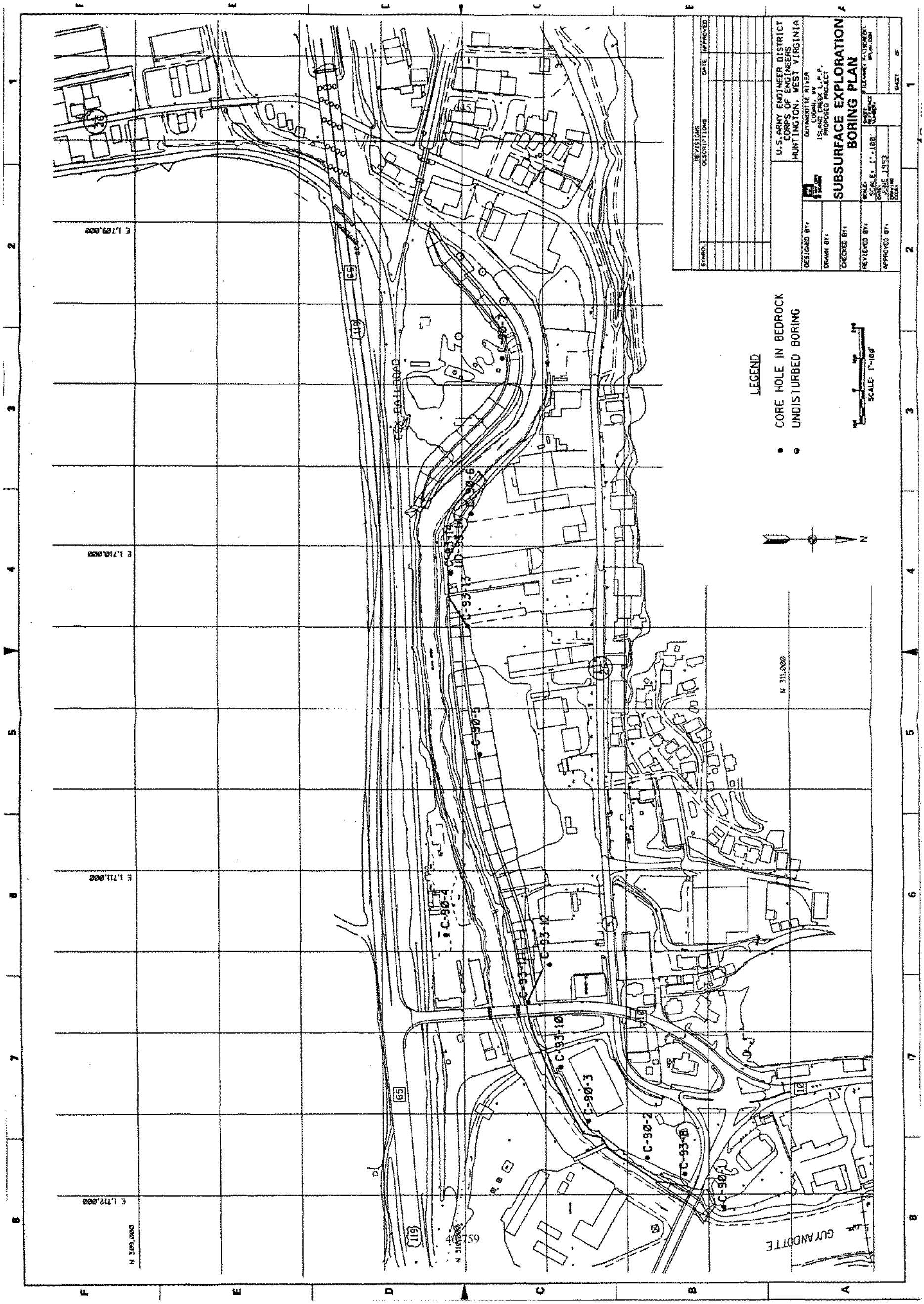
TAB IV

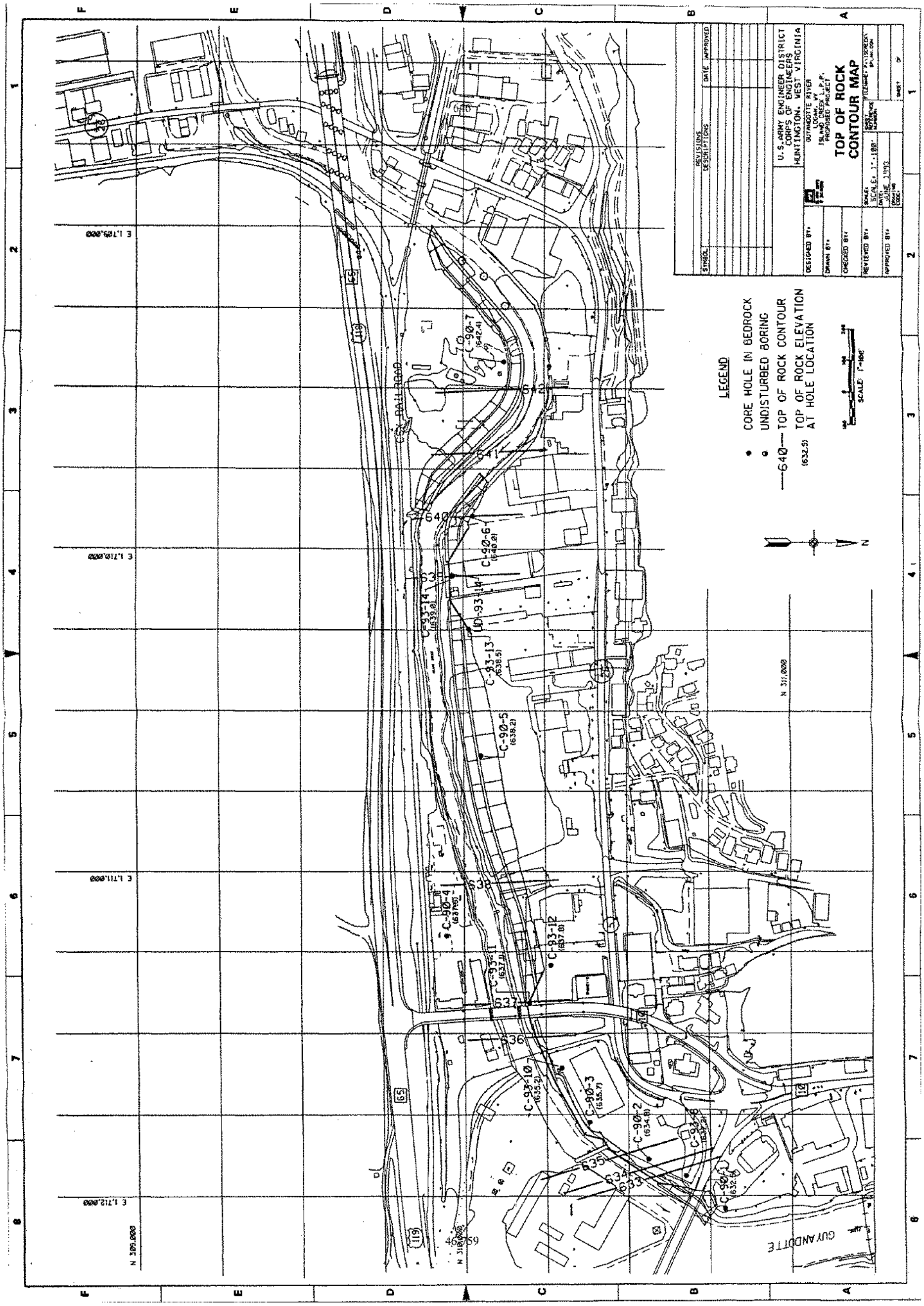
GEOTECHNICAL

SECTION A – LEGEND, BORING PLAN, AND TOP OF ROCK MAP

Department of the Army
Huntington District, Corps of Engineers
Huntington, West Virginia


Good Engineering Produces Better Environment
UNIFIED SOIL CLASSIFICATION
MAJOR DIVISIONS
GROUP SYMBOLS
TYPICAL NAMES
FIELD IDENTIFICATION PROCEDURES
INFORMATION REQUIRED FOR DESCRIBING SOILS
LABORATORY CLASSIFICATION CRITERIA
GW
GP
GM
GC
SW
SP
SM
SC
ML
CL
OL
MH
CH
OH
Pt
EXAMPLE
PLASTICITY INDEX
LIQUID LIMIT
PLASTICITY CHART
FIELD IDENTIFICATION PROCEDURES FOR FINE - GRAINED SOILS OR FRACTIONS
ABBREVIATIONS
NUMBER AND TYPE OF EXPLORATIONS
CODE
YEAR
HOLE NO.
DESIGNATION
ROCK
NAME
ABBREVIATION
SANDSTONE
SS.
CONGLOMERATE
CONG.
SHALE
SH.
SILTSTONE
SLS.
CLAYSTONE
CLS.
LIMESTONE
LS.
COAL
C.
INDURATED CLAY
DOLOMITE
DO.
ROCK & GRAPHIC LOG OF BORING LEGEND
GRAPHIC LOG OF BORING
PROJECT SAMPLE LOG
HOLE NO. C-87-39
DESCRIPTION OF MATERIALS
REMARKS
BOTTOM OF HOLE
U.S. ARMY ENGINEER DISTRICT, HUNTINGTON
CORPS OF ENGINEERS
HUNTINGTON, W.VA.
GUYANDOTTE RIVER
LOGAN, WEST VIRGINIA
ISLAND CREEK L.P.P.
GEOLOGY AND SOILS LEGEND


U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
GUYANDOTTE RIVER
ISLAND CREEK L.P.P.
PROPOSED PROJECT
SUBSURFACE EXPLORATION
BORING PLAN
REVISIONS
LEGEND
CORE HOLE IN BEDROCK
UNDISTURBED BORING
SCALE: 1"=100'
C&O RAILROAD
GUYANDOTTE
C-90-1
C-90-2
C-90-3
C-90-4
C-90-5
C-93-10
C-93-12
N 311,000
E 1,709,000
E 1,710,000
E 1,711,000
E 1,712,000


LEGEND
CORE HOLE IN BEDROCK
UNDISTURBED BORING
640 — TOP OF ROCK CONTOUR
(632.5) TOP OF ROCK ELEVATION AT HOLE LOCATION
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
TOP OF ROCK
CONTOUR MAP
CSX RAILROAD
C-90-7
(642.4)
C-90-6
(640.0)
C-93-14
UD-93-14
C-93-13
(638.5)
C-90-5
(638.2)
C-90-4
C-93-12
C-93-11
C-93-10
(635.2)
C-90-3
(635.7)
C-90-2
(634.8)
C-90-1
GUYANDOTTE

ISLAND CREEK

LOCAL PROTECTION PROJECT

ENGINEERING TECHNICAL APPENDIX

TO THE

GENERAL REEVALUATION REPORT

TAB IV

GEOTECHNICAL

SECTION B – GRAPHIC LOGS

Department of the Army
Huntington District, Corps of Engineers
Huntington, West Virginia

CORE SIZE NX
BATTER VERTICAL
DIRECTION
DATE:
STARTED 6 DEC 90
COMPLETED 7 DEC 90

PROJECT ISLAND CREEK BASIN LOGAN, WEST VIRGINIA

HOLE NO. C-90-1

SAMPLER 2" S.S.
DROP 30"
HAMMER 140#
COORDINATES:
N 310,794.71
E 1,712,039.00

ELEVATION (FEET) MSL	SYMBOL	R.S.E. *	DESCRIPTION OF MATERIALS	WC	LL	PL	% +4	% SAND	% -200	BLOWS
670.3										
669.3			BLACKTOP & GRAVEL							AUGER
667.3	CL		SANDY CLAY (CL), br., low pl., dmp., c. to f. sand.	16.0	33	21				4-4 5 4-4
	SC		GRAVELLY CLAYEY SAND (SC), br., low pl., dmp., c. to f. ang. & subang. gravel, c. to f. sand.	17.8	35	23				3 2-2 2 3-5
661.3				16.9			27	32	41	4 2-5 3 4-5
	CL		GRAVELLY SANDY CLAY (CL), br., low to m. pl., dmp., c. to f. subang. wd. claystone, ang. & subang. gravel, c. to f. sand.	16.5	32	20				4 23-11 6 6-9
				15.2	30	20				10 9-7 5 26-2[illegible]
652.3				11.7	34	21				6 5-5 3 5-9
649.3	CL		SANDY GRAVELLY CLAY (CL), bk.-br., low pl., dmp., c. to f. subang. gravel, c. to f. sand.	16.1	34	23				4 5-6 5 8-21
646.3	SM		SILTY SAND (SM), bk., nonpl., dmp., c. to f. sand.	21.6						4 5-12 3 4-6
643.3	SP-SM		GRAVELLY SAND (SP-SM), br.-bk., nonpl., dmp., c. to f. subang. & subrou. gravel & coal, c. to f. sand.	14.6						4 6-5 2 2-2
640.3	SM		GRAVELLY SILTY SAND (SM), bk., nonpl., dmp., c. to f. subang. & subrou. gravel, c. to f. sand.	22.1			16	66	18	4 4-4 5 14-21
637.3	SM		SILTY GRAVELLY SAND (SM), br., nonpl., dmp., c. to f. subang. to subrou. gravel, c. to f. sand.	21.5				INITIAL W.L. 12-6-20		4 14-19 5 14-19
	GP-GM		SANDY GRAVEL (GP-GM), br. to gr.-br., nonpl., dmp., c. to f. ang., subang. & subrou. gravel, w/so. shale, c. to f. sand.	13.1			65	27	8	16 9-8 8 14-26
632.5				15.1				65/0.3		18 26-3[illegible]
							TOP OF ROCK			
628.8	SH		SHALE, mod. hard to soft, gray, silty, shaly to thin bedded. Fractured and moderately broken at 632.3 to 632.1. Numerous, thin, lt. gray, fine grained, sandstone stringers at 632.0 to 631.7. Low angled slickensided plane at 629.7.	25 ← ROD L 0.0 ← LOSS 62 L 0.0						
620.3	SH		SHALE, mod. hard to soft, dark gray, carbonaceous, shaly to thin bedded with broken planes at 0.2' spacing. Mechanical spin loss at 627.6, 626.7, 625.3. Fractured and mod. broken at 628.4 -	25						

* ROCK STRUCTURAL ELEMENTS

PROJECT ISLAND CREEK BASIN
LOGAN, WEST VIRGINIA

HOLE NO. C-90-1

ELEVATION (FEET) MSL	SYMBOL	R.S.E. *	DESCRIPTION OF MATERIALS	REMARKS OR TEST RESULTS	
620.3					
617.5	SH		628.3, 627.3-627.2, 626.3-626.2, 625.5. Core diameter loss at 626.7-626.3, 624.8-624.6. Low angled (20°) planes with slk. at 627.3, 627.2, 627.1. Clayey at 624.8-624.1. Thin clay seams at 624.3, 624.1, 619.6. Clayey and broken with possible core loss at 624.1-617.5. 1.2' loss at end of run, 618.7-617.5.	L 2.2	BOTTOM OF HOLE

* ROCK STRUCTURAL ELEMENTS

CORE SIZE NX
BATTER VERTICAL
DIRECTION X
DATE:
STARTED 29 NOV 90
COMPLETED 3 NOV 90

PROJECT ISLAND CREEK BASIN LOGAN, WEST VIRGINIA

HOLE NO. C-90-2

SAMPLER 2" S.S.
DROP 30"
HAMMER 140#
COORDINATES:
N 310,560.52
E 1,711,885.70

ELEVATION (FEET) MSL	SYMBOL	R.S.E. *	DESCRIPTION OF MATERIALS	WC	LL	PL	% +4	% SAND	% -200	BLOWS
667.8										
664.8	SM		SILTY GRAVELLY SAND (SM), mot. gr., bk.-br., nonpl., c. to f. ang. & subang. shale, c. to f. sand.	17.3						8 6-4 2 3-5
661.8	SM		SILTY SAND (SM), br., nonpl., dmp., f. subang. & subrou. gravel, c. to f. sand.	15.2						8 6-4 2 1-2
658.8	SP-SM		GRAVELLY SAND (SP-SM), br., nonpl., dmp., c. to f. ang., subang. & rou. gravel, c. to f. sand.	14.2						0 2-3 3 3-8
				14.2			70	24	6	10 8-9 7 2-5
				22.7						20 10-6 7 4-4
	GP-GM		SANDY GRAVEL (GP-GM), br. to br.-bk. to bk., nonpl., dmp., c. to f. ang. & subang. gravel, w/so. coal & wood frags., c. to f. sand.	24.0			56	38	6	8 6-4 3 4-4
646.8				22.2						3 3-4 6 4-3
643.8	SM		SILTY SAND (SM), bk.-br., nonpl., dmp., f. subang. gravel, w/wood frags., c. to f. sand.	27.1						2 3-4 2 4-5
640.8	ML		SANDY SILT (ML), br. to dr. gr., nonpl., dmp., c. to f. sand.	19.0				INITIAL W.L. 11-29-90		3 6-9 2 8-11
637.8	SM		SILTY SAND (SM), dr. gr., nonpl., wet, c. to f. sand.	26.8						2 3-3 2 2-6
634.8	SM		GRAVELLY SILTY SAND (SM), gr.-br., nonpl., wet, f. subrou. gravel, c. to f. sand	25.5						8 8-7 8 20-30/0.4
619.8	SH		SHALE, mod. hard to soft, silty, gray, shaly to medium bedded, occ. thin lt. gray sandstone stringers throughout. 0.7' Sandstone, mod. hard, lt. gray, fine grained, numerous thin shaly stringers. 634.8-634.1 Thin clayey seam at 633.0. High angled fracture at 631.9-631.5. Dark gray below 623.0. 2.4' loss, with some mechanical spin loss, 623.0-620.6.	20 (ROD) L 0.0 (LOSS) 20 L 0.0 20 L 2.4	TOP OF ROCK L.D.W.					
					BOTTOM OF HOLE					

* ROCK STRUCTURAL ELEMENTS

SHEET 1 OF 1 SHEETS

CORE SIZE NX
BATTER VERTICAL
DIRECTION
DATE:
STARTED 21 NOV 90
COMPLETED 3 DEC 90

PROJECT ISLAND CREEK BASIN LOGAN, WEST VIRGINIA

HOLE NO. C-90-3

SAMPLER 2 S.S.
DROP 30"
HAMMER 140#
COORDINATES:
N 310,381.06
E 1,711,772.09

ELEVATION (FEET) MSL	SYMBOL	R.S.E.*	DESCRIPTION OF MATERIALS	WC	LL	PL	% +4	% SAND	% -200	BLOWS
667.8										
666.8			BLACKTOP & GRAVEL							
663.8	SM		SILTY GRAVELLY SAND (SM), br., nonpl., dmp., c. to f. ang. gravel, c. to f. sand.	12.6						5 / 7-2; 1 / 1-0
657.8	GP-GM		SANDY GRAVEL (GP-GM), bk., nonpl., c. to f. ang. & subang. coal, c. to f. sand.	21.0; 18.3						1 / 2-1; 4 / 1-2; 2 / 2-3; 2 / 2-1
654.8	SP-SM		GRAVELLY SAND (SP-SM), bk., nonpl., c. to f. ang. & subang. coal, c. to f. sand.	21.0			43	50	7	1 / 1-2; 1 / 2-1
647.3	GP-GM		SANDY GRAVEL (GP-GM), bk., nonpl., c. to f. ang. & subang. coal, c. to f. sand.	17.2; 22.1; 19.6						1 / 1-2; 1 / 1-1; 2 / 1-2; 2 / 1-1; 2 / 1-1
644.3	SM		SILTY SAND (SM), br., nonpl., dmp., c. to f. sand.	21.7			0	77	23	3 / 2-1; 3 / 2-3
641.3	SM		GRAVELLY SILTY SAND (SM), br., nonpl., dmp., f. subrou. & rou. gravel, c. to f. sand.	27.8			INITIAL W.L. 11-21-90			2 / 2-25; 2 / 13-10
638.3	SP-SM		GRAVELLY SAND (SP-SM), br., nonpl., dmp., c. to f. subrou. wd. sandstone, c. to f. sand.	16.8			25	66	9	5 / 5-10; 16 / 13-17
635.7	GM		SILTY SANDY GRAVEL (GM), br., nonpl., dmp., c. to f. ang. & subrou. sandstone & shale, c. to f. sand.	18.4				5 8-60/0.1		13 / 14-9
620.7	SH		SHALE, mod. hard to soft, gray to dark gray, silty, occ. thin lt. gray sandstone stringers throughout, shaly to medium bedded. Mod. broken at 635.7-635.6. High angled, irregular, clay coated, fracture at 634.2-633.9. Numerous, thin, lt. gray, sandstone stringers with occ. carbonaceous stringers, 631.9-630.8, 629.3-628.9. 0.5' Sandstone, mod. hard., lt. gray, fine grained, gradational contacts, occ. shaly stringers, 630.8-629.3. Calcareous at 630.3-629.8. Dark gray below 628.8 45° irregular fracture at 629.4-629.2.	15 ← ROD; L 0.0 ← LOSS; 67; L 0.0; 94; L 0.0			TOP OF ROCK			
							BOTTOM OF HOLE			

* ROCK STRUCTURAL ELEMENTS

SHEET 1 OF 1 SHEETS

CORE SIZE NX
BATTER VERTICAL
DIRECTION
DATE:
STARTED 5 DEC 90
COMPLETED 5 DEC 90

PROJECT ISLAND CREEK BASIN LOGAN, WEST VIRGINIA

HOLE NO. C-90-4

SAMPLER 2" S.S.
DROP 30"
HAMMER 140#
COORDINATES:
N 309,946.09
E 1,711,280.03

ELEVATION (FEET) MSL	SYMBOL	R.S.E. *	DESCRIPTION OF MATERIALS	WC	LL	PL	% +4	% SAND	% -200	BLOWS	REMARKS OR TEST RESULTS
666.2											
665.7			CONCRETE PAD FOR STORAGE AREA.								
663.2	GC		SANDY CLAYEY GRAVEL (GC), gr.-bk., m. pl., c. to f. ang. & subang. coal, c. to f. sand.	24.2						7-8 4 3-4	
657.2	GC		SANDY CLAYEY GRAVEL (GC), gr. to gr.-bk., m. pl., c. to f. ang. coal & wd. claystone, w/wood frags., c. to f. sand.	9.9 13.6						7 13-15 2 7-7 2 4-5 5 13-14	
654.2	SC		CLAYEY GRAVELLY SAND (SC), gr.-bk., m. pl., c. to f. ang. & subang. coal & claystone, w/wood frags., c. to f. sand.	22.1			34	46	20	2 8-13 4 6-7	
648.2	CH		SANDY CLAY (CH), br., hi. pl., mst., c. to f. sand.	24.9 37.1	56 50	27 25	0 0	16 13	84 87	1 2-4 2 3-3 2 2-3 1 3-4	
645.2	CL		SANDY CLAY (CL), br., m. pl., mst., c. to f. sand.	28.2	39	21	0	21	79	1 2-3 1 1-3	
642.2	SM		SILTY SAND (SM), br., nonpl., mst. to wet, m. to f. sand.	32.5			0	84	16	1 2-3 1 1-2	
637.6	SP-SM		SAND (SP-SM), br., nonpl., mst. to wet, c. to f. sand.	28.4 25.8						1 2-4 2 4-4 2 4-5	INITIAL W.L. 12-5-90
622.6	SS		SANDSTONE, mod. hard, lt. gray, fine to medium grained, micaceous, thin to medium bedded. Thin flaggy bedding above 634.0. Slightly broken and slightly weathered above 637.2 Numerous carbonaceous stringers at 636.7-636.2, 634.5-634.4, 633.3-633.0, 629.6-628.6. Calcareous at 632.3-630.1. Numerous shaly stringers below 627.7. Shale, dark gray, mod. hard, occ. thin sandstone stringers, 626.8-626.0, 623.2-622.7.	0 ← ROD L 0.0 ← LOSS 56 L 0.0 96 L 0.0							TOP OF ROCK
											BOTTOM OF HOLE

* ROCK STRUCTURAL ELEMENTS

SHEET 1 OF 1 SHEETS

CORE SIZE NX
BATTER VERTICAL
DIRECTION
DATE:
STARTED 19 NOV 90
COMPLETED 12 DEC 90

PROJECT ISLAND CREEK BASIN LOGAN, WEST VIRGINIA

HOLE NO. C-90-5

SAMPLER 2" S.S.
DROP 30"
HAMMER 140#
COORDINATES:
N 310,053.01
E 1,710,641.42

ELEVATION (FEET) MSL 677.1	SYMBOL	R.S.E. *	DESCRIPTION OF MATERIALS	WC	LL	PL	% +4	% SAND	% -200	BLOWS
674.1	SC		CLAYEY SAND (SC), br., m. pl., dmp., c. to f. subang. gravel, c. to f. sand.	10.1						10 4-28; 6 10-17
671.1	GP-GC		SANDY GRAVEL (GP-GC), br.-gr., low pl., dmp., c. to f. ang. & subang. gravel & shale, c. to f. sand.	8.7						3 19-19; 4 10-13
665.1	GM		SILTY SANDY GRAVEL (GM), dk. gr.-bk., nonpl., dmp., c. to f. ang. & subang. shale, c. to f. sand.	10.1						4 5-5; 8 12-15
				10.4			43	39	18	3 12-11; 3 6-5
653.1	GP-GM		SANDY GRAVEL (GP-GM), bk.-gr. to bk., nonpl., dmp., c. to f. ang. shale, c. to f. sand.	5.0						3 6-8; 3 15-14
				7.7						4 8-9; 4 10-18
				11.3						4 6-4; 1 3-5
				8.0						2 2-2; 2 2-4
650.1	ML		SANDY SILT (ML), gn.-gr., nonpl., dmp. to mst., f. ang. gravel, c. to f. sand.	34.4			2	19	79	2 2-3; 2 3-6
647.1	SM		SILTY SAND (SM), gn.-gr., nonpl., dmp. to mst., m. to f. sand.	21.2			0	57	43	3 5-7; 1 2-3
644.1	SP-SM		SAND (SP-SM), gn.-br., nonpl., dmp. to mst., c. to f. sand.	16.1				INITIAL W.L. 11-20-90		3 4-7; 2 4-4
641.1	SP-SM		GRAVELLY SAND (SP-SM), br.-gr., nonpl., dmp. to mst., c. to f. subang. & subrou. gravel, c. to f. sand.	25.7						1 7-8; 5 14-19
638.3	GP-GM		SANDY GRAVEL (GP-GM), br., nonpl., dmp. to mst., c. to f. subang. & subrou. gravel, c. to f. sand.	15.4						11 16-17; 9 20-81/0.3
627.1	SS		SANDSTONE, mod. hard to hard, lt. gray, fine to med. grained, micaceous, thin to med. bedded, occ. micaceous stringers and bedding planes throughout. Calcareous at 634.9-632.9. 45° fracture at 633.5-633.4. Slightly broken at 633.3-633.2. High angled fracture at 633.1-632.9. Numerous micaceous stringers and bedding planes at 632.8-632.7, 631.5-631.2, 623.8-623.7. Shale seam, dark gray, mod. hard, with few thin sandstone stringers, at	45 ROD; L 0.0 LOSS; 61						TOP OF ROCK

* ROCK STRUCTURAL ELEMENTS

SHEET 1 OF 2 SHEETS

ISLAND CREEK BASIN
PROJECT LOGAN, WEST VIRGINIA

HOLE NO. C-90-5

ELEVATION (FEET) MSL	SYMBOL	R.S.E. *	DESCRIPTION OF MATERIALS	REMARKS OR TEST RESULTS	
627.1					
623.0	SS		632.3-632.1, 631.8-631.5. Mechanically broken at 626.0-625.8.	L 0.0 0 L 0.0	
					BOTTOM OF HOLE

* ROCK STRUCTURAL ELEMENTS

CORE SIZE NX BATTER VERTICAL DIRECTION DATE: STARTED 20 NOV 90 COMPLETED 4 DEC 90	PROJECT ISLAND CREEK BASIN LOGAN, WEST VIRGINIA HOLE NO. C-90-6	SAMPLER 2" S.S. DROP 30" HAMMER 140# COORDINATES: N 310,028.95 E 1,709,896.40

ELEVATION (FEET) MSL	SYMBOL	R.S.E. *	DESCRIPTION OF MATERIALS	WC	LL	PL	% +4	% SAND	% -200	BLOWS
660.9										
657.9	SC		CLAYEY GRAVELLY SAND (SC), gr., low pl., dmp., c. to f. ang. & subang. shale & gravel, c. to f. sand.	22.5						2 4-4 2 2-2
654.9	ML		GRAVELLY SANDY SILT (ML), gr.-bk., low pl., dmp., c. to f. ang. & subang. gravel, c. to f. sand.	26.0	48	28				3 2-3 2 4-2
653.4	SC		GRAVELLY CLAYEY SAND (SC), br.-gr., m. pl., dmp., c. to f. ang. coal, c. to f. sand.	22.7	42	24	27	29	44	3 3-3
644.4	SM		SILTY SAND (SM), br., nonpl., dmp., c. to f. sand.	26.8 24.1 30.5			0	68	32	2 2-2 2 4-3 2 4-5 2 3-5 3 2-4 3 2-4
641.4	SM		SILTY SAND (SM), mot. br., gr. & bk., nonpl., dmp., f. subrou. gravel, c. to f. sand.	17.8				INITIAL W.L. 11-20-90		2 3-1 4 4-9
640.0	GP-GM		SANDY GRAVEL (GP-GM), gn.-gr., nonpl., dmp., c. to f. subang. & subrou. gravel, c. to f. sand.	11.3						13 12-70/0.4
624.8	SS		SANDSTONE, mod. hard to hard, lt. gray, fine to med. grained, micaceous, med. bedded, occ. micaceous bedding planes throughout. Slightly broken and weathered at 640.0-639.5. Thin bedded with numerous micaceous bedding planes above 638.1.	37 ← ROD L 0.0 ← LOSS 90 L 0.0 78 L 0.0			TOP OF ROCK			
							BOTTOM OF HOLE			

* ROCK STRUCTURAL ELEMENTS

SHEET 1 OF 1 SHEETS

CORE SIZE NX BATTER VERTICAL DIRECTION DATE: STARTED 11 DEC 90 COMPLETED 11 DEC 90	PROJECT ISLAND CREEK BASIN LOGAN, WEST VIRGINIA HOLE NO. C-90-7	SAMPLER 2" S.S. DROP 30" HAMMER 140# COORDINATES: N 310,126.40 E 1,709,418.11

ELEVATION (FEET) MSL	SYMBOL	R.S.E. *	DESCRIPTION OF MATERIALS	WC	LL	PL	% +4	% SAND	% -200	BLOWS	REMARKS OR TEST RESULTS
659.7											
656.7	ML		SANDY SILT (ML), dk. gr., nonpl., dmp., m. to f. sand.	24.2						3 3-4; 1 1-3	
653.7	SM		SILTY SAND (SM), br., nonpl., dmp., c. to f. sand.	15.3						2 2-2; 2 2-6	
650.7	ML		SANDY SILT (ML), br., nonpl., dmp., c. to f. sand.	32.8			0	31	69	5 5-5; 2 2-2	
647.7	SM		SILTY SAND (SM), br., nonpl., dmp., c. to f. sand.	25.2						2 1-2; 2 1-1	INITIAL W.L. 12-11-90
642.4	SP-SM		SAND (SP-SM), br. to gr.-br., nonpl., dmp., c. to f. sand.	33.9; 52.4						2 1-1; 2 1-2; 1 1-2; 2-65/0.3	
627.3	SS		SANDSTONE, hard to mod. hard, lt. gray, fine to med. grained, micaceous, medium bedded, occ. micaceous bedding planes throughout. Slightly broken and weathered at 642.4-642.2. Fer. stained bedding plane at 642.1. Numerous carbonaceous stringers at 640.1-639.7, 632.1-632.0, 631.7-631.6. High angled fracture at 636.5-636.3.	51 (ROD); L 0.0 (LOSS); 74; L 0.0; L 0.0	100						TOP OF ROCK
											BOTTOM OF HOLE

* ROCK STRUCTURAL ELEMENTS

SHEET 1 OF 1 SHEETS

CORE SIZE 4-INCH
BATTER VERTICAL
DIRECTION N/A
DATE:
STARTED 9 SEP 93
COMPLETED 13 SEP 93

PROJECT LOGAN, WV ISLAND CREEK L.P.P.

HOLE NO. C-93-8

SAMPLER 2" SPLITSPOON
DROP 30-INCH
HAMMER 140 LBS
COORDINATES:
N 310675.55
E 1711936.54

ELEVATION (FL.) MSL 671.7	SYMBOL	R.S.E. *	DESCRIPTION OF MATERIALS	WC	LL	PL	% +4	% SAND	% -200	BLOWS
668.7	GM		SILTY SANDY GRAVEL (GM). bge.-rd. brn., c. to f. ang. gravel with brk. frgs., c. to f. sand; nonpl.				50	35	15	8 16-7; 5 3-5
665.7	GW-GM		SANDY GRAVEL (GW-GM). bge.-rd. brn., c. to f. ang. gravel with brk. frgs., slag & coal, c. to f. sand; nonpl.	11.5			60	32	8	4 6-7; 6 6-6
662.7	GP-GM		SANDY GRAVEL (GW-GM). brn., c. to f. ang. gravel with brk. frgs., slag & coal, c. to f. nonpl.				50	40	10	6 3-1; 5 5-5
	SP-SM		GRAVELLY SAND (SP-SM). brnish. gry., c. to f. ang. gravel with brk. frgs., c. to f. sand; nonpl.	16.3			30	60	10	5 7-3; 2 2-1
656.7							30	60	10	1 1-2; 2 3-2
653.7	GP-GM		SANDY GRAVEL (GP-GM). gry.-brn., f. subang. gravel, c. to f. sand; nonpl.				50	40	10	3 5-5; 8 3-3
650.7	SW-SM		GRAVELLY SAND (SW-SM). brn. drk. gry., f. subang. gravel with slag, c. to f. sand; nonpl.	26.7			46	48	6	2 3-2; 3 3-5
647.7	SP-SM		GRAVELLY SAND (SP-SM). brn. drk. gry., c. to f. ang gravel with slag, c. to f. sand; nonpl.				40	50	10	3 2-2; 2 3-2
647.2	GP-GM		SANDY GRAVEL (GP-GM). drk. gry., f. subang. gravel with slag, c. to f. sand; nonpl.				55	40	5	1 1-1
644.7	SM		SILTY SAND (SM). grnish gry., c. to f. nonpl., with decayed wood.					70	30	1 3-4
641.7	SP-SM		SAND (SP-SM). brn., c. to f. sand; nonpl., with clay lumps.					90	10	2 4-5; 5 6-6
638.7	SP		SAND (SP). brn., f. subang. gravel, c. to f. sand; nonpl.	19.3			10	86	4	4 6-6; 2 2-3
635.7	SP		GRAVELLY SAND (SP). brn., c. to f. subang. to subrnd gravel, c. to f. sand; nonpl., with free water.				40	56	4	2 3-7; 3 10-18
632.7	SP-SM		GRAVELLY SAND (SP-SM). brn., c. to f. subang. to subrnd gravel, c. to f. sand; nonpl., with free water.	15.2			35	54	11	28 25-15
632.2	SP		GRAVELLY SAND (SP-SM). brn., c. to f. subang. to subrnd gravel, w/shale c. to f. sand; nonpl., with free water.				40	56	4	20 25-33; 50
625.4	SH		SHALE: Gray, mod. hard to soft, silty, occasional light gray sandstone stringers throughout, few thin ferruginous stained seams. 0.6' loss at 626.0-625.4.	100 ← RQD; L 0.0 ← LOSS; 86; L 0.6	TOP OF ROCK					
621.7	SH		SHALE: Dark gray to black, soft, occasionally clayey, carbonaceous. Moderately broken at 624.6-624.5.	73						

* ROCK STRUCTURAL ELEMENTS

PROJECT LOGAN, WV ISLAND CREEK, L.P.P.

HOLE NO. C-93-8

ELEVATION (FEET) MSL 621.7	SYMBOL	R.S.E. *	DESCRIPTION OF MATERIALS		REMARKS OR TEST RESULTS
	SH		SHALE: (continued) Severely broken with occasional clay coated surfaces at: 622.Ø-621.5, 616.5-615.9. High angled fracture with a rough and planar surface terminating on bedding planes at 621.2-62Ø.2. Gray and non-carbonaceous below 614.3. Sandy, with occasional brown siltstone inclusions at 614.3-613.9.	73 L Ø.Ø 58 L Ø.Ø	
612.6				94	
61Ø.7	SS		SANDSTONE: Light gray, mod. hard, fine grained, micaceous, gradational upper and lower contacts. Silty at 612.4-612.2.	L Ø.Ø	
	SH		SHALE: Gray to dark gray, mod. hard to soft, silty, occasional thin ferruginous stained seams throughout. Scattered light gray sandstone stringers above 6Ø8.Ø. Clayey at 6Ø2.6-6Ø2.5. Ø.3' Coal: black, mod. hard, blocky with plant fossils at 6Ø2.5-6Ø2.2.	1ØØ L Ø.Ø 86 L Ø.Ø	
6Ø2.2					BOTTOM OF BORING

* ROCK STRUCTURAL ELEMENTS

SHEET 2 OF 2 SHEETS

[illegible] SIZE 4"-INCH BATTER VERTICAL DIRECTION N/A DATE: STARTED 13 SEP 93 COMPLETED 14 SEP 93	PROJECT LOGAN, WV ISLAND CREEK L.P.P. HOLE NO. C-93-10	SAMPLER 2" SPLIT SPOON DROP 30-INCH HAMMER 140 LBS COORDINATES: N 310297.32 E 1711607.26

ELEV. MSL	SYMBOL	R.S.E. *	DESCRIPTION OF MATERIALS	WC	LL	PL	% +4	% SAND	% -200	BLOWS
58.4										
665.4	SM		SILTY GRAVELLY SAND (SM) gry.-brn., c. to f. ang. to subang. gravel. c. to f. sand: nonpl.				35	50	15	8-12 6 5-5
662.4	SM		SILTY GRAVELLY SAND (SM) gry.-brn., c. to f. ang. to subang. gravel. with shale & slag. c. to f. sand: nonpl.	17.7			38	47	15	3 4-3 1 1-1
	GP-GM		SANDY GRAVEL (GP-GM). gryish brn., c. to f. ang. to subang. gravel. c. to f. sand: nonpl.				50	40	10	2 2-1 2 2-1
56.4							50	40	10	2 1-1 1 2-1
653.4	GP-GM		SANDY GRAVEL (GP-GM). drk gry., c. to f. ang. to subang. gravel. c. to f. sand: nonpl.	18.8			50	40	10	1 1-WOH 1 1-1
550.4	GW		SANDY GRAVEL (GW). drk gry., c. to f. ang. to subang. gravel. c. to f. sand: nonpl.	21.5			63	33	4	1 0-1 1 1-1
50.2	GP		SANDY GRAVEL (GP). gry., c. to f. subang. gravel with slag. c. to f. sand: nonpl.	26.1			56	40	4	1 1-2
47.4	SC		CLAYEY SAND (SC). brn., c. to f. sand: low pl.					70	30	3 2-2
46.4	SP-SM		SAND (SP-SM). brn., m. to f. sand: nonpl.					90	10	2 3-5
44.4	SM		SILTY SAND (SM). brn., c. to f. sand: nonpl..	9.0				87	13	4 4-4
641.4	SP		GRAVELLY SAND (SP). brn., c. to f. subrnd.. gravel c. to f. sand: nonpl.	9.1			35	61	4	2 3-4 8 11-8
638.6	GP		SANDY GRAVEL (GP). brn., c. to f. subrnd. gravel. c. to f. sand: nonpl., with free water.				56	40	4	6 5-2 4 8-5

ELEV. MSL	SYMBOL	R.S.E. *	DESCRIPTION OF MATERIALS	RQD / LOSS	REMARKS
635.2			RIVER GRAVEL AND COBBLES	35 L 0.2 0	BEGAN CORING
629.8	SH		SHALE Interbedded with Sandstone: Dark gray, soft to mod. hard, silty, numerous light gray sandstone stringers, gradational lower contact. 0.4' Claystone: gray, very soft, highly weathered to soil-like, clayey at 635.2-634.8. Moderately broken (poss. mech.) at: 634.8-634.6, 634.1-633.8. 0.6' loss at 634.6-634.0. Sandstone: gray, mod. hard, fine grained, numerous shaly stringers at: 634.0-633.6, 632.2-630.5. Calcareous cement at 632.2-631.9.	L 1.4 54 ←RQD L 0.6 ←LOSS 96 L 0.0	TOP OF ROCK
619.4	SH		SHALE: Gray to dark gray, mod. hard to soft, silty, scattered light gray sandstone stringers throughout. Moderately broken at: 628.0-627.9, with 0.2' loss at 624.6-623.7, 623.2-623.0, 622.7-622.1.	46 L 0.2	
618.4	SH		SHALE: (see sheet 2 for description)		

* ROCK STRUCTURAL ELEMENTS

SHEET 1 OF 2 SHEETS

PROJECT LOGAN, WV ISLAND CREEK L.P.P.

HOLE NO. C-93-1Ø

ELEVATION (FEET) MSL 618.4	SYMBOL	R.S.E. *	DESCRIPTION OF MATERIALS	REMARKS OR TEST RESULTS	
	SH		SHALE: Dark gray to black, soft to mod. hard, carbonaceous, occasionally clayey. Moderately broken with occ. clay coated surfaces at: 618.9-618.3, 6Ø8.2-6Ø8.1. High angled fracture with a planar surface, and slightly broken at 617.6-617.1. Severely broken (poss. mech.): with Ø.2' loss at 615.4-615.1, with Ø.6' loss at 613.8-613.1. Severely broken with scattered clay coated surfaces at 6Ø7.1-6Ø6.6. Numerous brown siltstone inclusions (conglomeratic) at 6Ø6.4-6Ø6.2. Numerous sandstone stringers below 6Ø6.Ø.	52 L Ø.Ø 69 L Ø.2 60 L Ø.6 4Ø L Ø.Ø	
6Ø5.4					BOTTOM OF BORING

* ROCK STRUCTURAL ELEMENTS

SHEET 2 OF 2 SHEETS

CORE SIZE 4-INCH
BATTER VERTICAL
DIRECTION N/A
DATE:
STARTED 26 AUG 93
COMPLETED 28 AUG 93

PROJECT LOGAN, WV ISLAND CREEK L.P.P.

HOLE NO. C-93-11

SAMPLER 2" SPLITSPOON
DROP 30-INCH
HAMMER 140 LBS
COORDINATES:
N 310198.97
E 1711407.24

ELEVATION (FEET) MSL	SYMBOL	R.S.E. *	DESCRIPTION OF MATERIALS	WC	LL	PL	% +4	% SAND	% -200	BLOWS
664.9										
658.9	SM		SILTY GRAVELLY SAND (SM) brn.-blk., f. ang. to subang. gravel with coal & wthrd shale, c. to f. sand; nonpl.				35	45	20	4 6-5; 3 2-3
				12.5			29	58	13	9 4-4; 3 2-2
652.9	GM		SILTY GRAVELLY SAND (GM) gry.-blk., f. ang. to subang. gravel with coal & wthrd shale, c. to f. sand; nonpl.				45	35	20	2 1-1; 1 2-2
							45	35	20	2 2-2; 2 2-2
646.9	GM		SILTY GRAVELLY SAND (GM) gry.-blk., c. to f. ang. to subang. gravel with coal & wthrd shale, c. to f. sand; nonpl.	18.8			45	35	20	3 3-7; 7 7-7
							45	35	20	3 3-2; 2 2-3
644.5	SP-SM		GRAVELLY SAND (SP-SM), brnish.-gry., c. to f. subang. gravel, c. to f. sand; nonpl.	33.2			45	46	9	1 1-2
642.4	SP-SC		GRAVELLY SAND (SP-SC), brn.-gry., f. subang. gravel, c. to f. sand; v. low pl.	26.6			25	70	5	3 2-9; 3 5-7
637.1	SP-SM		GRAVELLY SAND (SP-SM), brn., c. to f. subang. gravel c. to f. sand; nonpl., w/free water.				25	65	10	3 5-8; 1 5-18
				15.4			34	56	10	19 13-14; 22 50
617.4	SH		SHALE Interbedded with Sandstone: Gray to dark gray, soft to mod. hard, silty, numerous light gray sandstone stringers throughout. Sandstone: light gray, mod. hard to hard, fine grained, numerous dark gray shaly stringers, gradational contacts at: 637.1-635.2, 632.2-632.1, 630.7-630.5, 630.1-629.9, 629.1-628.9, 624.6-623.9, 620.5-620.4, 618.7-617.4. Severely broken, weathered and ferruginous stained at 637.1-635.9. Severely broken with 2.2' loss at 635.1-632.2. Clay coated bedding plane at 623.9.	0 / L 0.0; 0 ← RQD; L 1.5 ← LOSS; 68; L 0.7; 96; L 0.0; 100; L 0.0	TOP OF ROCK					
614.9	SH		SHALE: (see sheet 2 for description)	94						

* ROCK STRUCTURAL ELEMENTS

SHEET 1 OF 2 SHEETS

PROJECT LOGAN, WV ISLAND CREEK L.P.P.

HOLE NO. C-93-11

ELEVATION (FEET) MSL	SYMBOL	R.S.E. *	DESCRIPTION OF MATERIALS	REMARKS OR TEST RESULTS	
614.9					
	SH		SHALE: Gray to dark gray, mod. hard to soft, scattered light gray sandstone stringers throughout.	L Ø.Ø	
				94	
607.1				L Ø.Ø	BOTTOM OF BORING

* ROCK STRUCTURAL ELEMENTS

SHEET 2 OF 2 SHEETS

CORE SIZE 4-INCH
BATTER VERTICAL
DIRECTION N/A
DATE:
STARTED 30 AUG 93
COMPLETED 31 AUG 93

PROJECT LOGAN, WV ISLAND CREEK L.P.P.

HOLE NO. C-93-12

SAMPLER 2" SPLITSPOON
DROP 30-INCH
HAMMER 140 LBS
COORDINATES:
N 310265.15
E 1711291.56

ELEVATION (FEET) MSL	SYMBOL	R.S.E. *	DESCRIPTION OF MATERIALS	WC	LL	PL	% +4	% SAND	% -200	BLOWS
665.2										
662.2	GC		CLAYEY SANDY GRAVEL (GC), brnish.-gry., c. to f. ang. to subang. gravel, c. to f. sand; l. pl.	13.8			50	30	20	18 / 9-10 / 5 / 8-11
659.2	GM		SILTY SANDY (GM) rd. brnish-gry., c. to f. ang. to subang. gravel with brick frags., c. to f sand; l. pl.		43	28	50	30	20	10 / 5-15 / 5 / 35
				13.6			30	57	13	3 / 56 / 2 / 2-3
653.2	SM		SILTY GRAVELLY SAND (SM), drk. gry.-blk., c. to f. ang. to subang. gravel with coal, c. to f. sand; nonpl.				30	50	20	3 / 2-3 / 4 / 2-2
652.1	GM		SANDY GRAVEL (GP-GM), drk. gry.-blk., c. to f. ang. to subang. gravel with coal & wthrd shale, c. to f. sand; nonpl.				50	40	10	2 / 3-2
				18.7			2	40	58	2 / 2-2
647.2	ML		SANDY SILT (ML), gry.-brn., f. subang. gravel, c. to f. sand; nonpl.				5	40	58	2 / 2-2 / 1 / 1-1
644.2	SC		CLAYEY SAND (SC), gryish.-brn., c. to f. sand; l. pl.					55	45	WOH / WOH
641.2	SM		SILTY SAND (SM), gryish-brn., f. subang. gravel, c. to f. sand; l. pl., w/free water.	31.5	30	23	10	45	45	WOH / WOH WOH-3
638.2	GP-GM		SANDY GRAVEL (GP-GM), gryish- brn., c. to f. subang. gravel c. to f. sand; nonpl., w/free water.				50	40	10	3 / 4-11
637.8	SP-SM		GRAVELLY SAND (SP-SM), brn., c. to f. subang. gravel c. to f. sand; nonpl., (sm. sample).				40	50	10	13 / 19-25 / 50
633.1	SH & SS		INTERBEDDED SHALE AND SANDSTONE: SANDSTONE: gray, mod. hard, fine grained at 637.8-636.6, with shaly stringers 635.7-634.6. SHALE: Dark gray, soft to mod. hard, sandy, numerous sandstone stringers at 636.6-635.7, 634.6-633.1. Severely broken, weathered, ferruginous stained, with 0.3' loss at 637.8-637.1. 0.06' Clay seam: gray, soft at 635.8.	24 (RQD) / L 0.3 (LOSS)	TOP OF ROCK					
626.0	SH		SHALE: Gray, soft, clayey, gradational upper and lower contacts. Severely to moderately broken (poss. mech), with numerous low angled (30) bedding planes and 0.2' loss at 632.8-627.9. Silty below 627.6. Moderately broken at 626.4-626.3.	0 / L 0.2 / 66 / L 0.0						
616.9	SH		SHALE Interbedded with Sandstone: Dark gray, soft to mod. hard, silty, numerous light gray sandstone stringers throughout. Sandstone: light gray, mod. hard, fine grained, numerous dark gray shaly stringers, gradational contacts at: 625.0-624.6, 618.3-616.9, 620.2-620.0. High angled fracture with rough and irregular surface at 623.7-623.3	78 / L 0.3						
615.2	SH		Moderately broken at 618.0-617.8.	78						

* ROCK STRUCTURAL ELEMENTS

SHEET 1 OF 2 SHEETS

PROJECT LOGAN, WV ISLAND CREEK L.P.P.

HOLE NO. C-93-12

ELEVATION (FEET) MSL	SYMBOL	R.S.E. *	DESCRIPTION OF MATERIALS	REMARKS OR TEST RESULTS	
615.2					
	SH		SHALE: Dark gray, soft to mod. hard, silty, scattered light gray sandstone stringers, few ferruginous stained seams. Moderately broken at 616.9-616.8.	L Ø.Ø 1ØØ L Ø.Ø	
6Ø7.8					BOTTOM OF BORING

* ROCK STRUCTURAL ELEMENTS

SHEET 2 OF 2 SHEETS

CORE SIZE 4-INCH
BATTER VERTICAL
DIRECTION N/A
DATE:
STARTED 24 AUG 93
COMPLETED 25 AUG 93

PROJECT LOGAN, WV ISLAND CREEK L.P.P.

HOLE NO. C-93-13

SAMPLER 2" SPLITSPOON
DROP 30-INCH
HAMMER 140 LBS
COORDINATES:
N 310017.37
E 1710247.14

ELEVATION (FEET) MSL	SYMBOL	R.S.E. *	DESCRIPTION OF MATERIALS	REMARKS OR TEST RESULTS						
664.2				WC	LL	PL	% +4	% SAND	% -200	BLOWS
661.2	GM		SILTY SANDY GRAVEL (GM), drk gry-blk., f. ang. to subang. gravel w/coal, c. to f. sand: nonpl				50	35	15	7 7-4 3 2-2
658.2	GM		SILTY SANDY GRAVEL (GM) drk. gry.-blk., c. to f. ang. to subang. gravel w/coal & brick frags, c. to f. sand: nonpl.				50	35	15	2 3-7 5 4-5
655.2	SM		GRAVELLY SILTY SAND (SM), gry.-blk., c. to f. ang. to subang. gravel. c. to f. sand: nonpl.	19.2			24	48	28	3 6-8 3 3-7
653.6	GM		SILTY SANDY GRAVEL (GM), drk gry-blk., c. to f. ang. to subang. gravel with coal & wthrd shale, c. to f. sand: nonpl.				50	30	20	3 5-2
	ML		SANDY SILT (ML), grnish gry.-brn., f. ang. to subang. gravel. c. to f. sand: l. pl.	33.1	48	36	10	30	60	4 6-7 1 1-1
647.7				24.3			5	35	60	WOH 1-1 WOH WOH
644.7	SP		SAND (SP), brn., c. to f. sand: nonpl. with free water.					96	4	WOH WOH-1 1 2-2
	SP-SM		GRAVELLY SAND (SP-SM), brn., c. to f. ang. to subang. gravel, c. to f. sand: nonpl, with free water.	22.6			25	66	9	1 1-2 7 17-19
							25	65	10	14 20-19
638.7	SP-SM		GRAVELLY SAND (SP-SM), brnish.-gry., c. to f. subang. gravel, c. to f. sand: nonpl.				40	50	10	50/0.2 13 10-16
638.5										TOP OF ROCK
635.3	SH		SHALE: Dark gray, mod. hard, occasionally sandy, scattered light gray sandstone stringers, thin to shaly bedded, gradational lower contact. 0.8' Sandstone, gray, mod. hard, fine grained, with numerous dark gray shaly stringers at 638.5-637.7. Sandy at 637.1-636.5.	30 L 0.0 46 ← RQD L 0.0 ← LOSS						
618.4	SS		SANDSTONE: Light gray to gray, mod. hard to hard, fine to medium grained, micaceous, occasional carbonaceous stringers, occasional shaly and micaceous stringers and bedding planes throughout. Numerous thin dark gray shaly and micaceous stringers at 631.4-631.1. 0.3' Shale, dark gray, mod. hard, occasional light gray sandstone stringers at 629.2-628.9. 0.8' Shale, dark gray, mod. hard, numerous light gray sandstone stringers at 627.4-626.6.	86 L 0.0 64 L 0.0 96 L 0.0						BOTTOM OF BORING

* ROCK STRUCTURAL ELEMENTS

SHEET 1 OF 1 SHEETS

CORE SIZE 4-INCH
BATTER VERTICAL
DIRECTION N/A
DATE:
STARTED 28 AUG 93
COMPLETED 29 AUG 93

PROJECT LOGAN, WV ISLAND CREEK L.P.P.

HOLE NO. C-93-14

SAMPLER 2" SPLITSPOON
DROP 30-INCH
HAMMER 140 LBS
COORDINATES:
N 309965.80
E 1710084.90

ELEVATION (FEET) MSL	SYMBOL	R.S.E. *	DESCRIPTION OF MATERIALS	REMARKS OR TEST RESULTS						
662.4				WC	LL	PL	% +4	% SAND	% -200	BLOWS
659.4	SM		SILTY GRAVELLY SAND (SM), brn.-blk., c. to f. ang. gravel with coal, c. to f. sand; nonpl.				35	50	15	25 6-8 / 5 4-4
653.4	GM		SILTY SANDY GRAVEL (GM), gry.-drk gry., c. to f. ang. to subang. gravel with wthrd. shale, c. to f. sand; nonpl.	10.5			44	39	17	3 4-5 / 2 1-2
							45/ 50	35/ 35	20/ 15	1 2-1 / 1 1-3
650.4	SM		SILTY GRAVELLY SAND (SM), brn.-gry blk., c. to f. ang. to subang. gravel with coal & wthrd. shale, c. to f. sand; nonpl.				30	50	20	1 1-3 / 2 7-4
647.4	SM		SILTY GRAVELLY SAND (SM), brn. gry., c. to f. ang. gravel with coal, c. to f. sand; nonpl.	18.6	55	31	35	50	15	1 3-1 / 2 1-7
644.4	SP-SM		GRAVELLY SAND (SP-SM), gry. brn. blk., c. to f. ang. gravel with coal, c. to f. sand; nonpl.	12.6			44	50	6	4 7-8 / 6 6-7
639.0	GP-GM		SANDY GRAVEL (GP-GM), grayish brn., c. to f. ang. to subang. gravel with cool, c. to f. sand; nonpl, with free water.				50	40	10	6 6-10 / 6 12-8
							50	40	10	6 14-13 / 9 50
636.5	SH		SHALE: Gray, soft to mod. hard, weathered, grades from clayey to sandy at base, gradational lower contact.	30 L 0.0	TOP OF ROCK					
616.4	SS		0.4' Sandstone, light gray, mod. hard, fine to medium grained at 639.0-638.6. High angled fracture, tight with an irregular surface at 639.0-638.6. 0.3' loss at 637.6-637.3. Moderately broken at 637.3-637.2. SANDSTONE: Light gray, mod. hard to hard, fine to medium grained, micaceous, occasional carbonaceous stringers, scattered dark gray shaly and micaceous stringers and bedding planes throughout. 1.0' Shale, dark gray, soft to mod. hard, silty, numerous light gray sandstone stringers throughout at 30.6-31.6. Increased number of shaly stringers, slightly broken and thin bedded at: 626.8-625.2, 621.4-621.2. 0.4' Shale, dark gray, soft to mod. hard, silty, at 624.4-624.0.	72 ← RQD; L 0.0 ← LOSS; 98; L 0.0; 0 L 0.0; 93; L 0.0; 99; L 0.0; 98						
612.4	SH		SHALE Interbedded with Sandstone: Dark gray, soft to mod. hard, silty, numerous light gray sandstone stringers throughout.	L 0.0; 95						

* ROCK STRUCTURAL ELEMENTS

PROJECT LOGAN, WV ISLAND CREEK L.P.P.

HOLE NO. C-93-14

ELEVATION (FEET) MSL	SYMBOL	R.S.E. *	DESCRIPTION OF MATERIALS	REMARKS OR TEST RESULTS	
612.4					
	SH		SHALE Interbedded with Sandstone: (continued) Sandstone: light gray, mod. hard to hard, micaceous, numerous dark gray shaly stringers at: 614.3-613.4, 612.7-612.5, 611.1-610.9, 610.3-610.1. Decreased number of sandstone stringers below 609.8.		
608.8				L 0.0	BOTTOM OF BORING

* ROCK STRUCTURAL ELEMENTS

SHEET 2 OF 2 SHEETS

ISLAND CREEK

LOCAL PROTECTION PROJECT

ENGINEERING TECHNICAL APPENDIX

TO THE

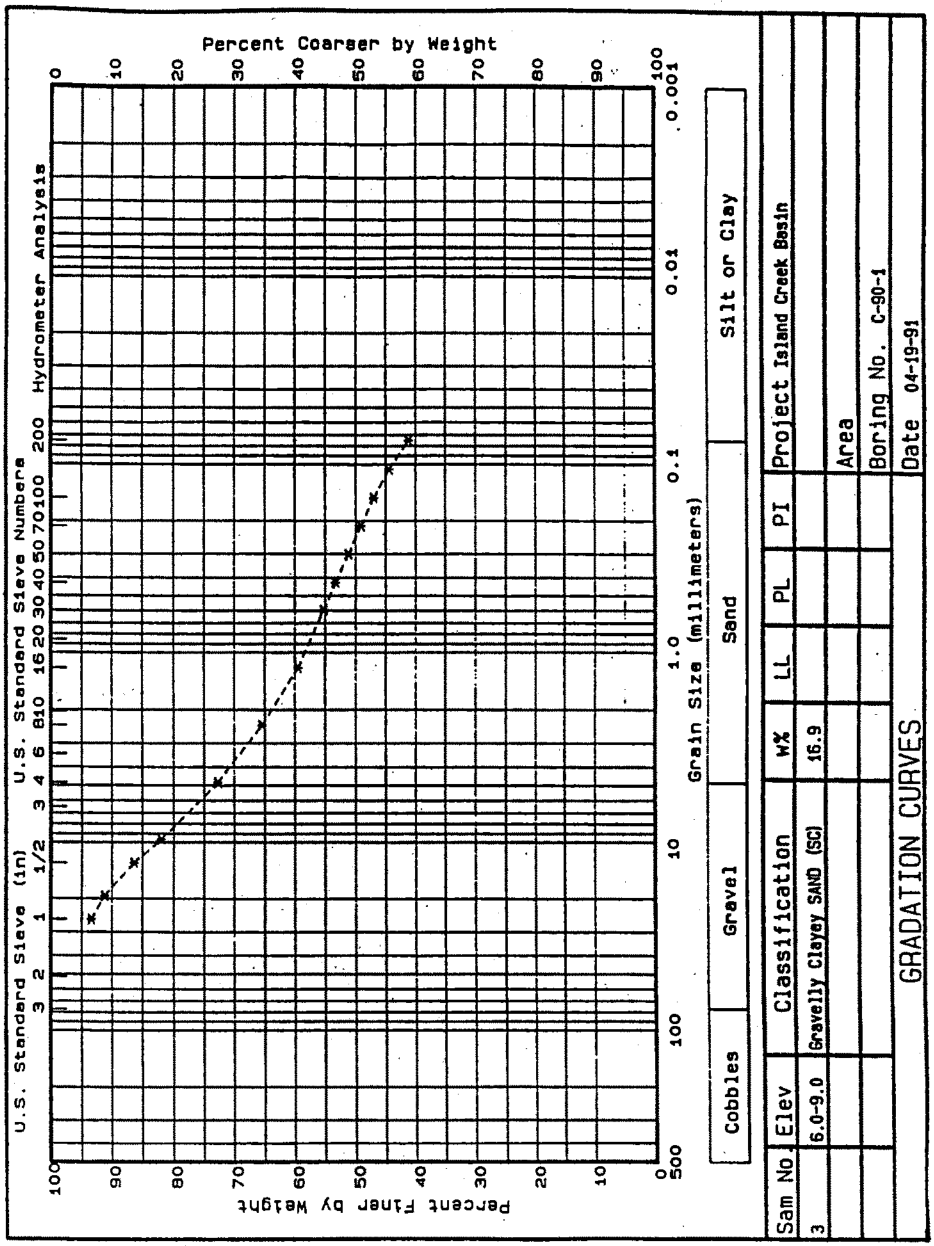
GENERAL REEVALUATION REPORT

TAB IV

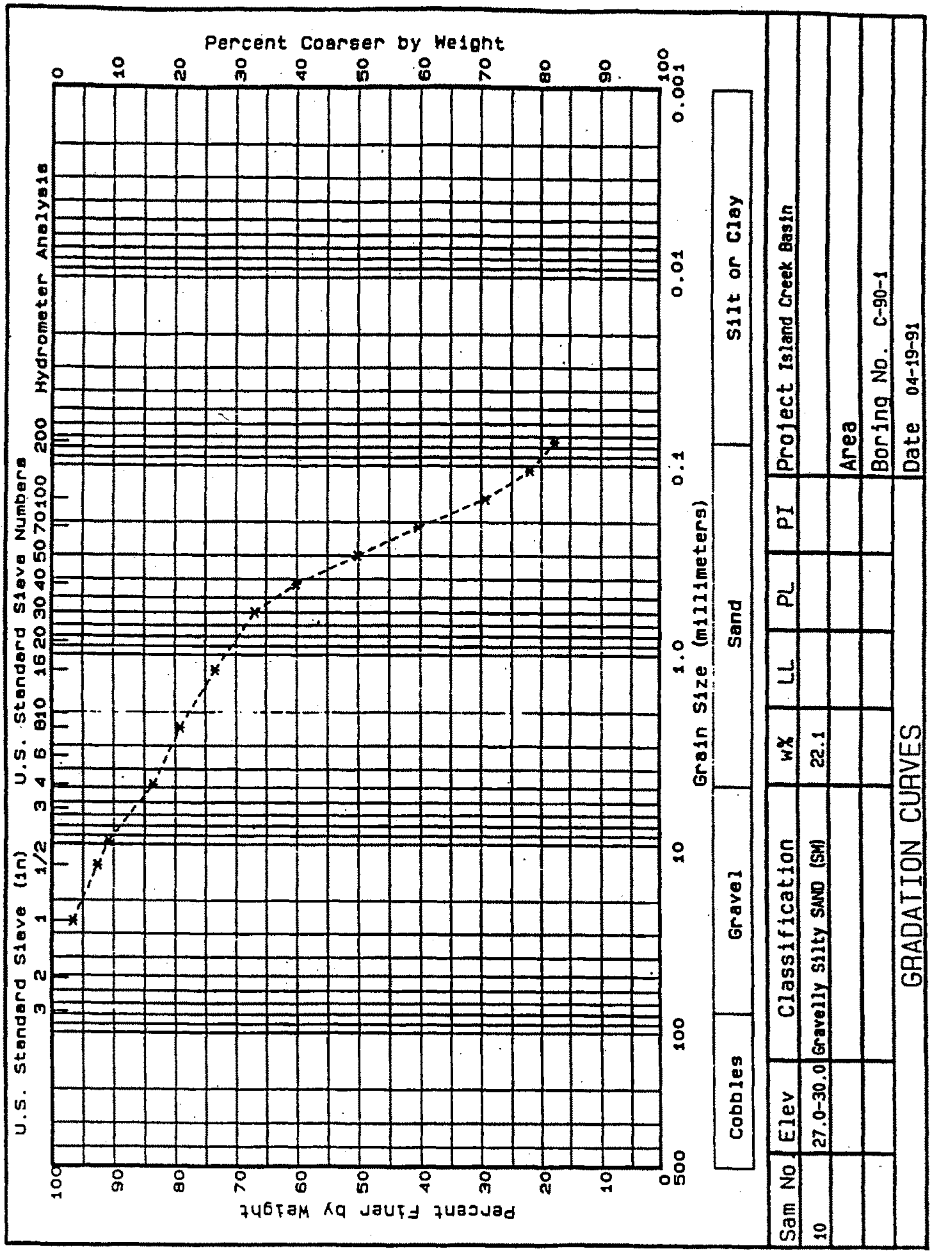
GEOTECHNICAL

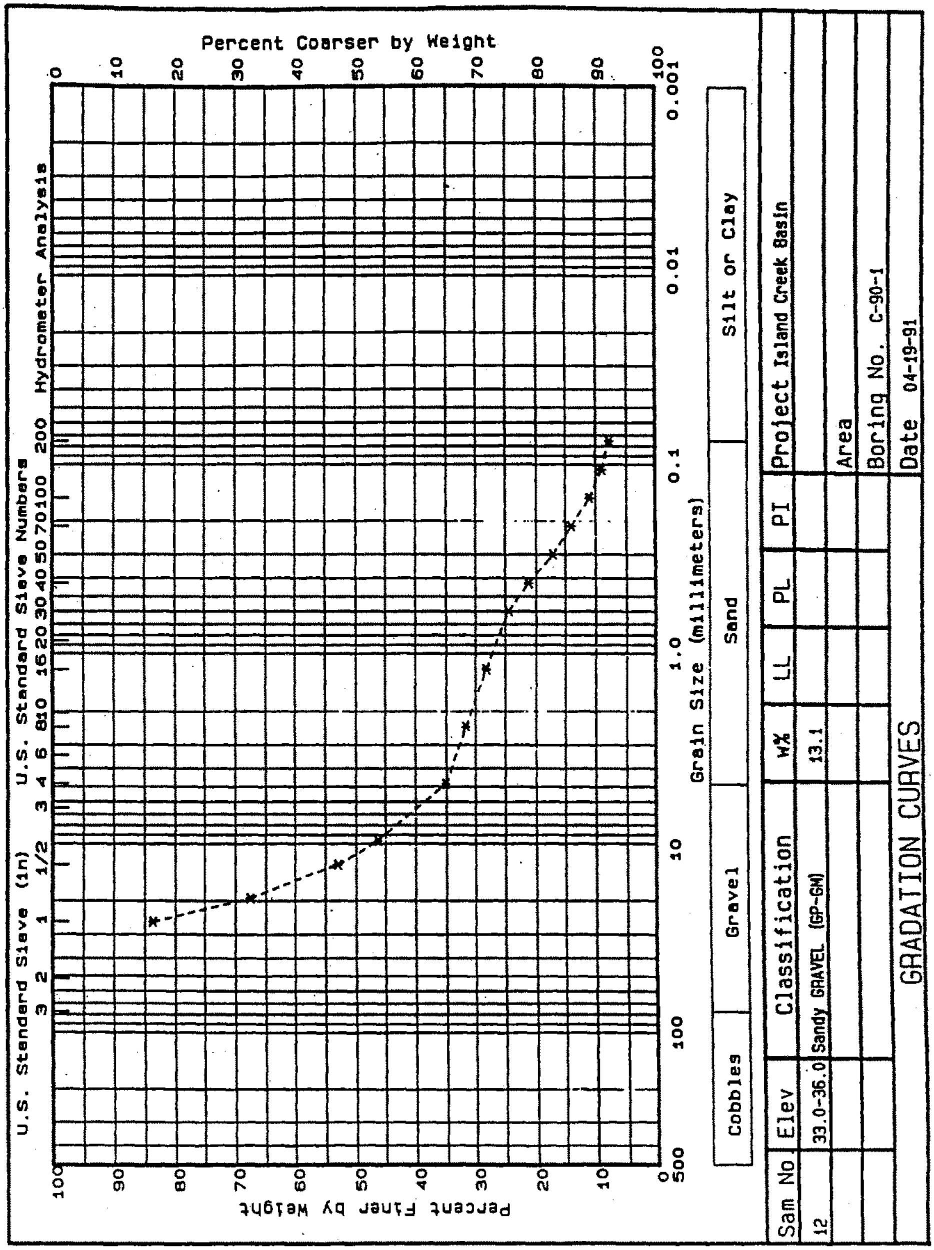
SECTION C – LABORATORY TESTING

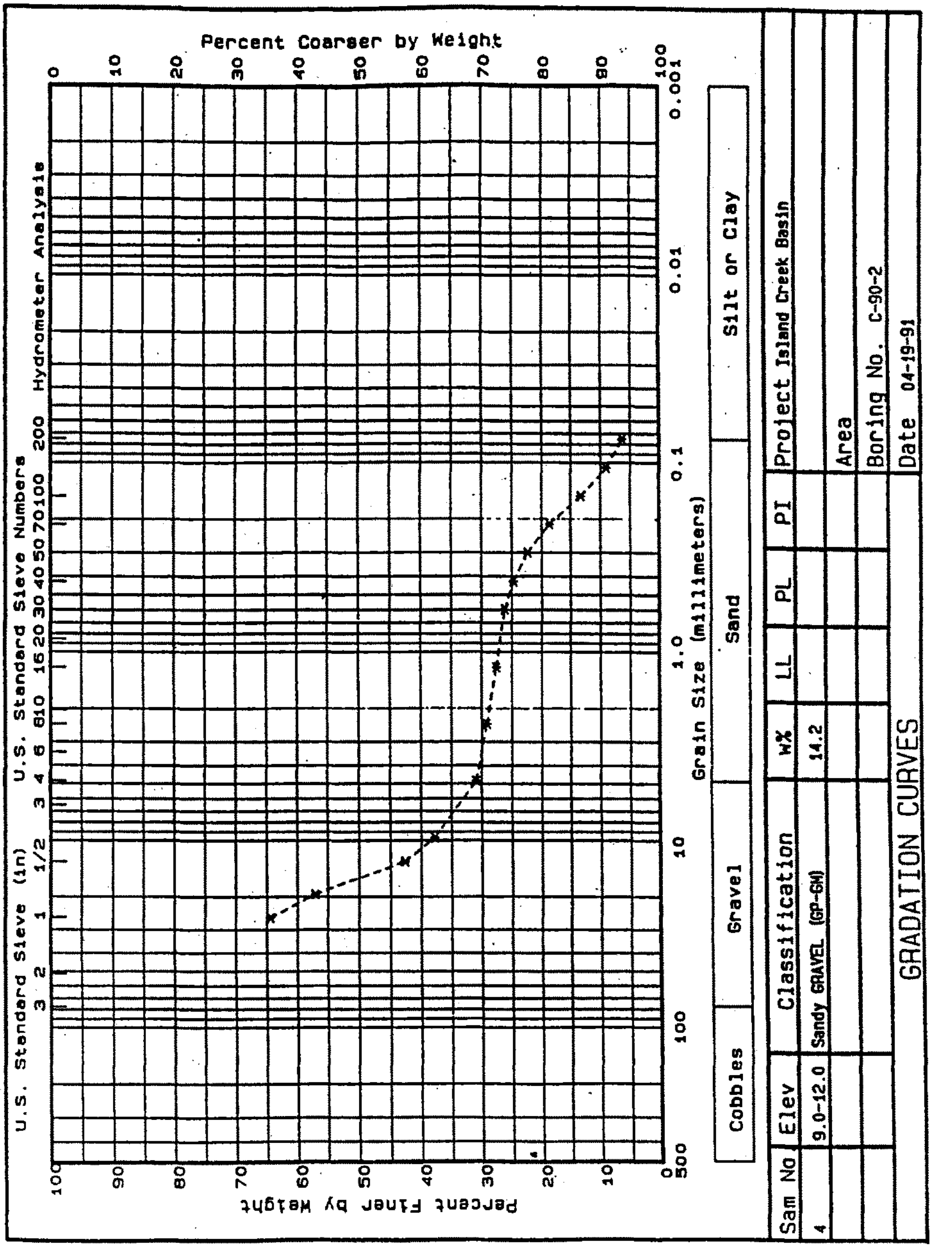
Department of the Army
Huntington District, Corps of Engineers
Huntington, West Virginia

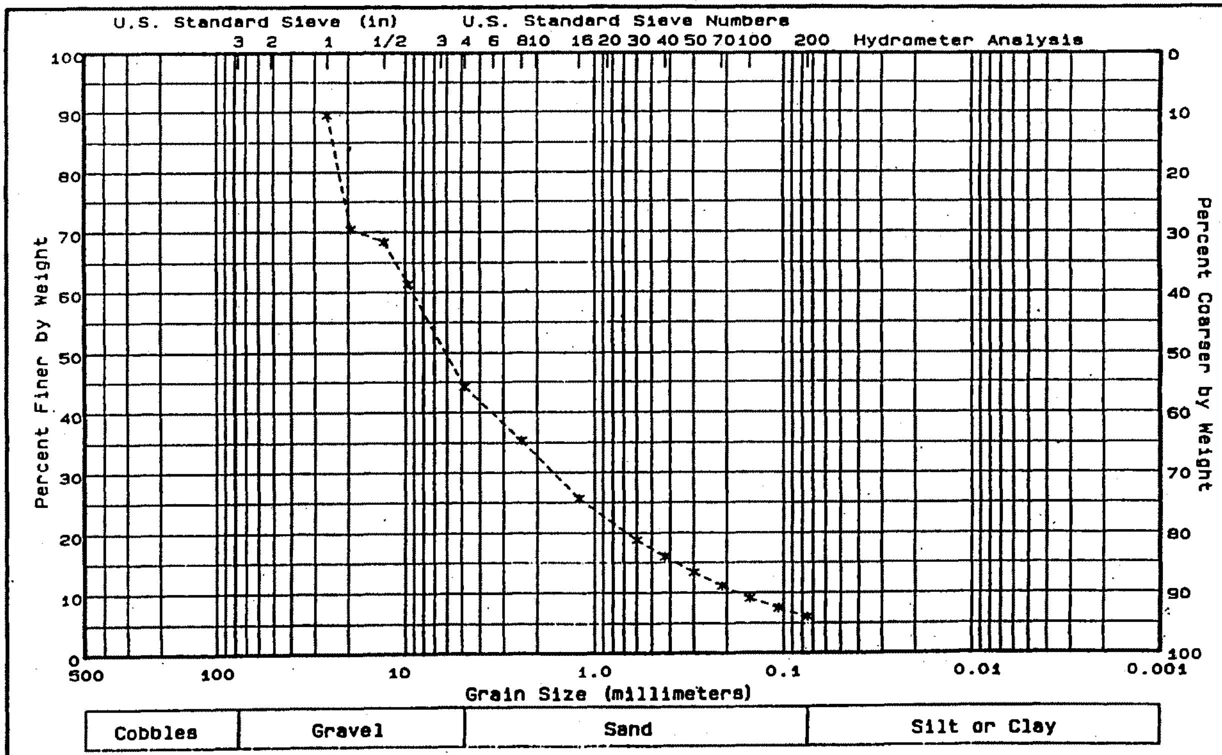


Percent Coarser by Weight
0 10 20 30 40 50 60 70 80 90 100
U.S. Standard Sieve (in)
3 2 1 1/2
U.S. Standard Sieve Numbers
3 4 6 810 16 20 30 40 50 70 100 200
Hydrometer Analysis
Percent Finer by Weight
100 90 80 70 60 50 40 30 20 10 0
500 100 10 1.0 0.1 0.01 0.001
Grain Size (millimeters)
Cobbles
Gravel
Sand
Silt or Clay
Sam No.
Elev
Classification
W%
LL
PL
PI
3
6.0-9.0
Gravelly Clayey SAND (SC)
16.9
Project Island Creek Basin
Area
Boring No. C-90-1
Date 04-19-91
GRADATION CURVES

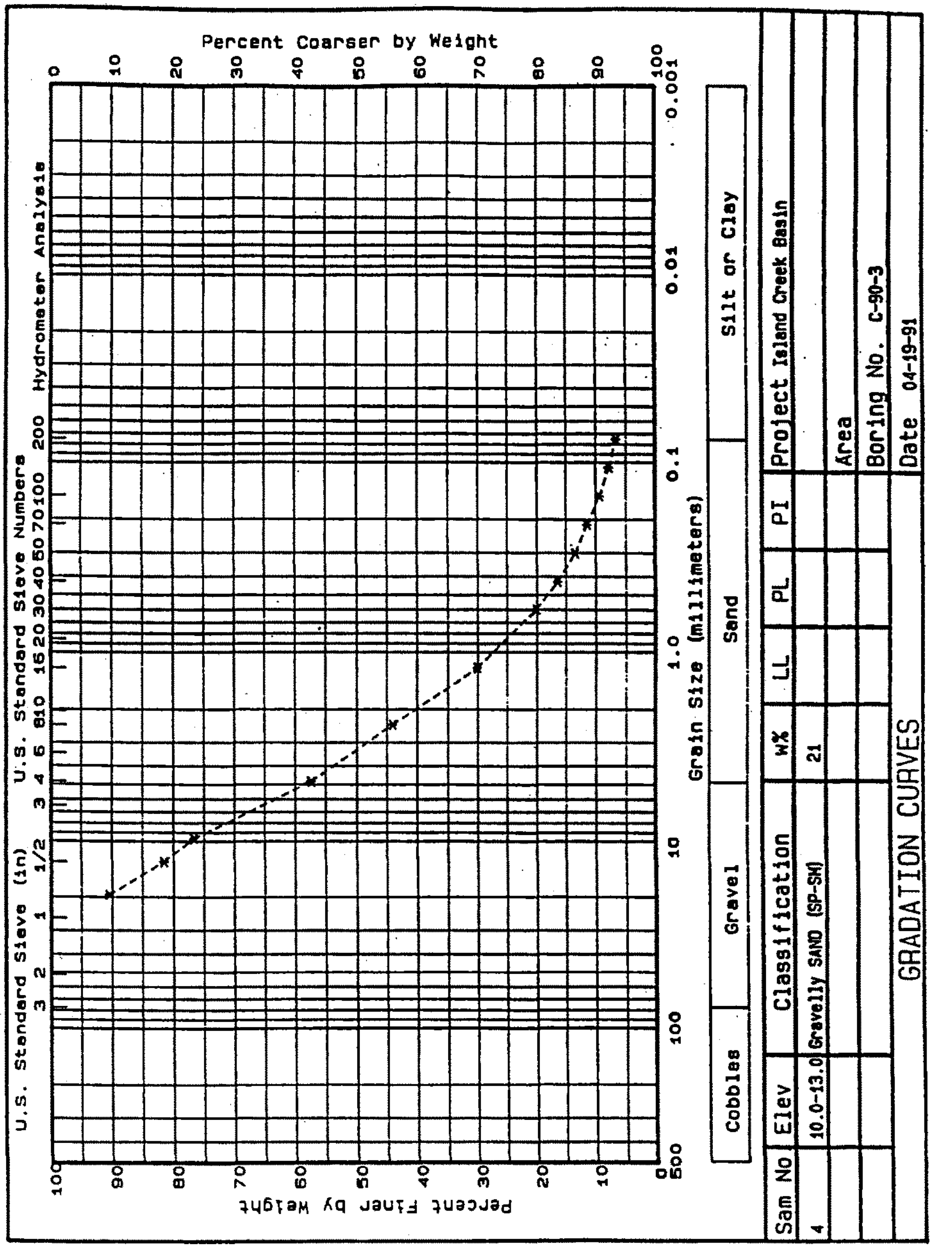

Percent Coarser by Weight
0 10 20 30 40 50 60 70 80 90 100
U.S. Standard Sieve (in)
3 2 1 1/2 3 4 6 810 16 20 30 40 50 70100 200
U.S. Standard Sieve Numbers
Hydrometer Analysis
100 90 80 70 60 50 40 30 20 10 0
Percent Finer by Weight
500 100 10 1.0 0.1 0.01 0.001
Grain Size (millimeters)
Cobbles
Gravel
Sand
Silt or Clay
Sam No
10
Elev
27.0-30.0
Classification
Gravelly Silty SAND (SM)
w%
22.1
LL
PL
PI
Project Island Creek Basin
Area
Boring No. C-90-1
Date 04-19-91
GRADATION CURVES

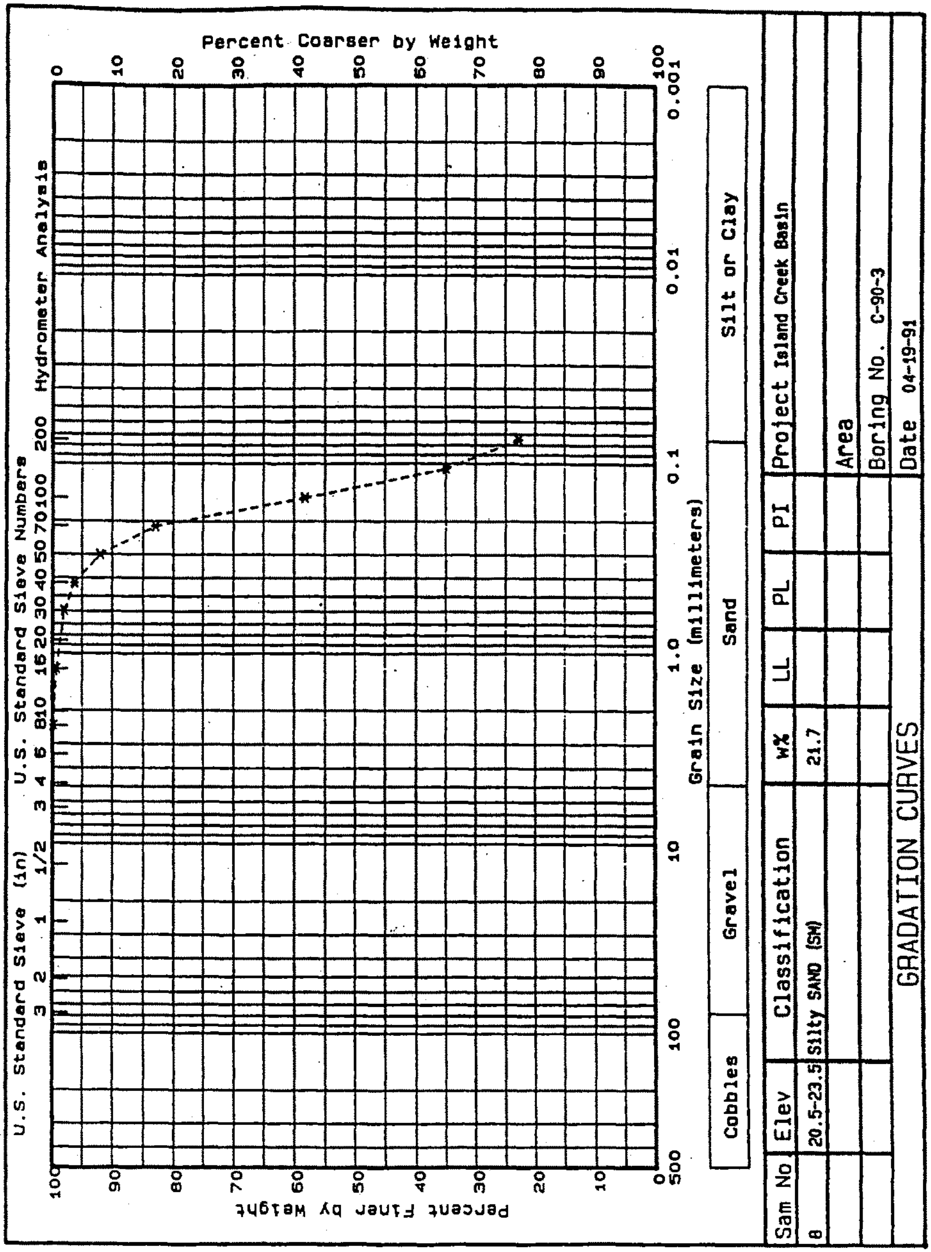

Percent Coarser by Weight
U.S. Standard Sieve (in)
U.S. Standard Sieve Numbers
Hydrometer Analysis
Percent Finer by Weight
Grain Size (millimeters)
Cobbles
Gravel
Sand
Silt or Clay
Sam No
Elev
Classification
W%
LL
PL
PI
Project Island Creek Basin
Area
Boring No. C-90-1
Date 04-19-91
12
33.0-36.0
Sandy GRAVEL (GP-GM)
13.1
GRADATION CURVES

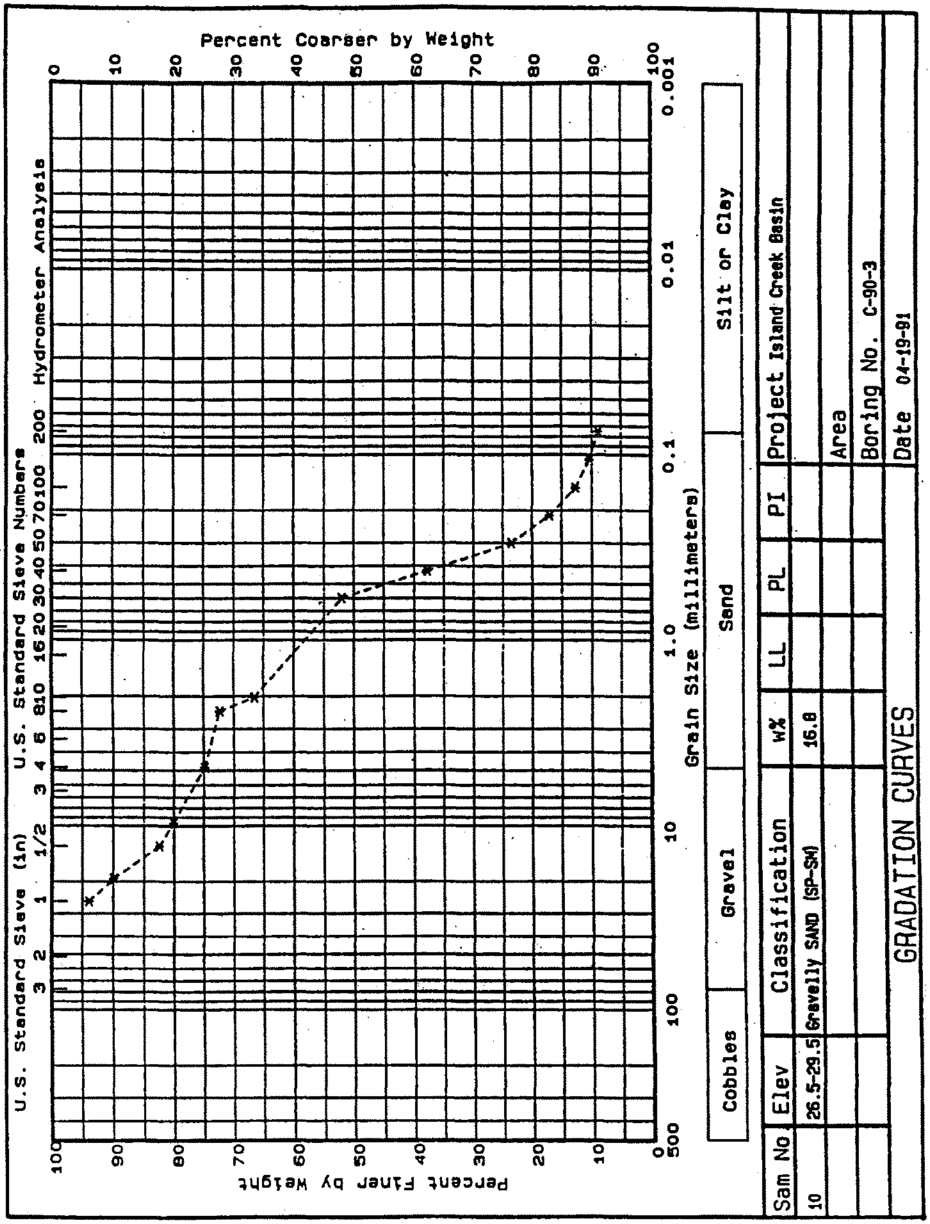

Percent Coarser by Weight
U.S. Standard Sieve (in)
U.S. Standard Sieve Numbers
Hydrometer Analysis
Grain Size (millimeters)
Percent Finer by Weight
Cobbles
Gravel
Sand
Silt or Clay
Sam No
4
Elev
9.0-12.0
Classification
Sandy GRAVEL (GP-GM)
W%
14.2
LL
PL
PI
Project Island Creek Basin
Area
Boring No. C-90-2
Date 04-19-91
GRADATION CURVES

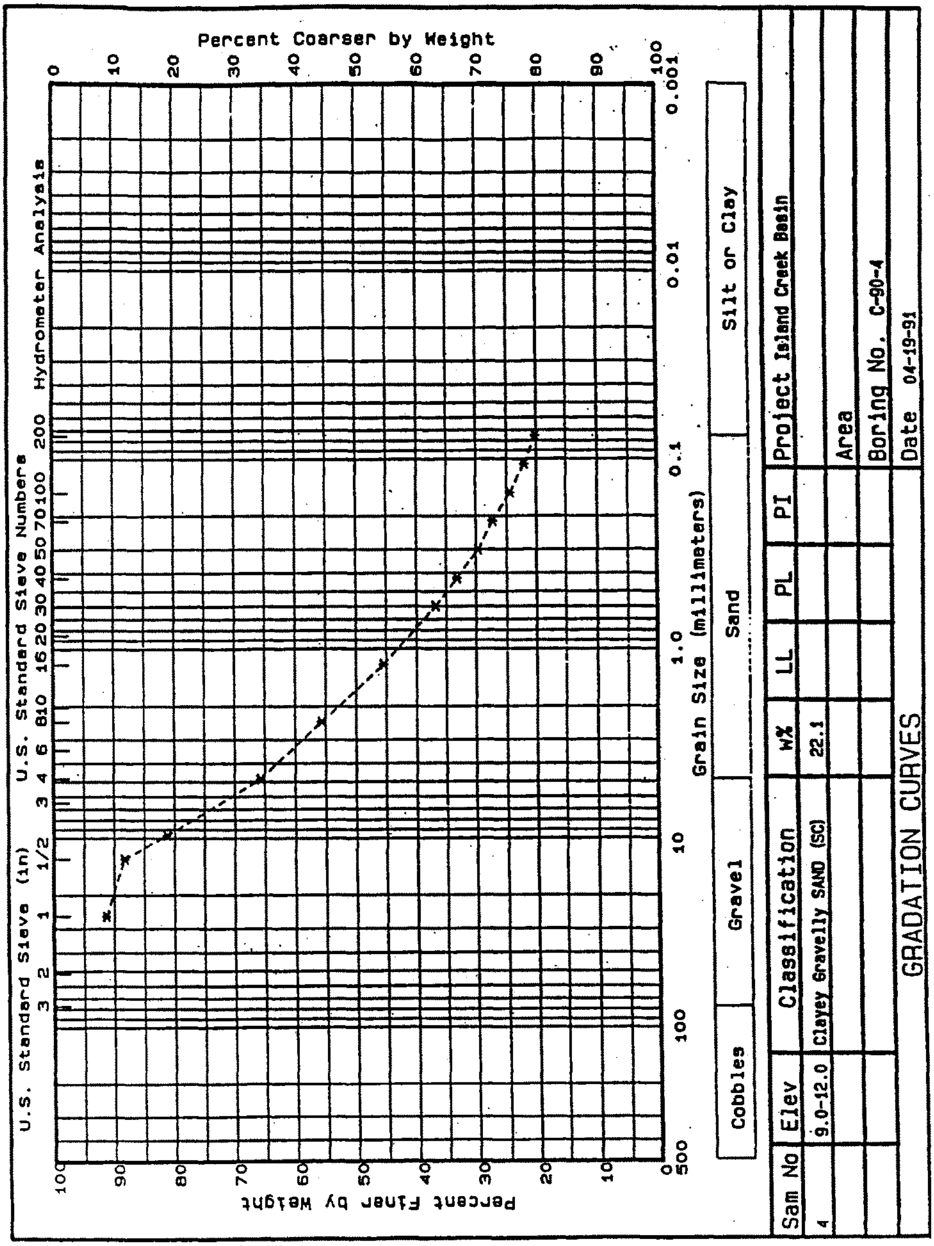


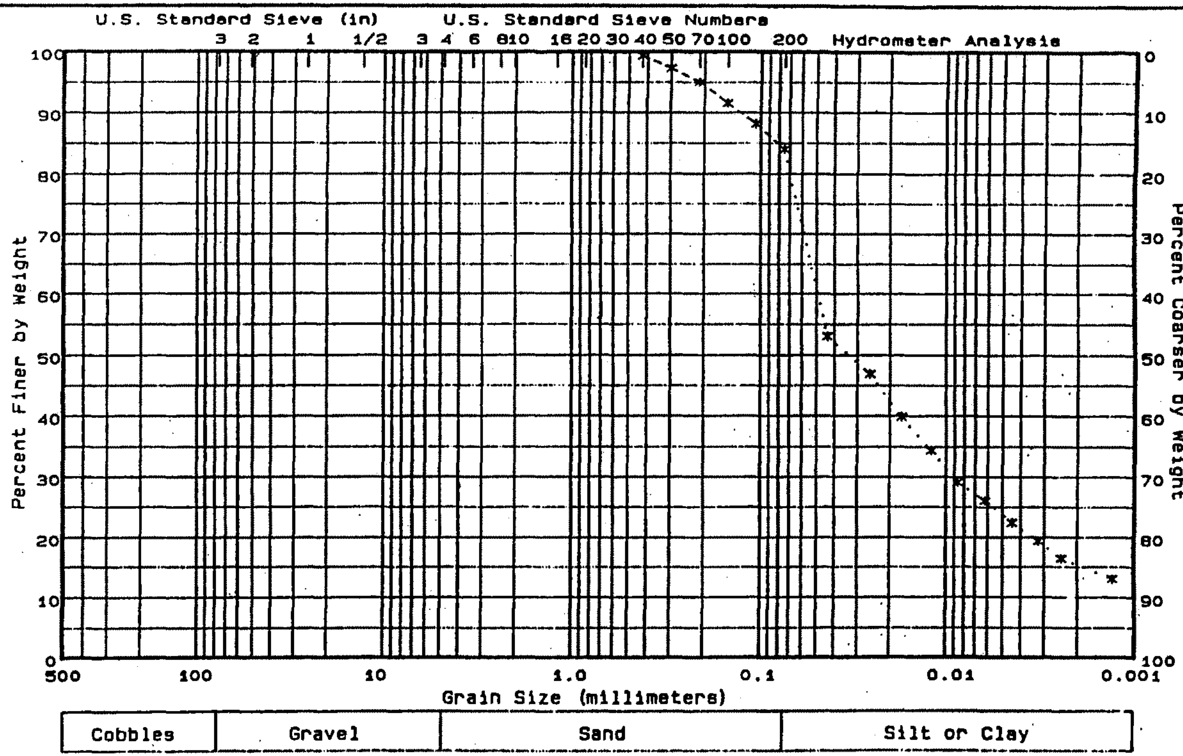
Sam No	Elev	Classification	W%	LL	PL	PI	Project Island Creek Basin
6	15.0-18.0	Sandy GRAVEL (GP-GM)	24				
							Area
							Boring No. C-90-2
GRADATION CURVES							Date 04-19-91


Percent Coarser by Weight
U.S. Standard Sieve (in)
U.S. Standard Sieve Numbers
Hydrometer Analysis
Percent Finer by Weight
Grain Size (millimeters)
Cobbles
Gravel
Sand
Silt or Clay
Sam No
Elev
Classification
W%
LL
PL
PI
Project Island Creek Basin
4
10.0-13.0
Gravelly SAND (SP-SM)
21
Area
Boring No. C-90-3
Date 04-19-91
GRADATION CURVES

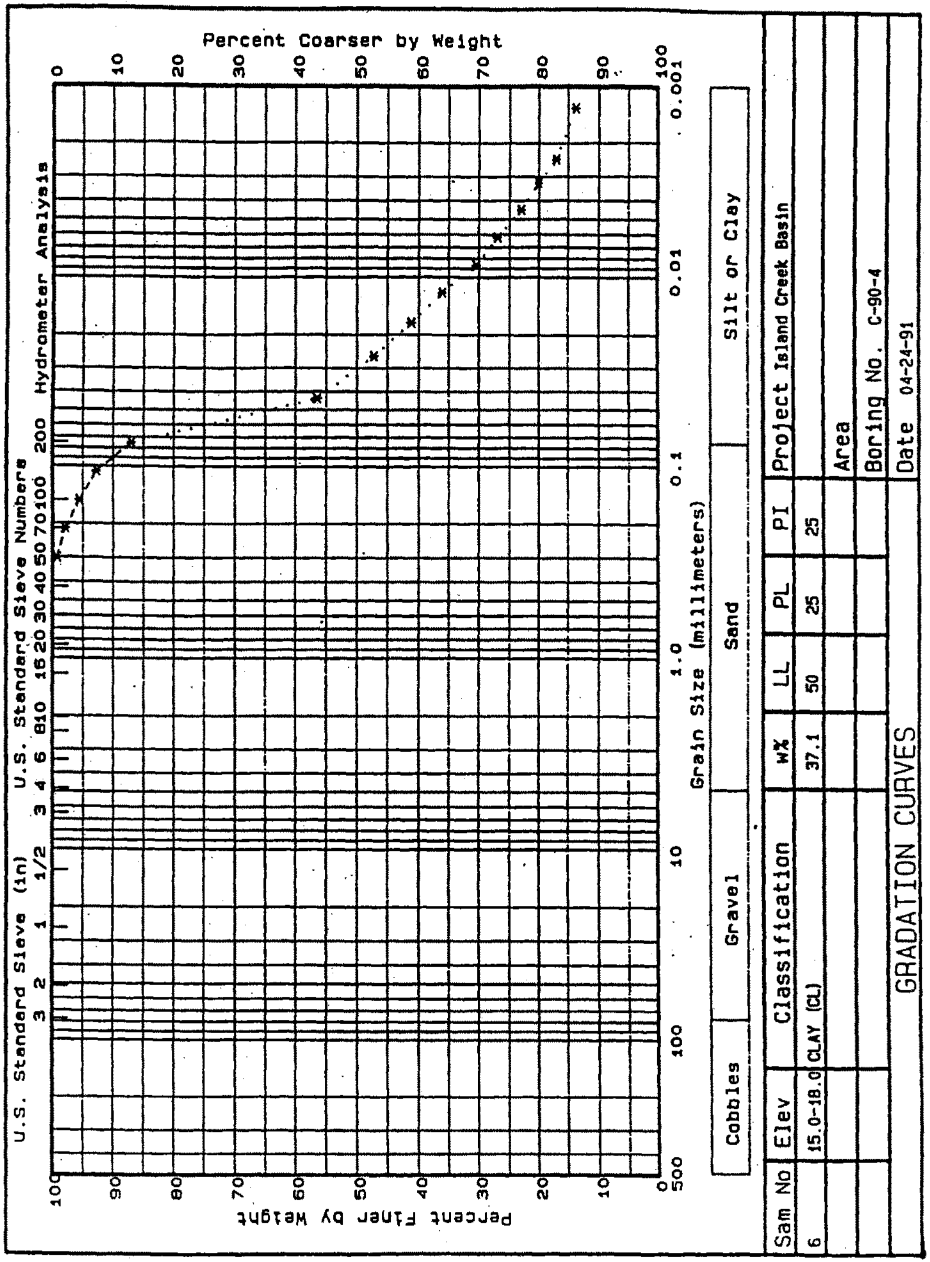

Percent Coarser by Weight
Percent Finer by Weight
U.S. Standard Sieve (in) 3 2 1 1/2 3
U.S. Standard Sieve Numbers 4 6 8 10 16 20 30 40 50 70 100 200
Hydrometer Analysis
Grain Size (millimeters)
500 100 10 1.0 0.1 0.01 0.001
Cobbles
Gravel
Sand
Silt or Clay
Sam No
Elev
Classification
w%
LL
PL
PI
Project Island Creek Basin
8
20.5-23.5
Silty SAND (SM)
21.7
Area
Boring No. C-90-3
Date 04-19-91
GRADATION CURVES

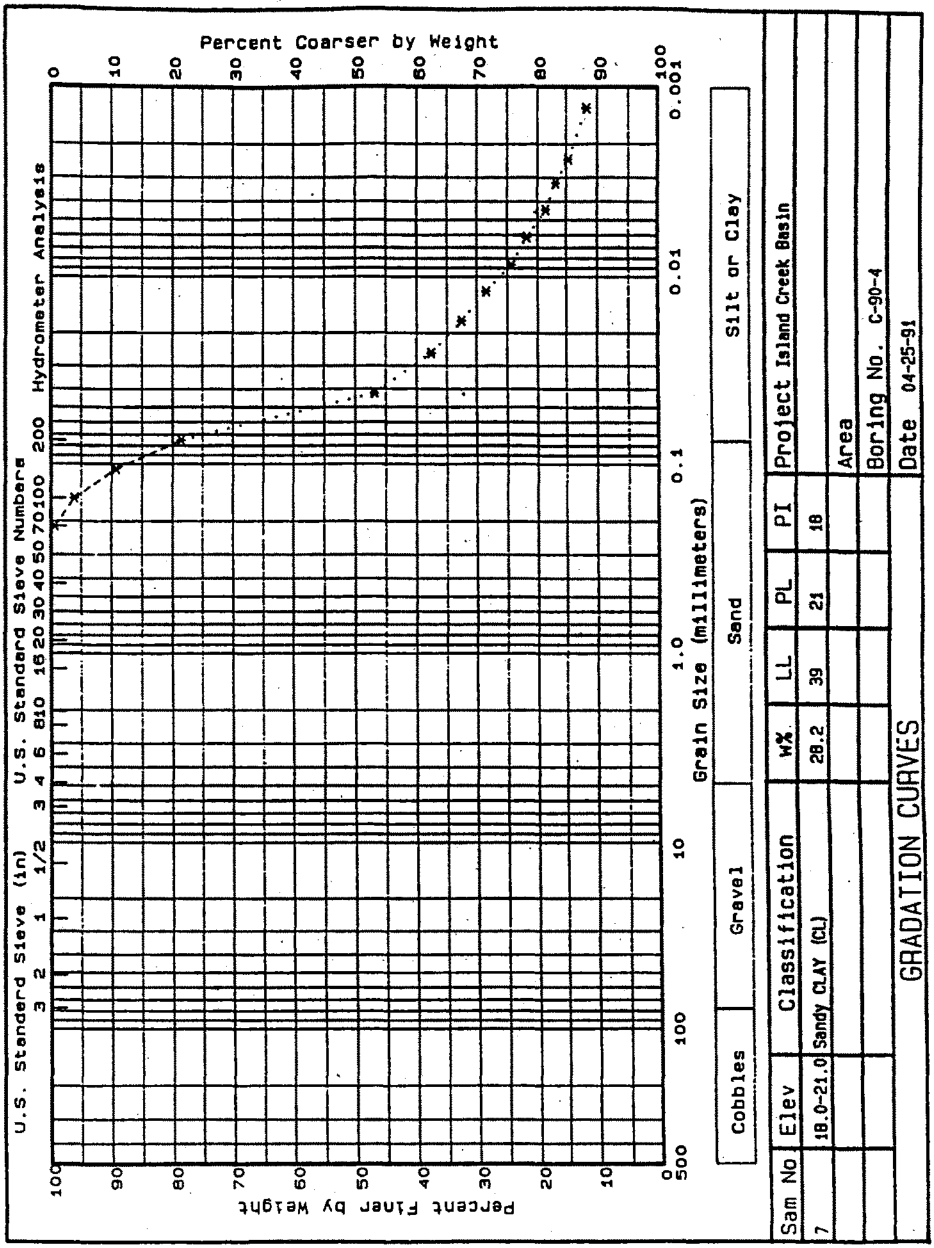

Percent Coarser by Weight
U.S. Standard Sieve (in)
3 2 1 1/2
U.S. Standard Sieve Numbers
3 4 6 810 16 20 30 40 50 70 100 200
Hydrometer Analysis
Percent Finer by Weight
Grain Size (millimeters)
500 100 10 1.0 0.1 0.01 0.001
Cobbles
Gravel
Sand
Silt or Clay
Sam No
10
Elev
26.5-29.5
Classification
Gravelly SAND (SP-SM)
w%
16.8
LL
PL
PI
Project Island Creek Basin
Area
Boring No. C-90-3
Date 04-19-91
GRADATION CURVES


Percent Coarser by Weight
0 10 20 30 40 50 60 70 80 90 100
U.S. Standard Sieve (in)
3 2 1 1/2 3
U.S. Standard Sieve Numbers
4 6 810 16 20 30 40 50 70 100 200
Hydrometer Analysis
Percent Finer by Weight
100 90 80 70 60 50 40 30 20 10 0
500 100 10 1.0 0.1 0.01 0.001
Grain Size (millimeters)
Cobbles
Gravel
Sand
Silt or Clay
Sam No
Elev
Classification
W%
LL
PL
PI
4
9.0-12.0
Clayey Gravelly SAND (SC)
22.1
Project Island Creek Basin
Area
Boring No. C-90-4
Date 04-19-91
GRADATION CURVES

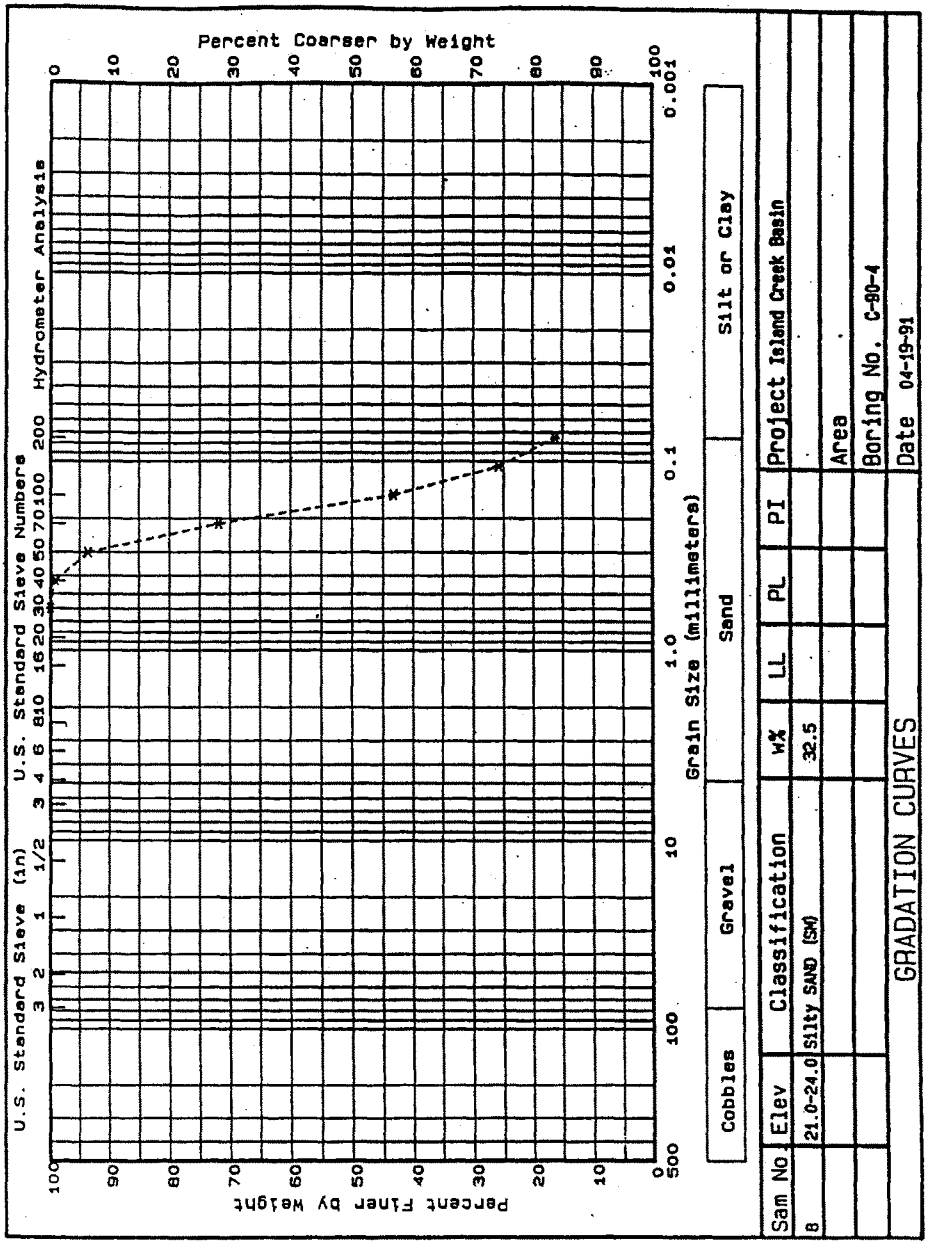


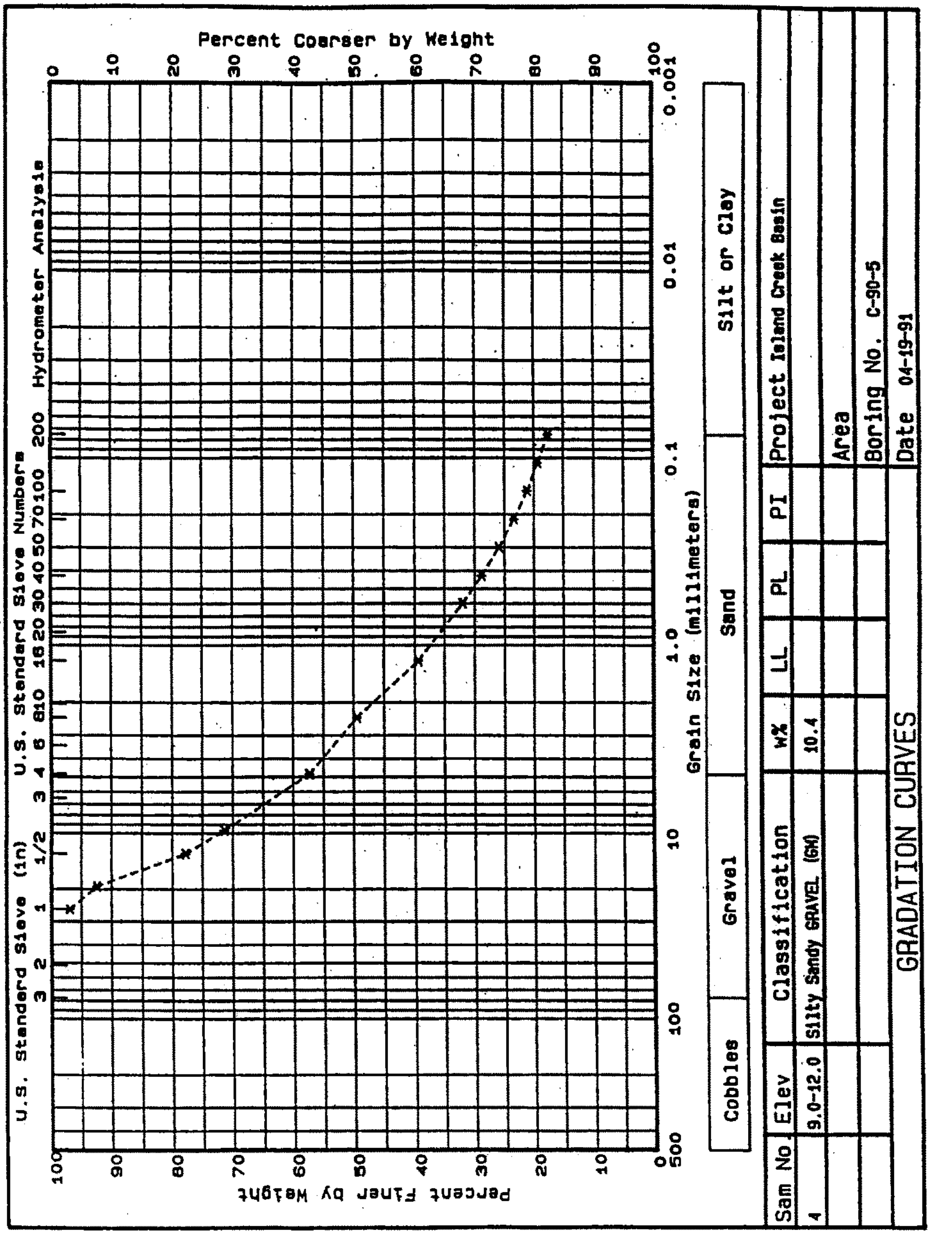
Sam No	Elev	Classification	W%	LL	PL	PI	Project Island Creek Basin
5	12.0-15.0	Sandy CLAY (CH)	24.9	56	27	29	
							Area
							Boring No. C-90-4
GRADATION CURVES							Date 04-25-91


Percent Coarser by Weight
U.S. Standard Sieve (in) 3 2 1 1/2
U.S. Standard Sieve Numbers 3 4 6 8 10 16 20 30 40 50 70 100 200
Hydrometer Analysis
Percent Finer by Weight
Grain Size (millimeters)
500 100 10 1.0 0.1 0.01 0.001
Cobbles
Gravel
Sand
Silt or Clay
Sam No
Elev
Classification
W%
LL
PL
PI
6
15.0-18.0
CLAY (CL)
37.1
50
25
25
Project Island Creek Basin
Area
Boring No. C-90-4
Date 04-24-91
GRADATION CURVES

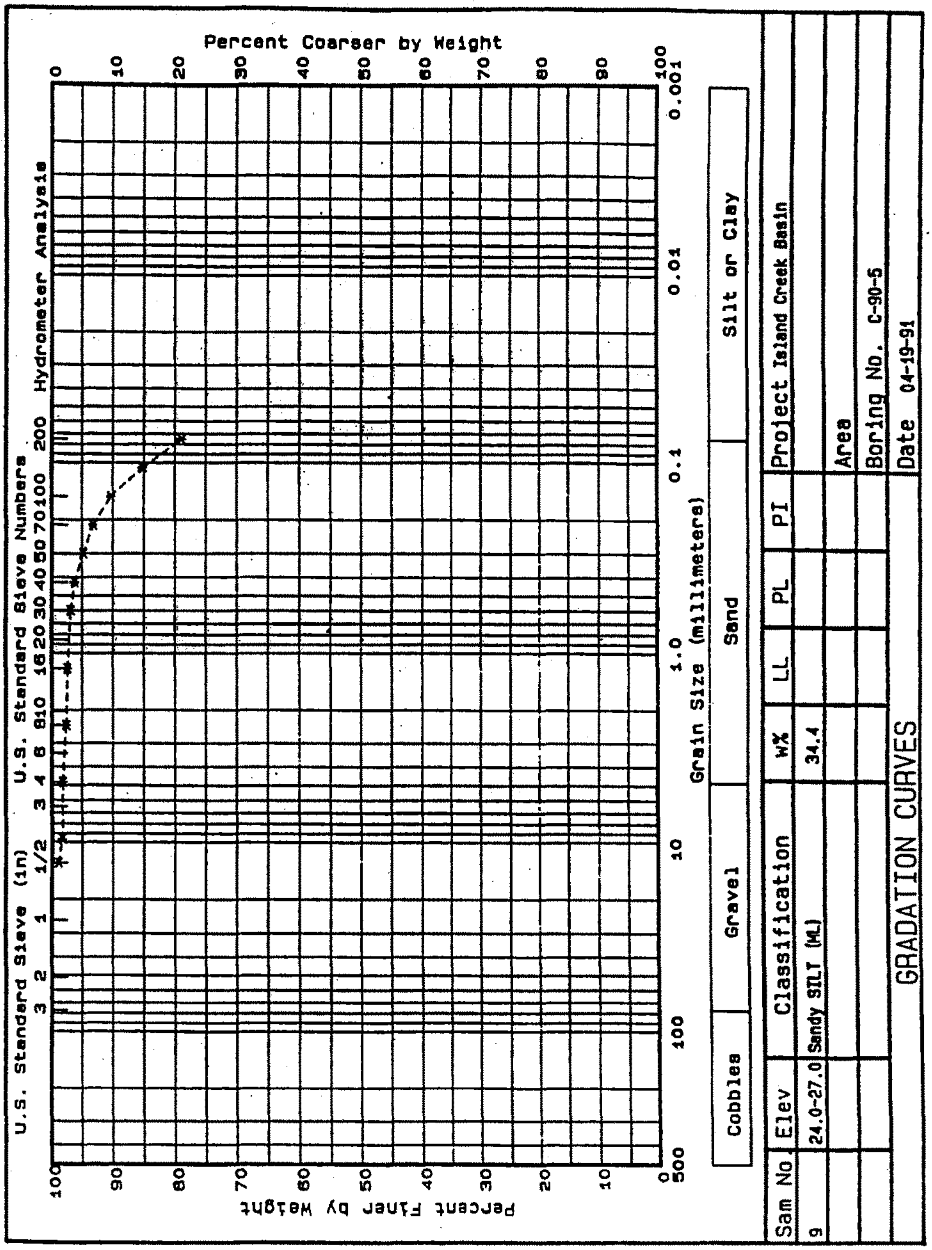


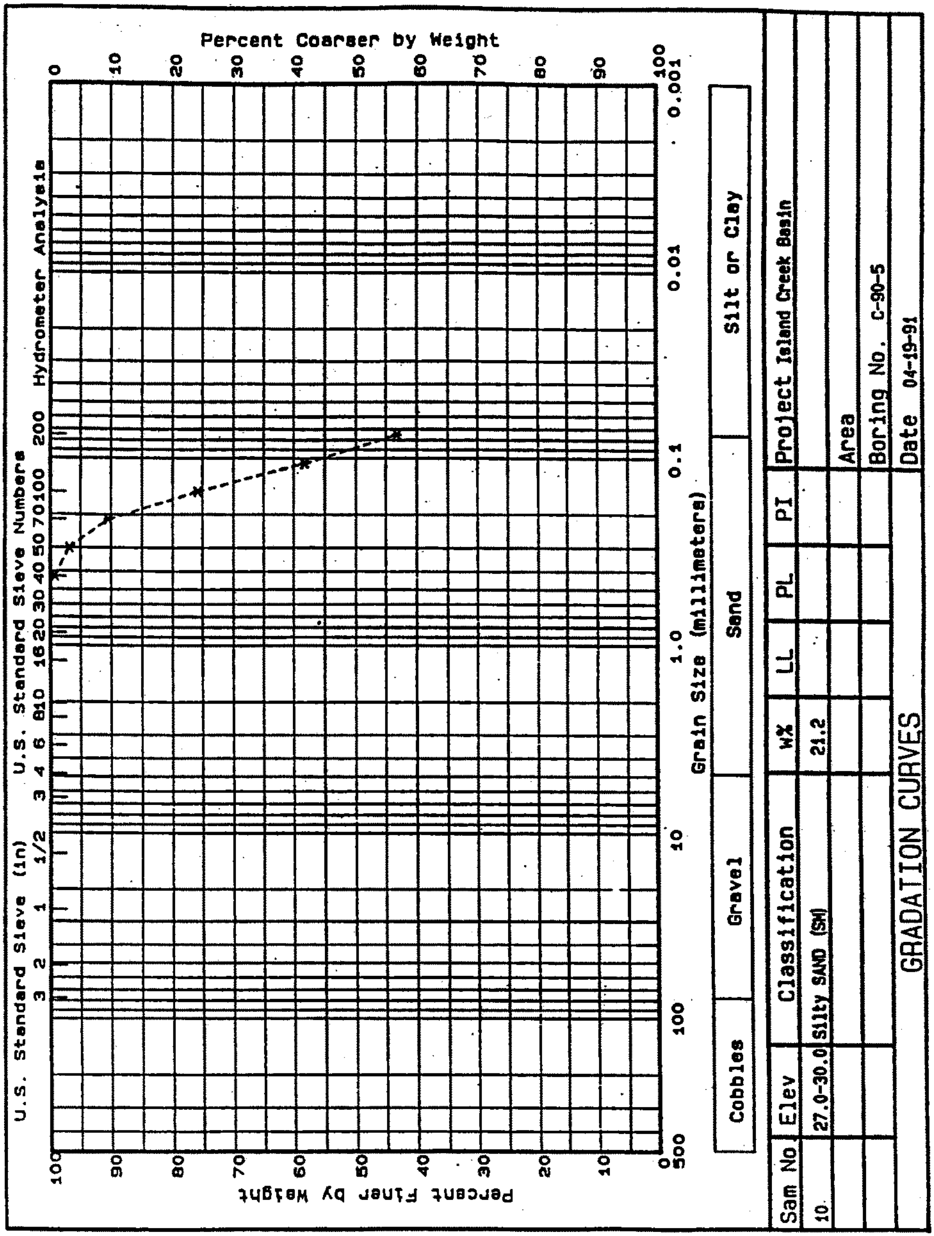
U.S. Standard Sieve (in)
3 2 1 1/2
U.S. Standard Sieve Numbers
3 4 6 810 16 20 30 40 50 70 100 200
Hydrometer Analysis
Percent Coarser by Weight
Percent Finer by Weight
Grain Size (millimeters)
500 100 10 1.0 0.1 0.01 0.001
Cobbles
Gravel
Sand
Silt or Clay
Sam No
Elev
Classification
W%
LL
PL
PI
Project Island Creek Basin
7
18.0-21.0
Sandy CLAY (CL)
28.2
39
21
18
Area
Boring No. C-90-4
Date 04-25-91
GRADATION CURVES

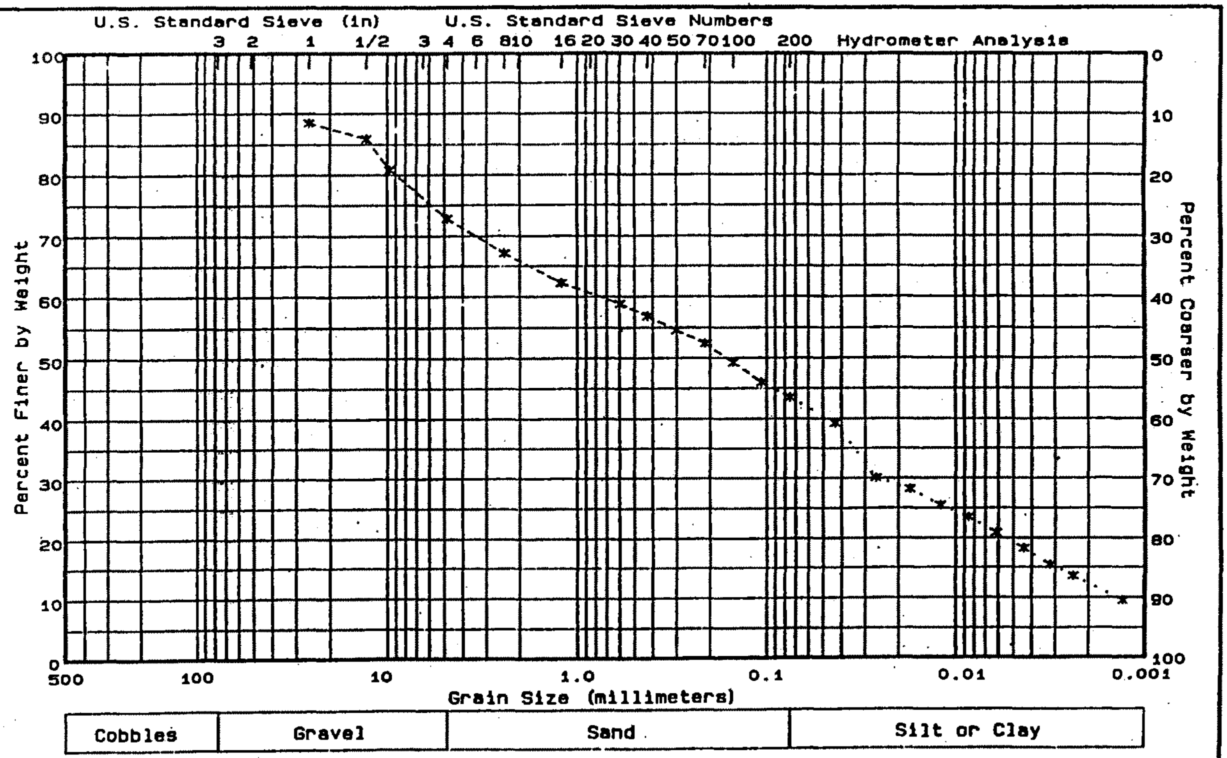

U.S. Standard Sieve (in)
3 2 1 1/2 3
U.S. Standard Sieve Numbers
4 6 810 16 20 30 40 50 70 100 200
Hydrometer Analysis
Percent Coarser by Weight
0 10 20 30 40 50 60 70 80 90 100
Percent Finer by Weight
100 90 80 70 60 50 40 30 20 10 0
500 100 10 1.0 0.1 0.01 0.001
Grain Size (millimeters)
Cobbles
Gravel
Sand
Silt or Clay
Sam No.
Elev
Classification
W%
LL
PL
PI
Project Island Creek Basin
8
21.0-24.0
Silty SAND (SM)
32.5
Area
Boring No. C-90-4
Date 04-19-91
GRADATION CURVES



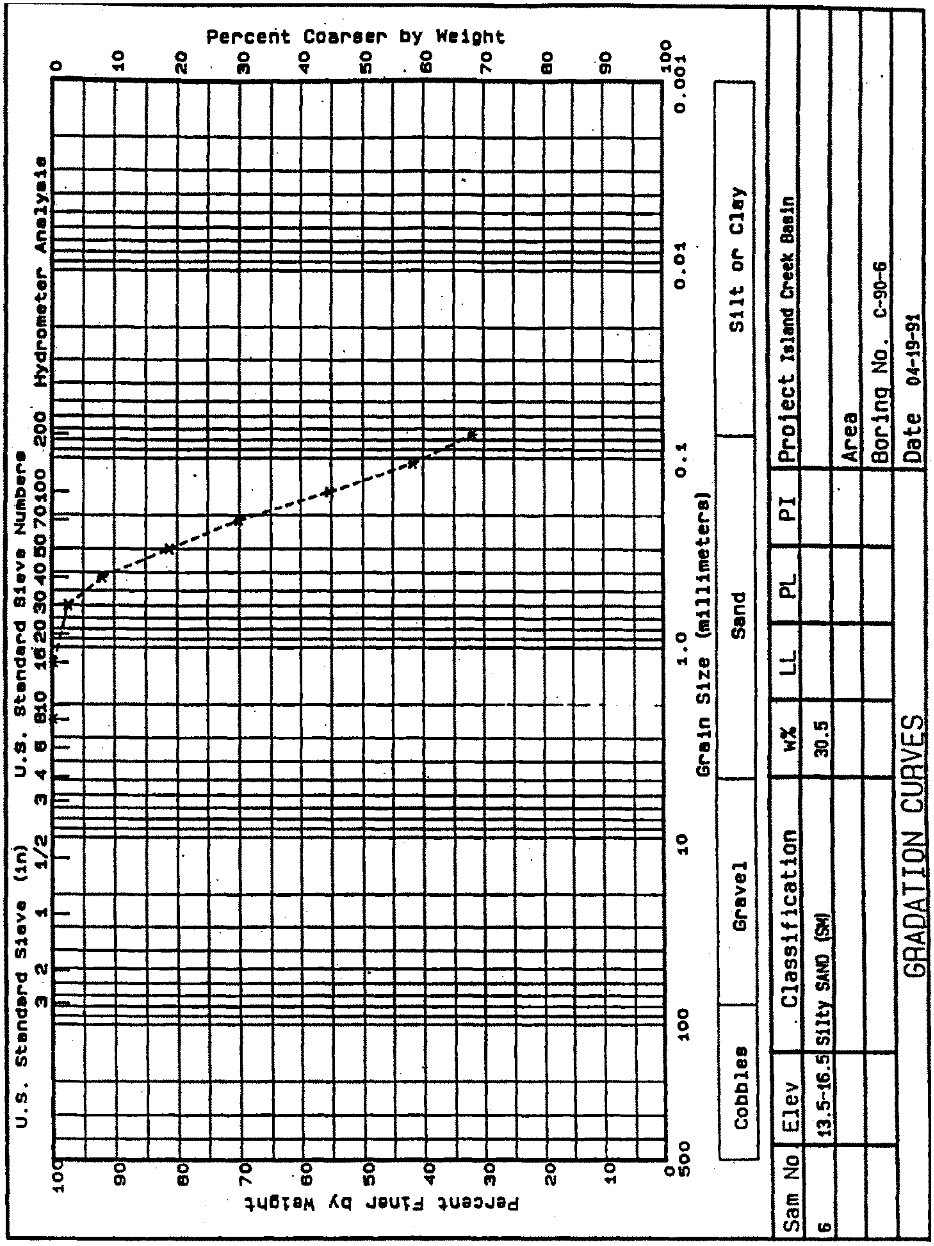
Percent Coarser by Weight
Percent Finer by Weight
U.S. Standard Sieve (in)
3 2 1 1/2 3
U.S. Standard Sieve Numbers
4 6 810 16 20 30 40 50 70 100 200
Hydrometer Analysis
Grain Size (millimeters)
500 100 10 1.0 0.1 0.01 0.001
Cobbles
Gravel
Sand
Silt or Clay
Sam No
Elev
Classification
W%
LL
PL
PI
4
9.0-12.0
Silty Sandy GRAVEL (GM)
10.4
Project Island Creek Basin
Area
Boring No. C-90-5
Date 04-19-91
GRADATION CURVES

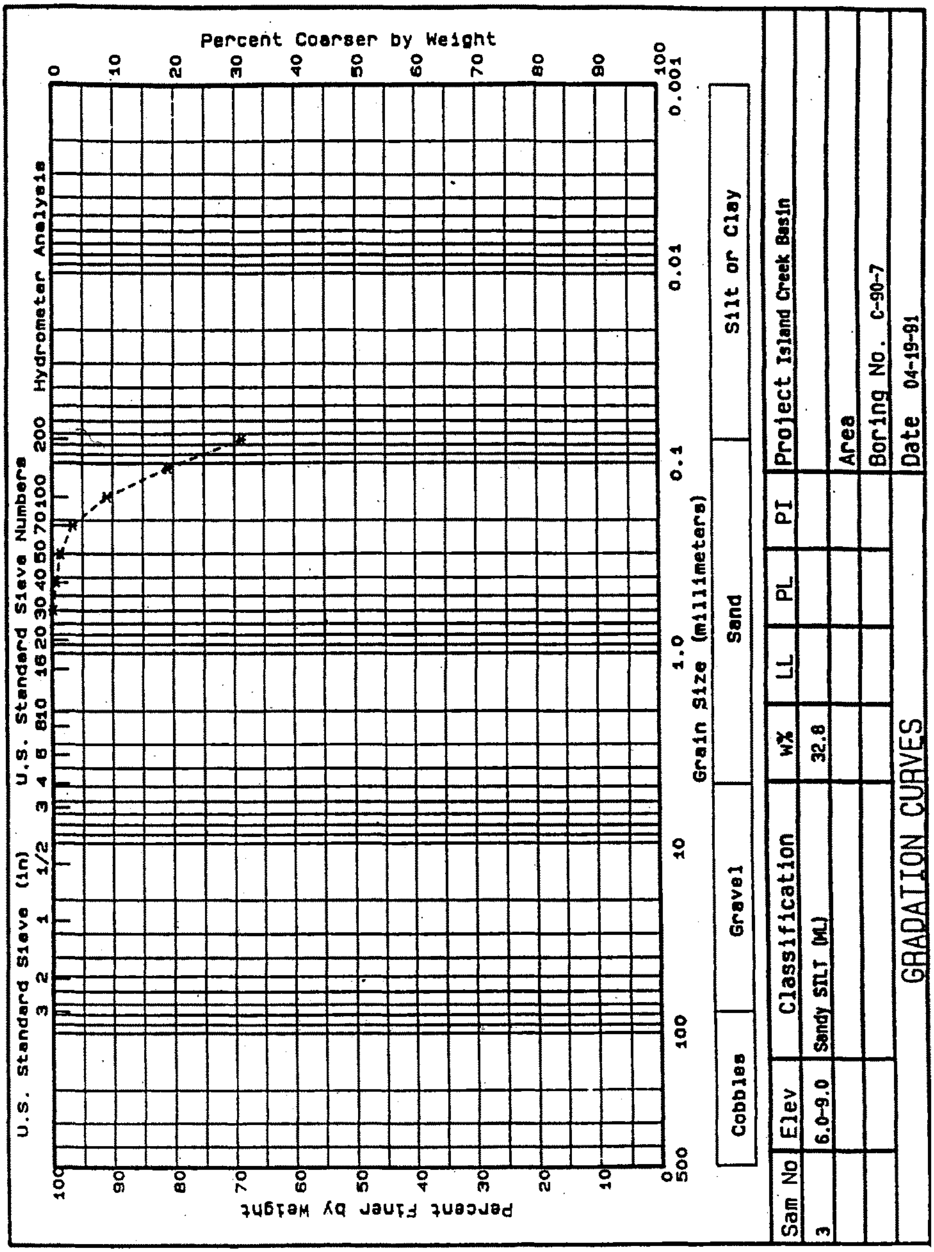

Percent Coarser by Weight
U.S. Standard Sieve (in)
U.S. Standard Sieve Numbers
Hydrometer Analysis
Percent Finer by Weight
Grain Size (millimeters)
Cobbles
Gravel
Sand
Silt or Clay
Sam No.
Elev
Classification
W%
LL
PL
PI
Project Island Creek Basin
9
24.0-27.0
Sandy SILT (ML)
34.4
Area
Boring No. C-90-5
Date 04-19-91
GRADATION CURVES


Percent Coarser by Weight
Percent Finer by Weight
U.S. Standard Sieve (in)
U.S. Standard Sieve Numbers
Hydrometer Analysis
Grain Size (millimeters)
Cobbles
Gravel
Sand
Silt or Clay
Sam No
Elev
Classification
W%
LL
PL
PI
Project Island Creek Basin
10
27.0-30.0
Silty SAND (SM)
21.2
Area
Boring No. C-90-5
Date 04-19-91
GRADATION CURVES

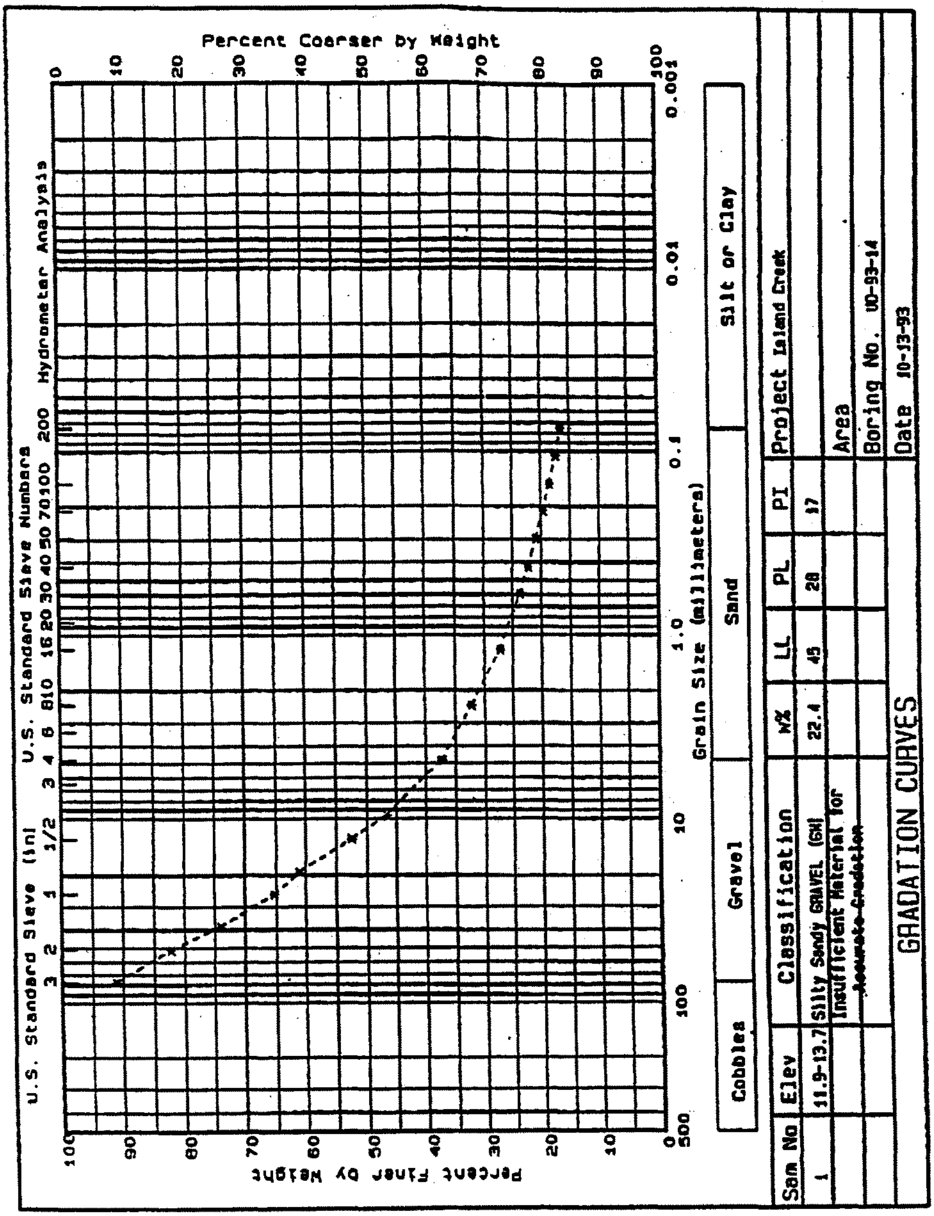


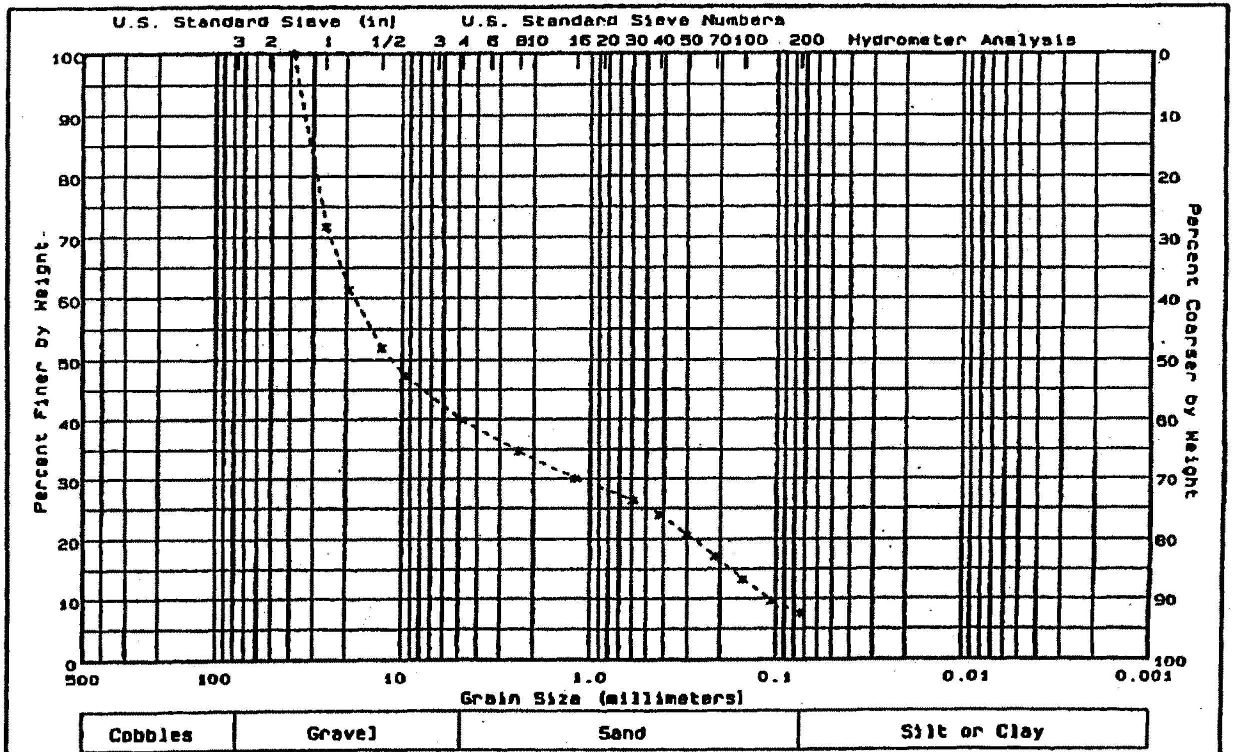
Sam No.	Elev	Classification	W%	LL	PL	PI	Project Island Creek Basin
3	6.0-7.5	Gravelly Clayey SAND (SC)	22.7	42	24	18	
							Area
							Boring No. C-90-6
GRADATION CURVES							Date 04-25-91


Percent Coarser by Weight
0 10 20 30 40 50 60 70 80 90 100
U.S. Standard Sieve (in)
3 2 1 1/2
U.S. Standard Sieve Numbers
3 4 6 8 10 16 20 30 40 50 70 100 200
Hydrometer Analysis
500 100 10 1.0 0.1 0.01 0.001
Grain Size (millimeters)
Percent Finer by Weight
100 90 80 70 60 50 40 30 20 10 0
Cobbles
Gravel
Sand
Silt or Clay
Sam No
Elev
Classification
W%
LL
PL
PI
Project Island Creek Basin
6
13.5-16.5
Silty SAND (SM)
30.5
Area
Boring No. C-90-6
Date 04-19-91
GRADATION CURVES



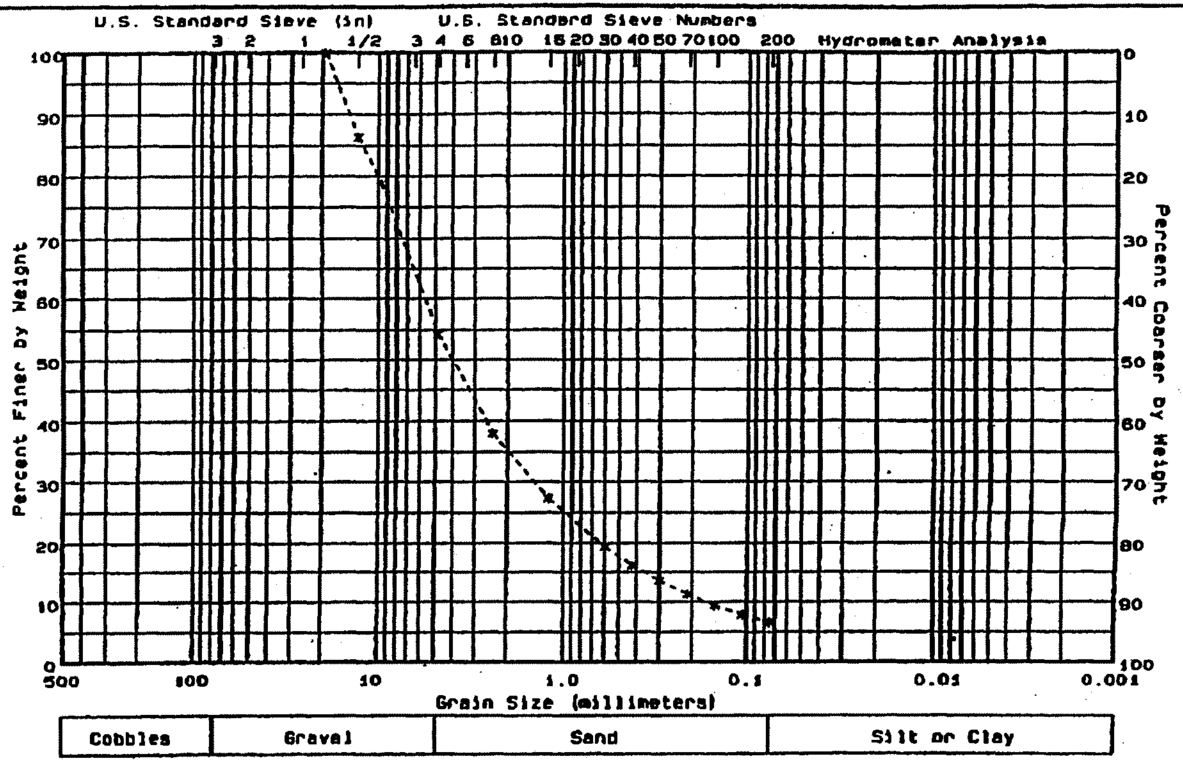
Percent Coarser by Weight
Percent Finer by Weight
U.S. Standard Sieve (in)
3 2 1 1/2 3
U.S. Standard Sieve Numbers
4 6 8 10 16 20 30 40 50 70 100 200
Hydrometer Analysis
Grain Size (millimeters)
500 100 10 1.0 0.1 0.01 0.001
Cobbles
Gravel
Sand
Silt or Clay
Sam No
Elev
Classification
W%
LL
PL
PI
3
6.0-9.0
Sandy SILT (ML)
32.8
Project Island Creek Basin
Area
Boring No. C-90-7
Date 04-19-91
GRADATION CURVES


Percent Coarser by Weight
0
10
20
30
40
50
60
70
80
90
100
U.S. Standard Sieve (in)
3 2 1 1/2
U.S. Standard Sieve Numbers
3 4 6 8 10 16 20 30 40 50 70 100 200
Hydrometer Analysis
100
90
80
70
60
50
40
30
20
10
0
Percent Finer by Weight
500
100
10
1.0
0.1
0.01
0.001
Grain Size (millimeters)
Cobbles
Gravel
Sand
Silt or Clay
Sam No
Elev
Classification
W%
LL
PL
PI
1
11.9-13.7
Silty Sandy GRAVEL (GM)
Insufficient Material for
Accurate Gradation
22.4
45
28
17
Project Island Creek
Area
Boring No. UD-93-14
Date 10-13-93
GRADATION CURVES

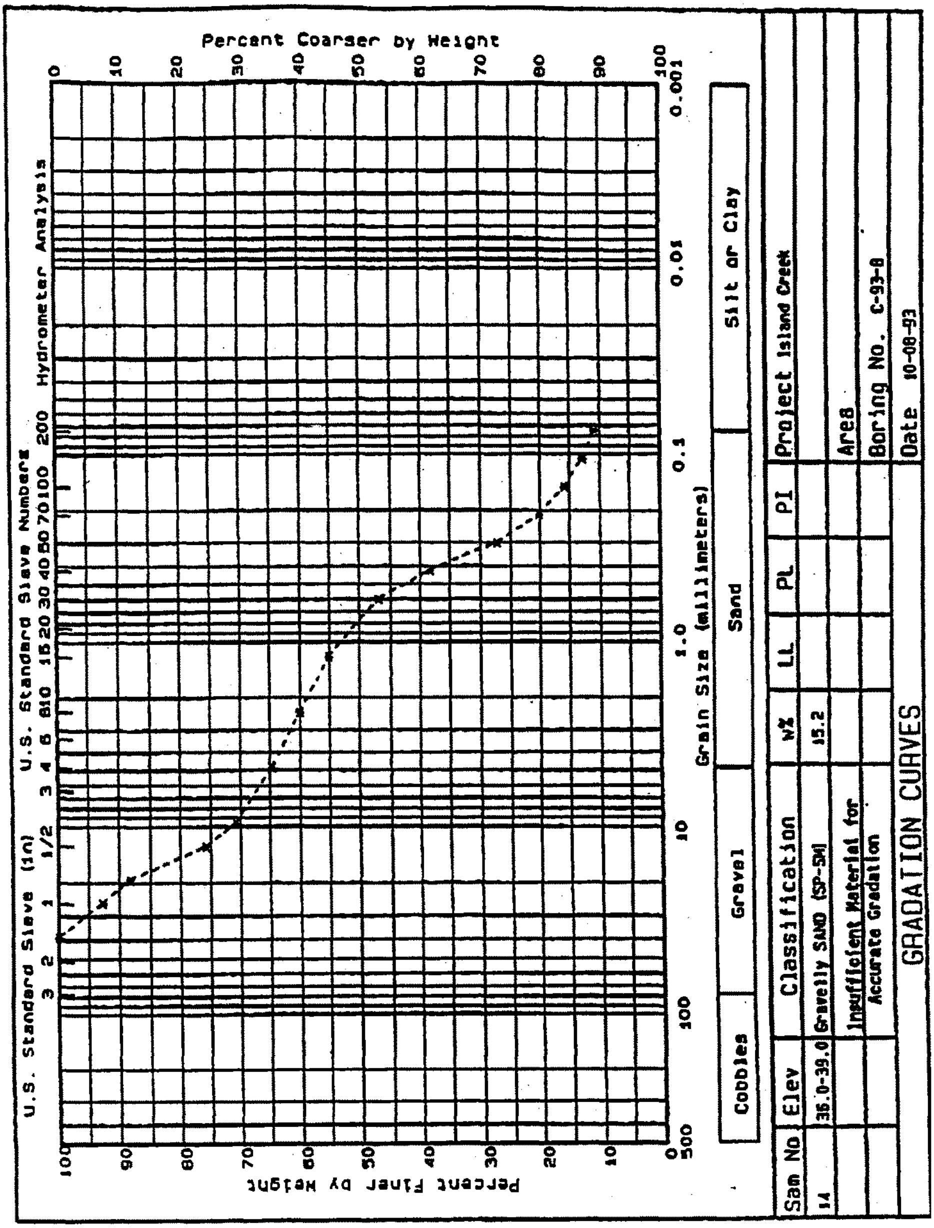


San No	Elev	Classification	W%	LL	PL	PI	Project Island Creek
2	3.0-6.0	Sandy GRAVEL (GW-GM)	11.5				
		Insufficient Material for ~~Accurate Gradation~~					Area
							Boring No. C-93-8

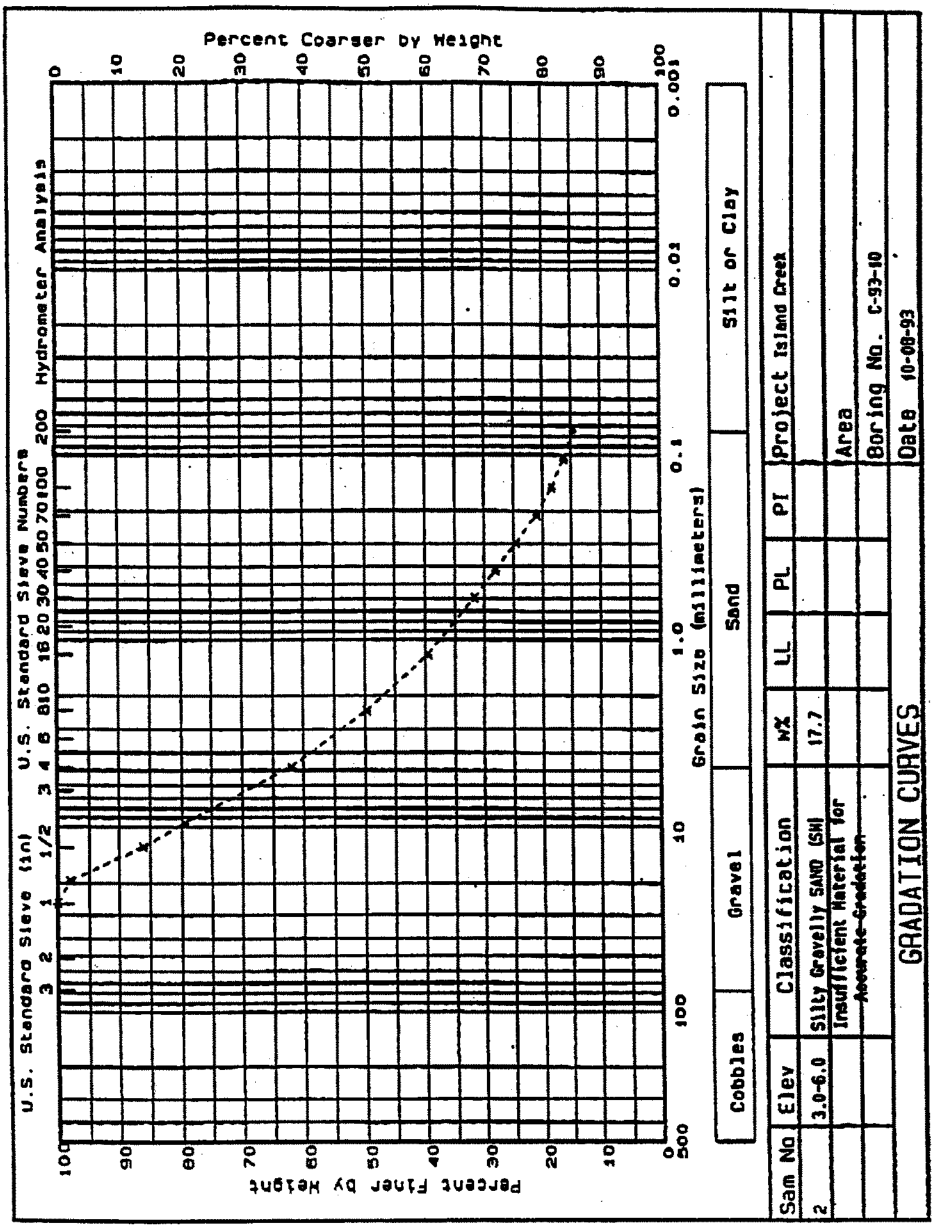
GRADATION CURVES — Date 10-08-93

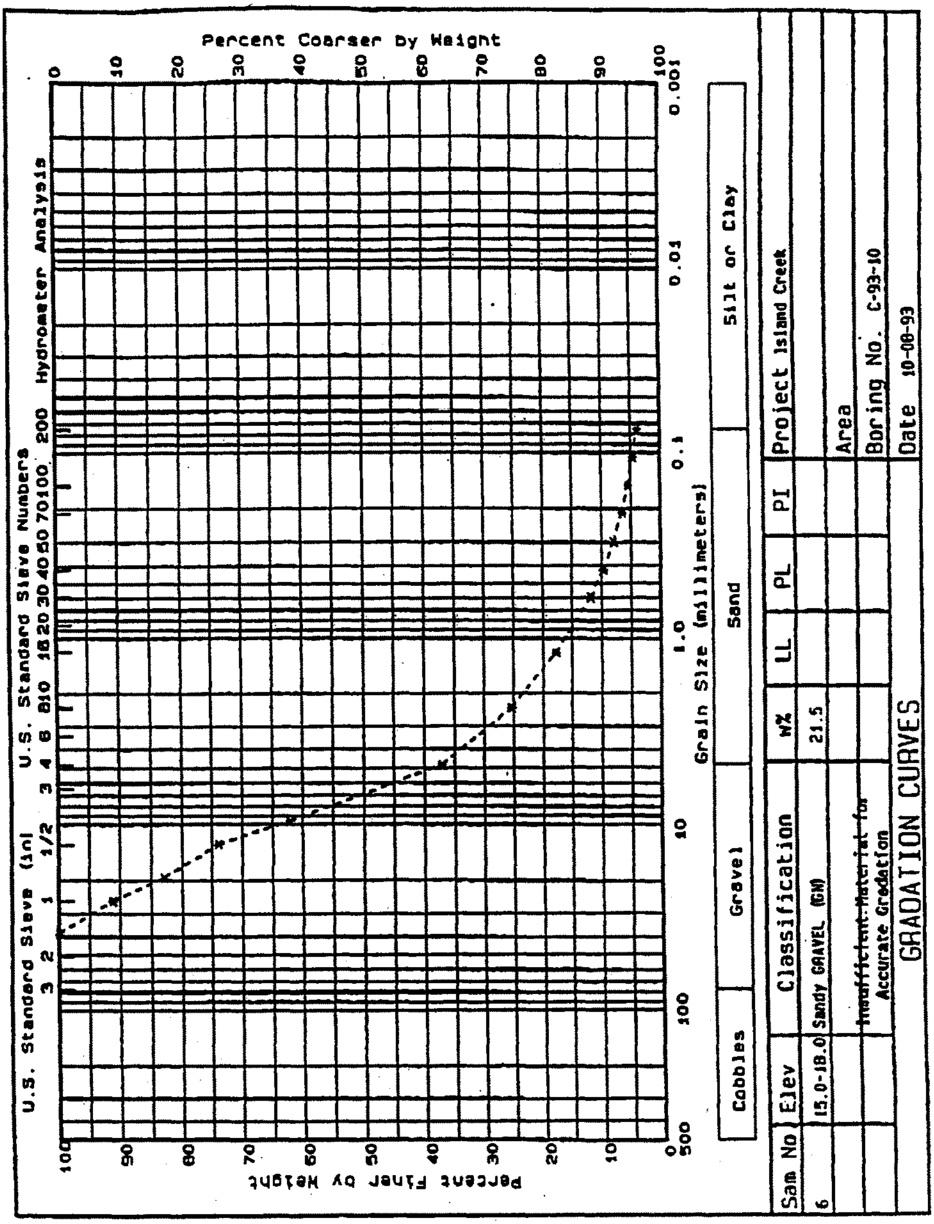


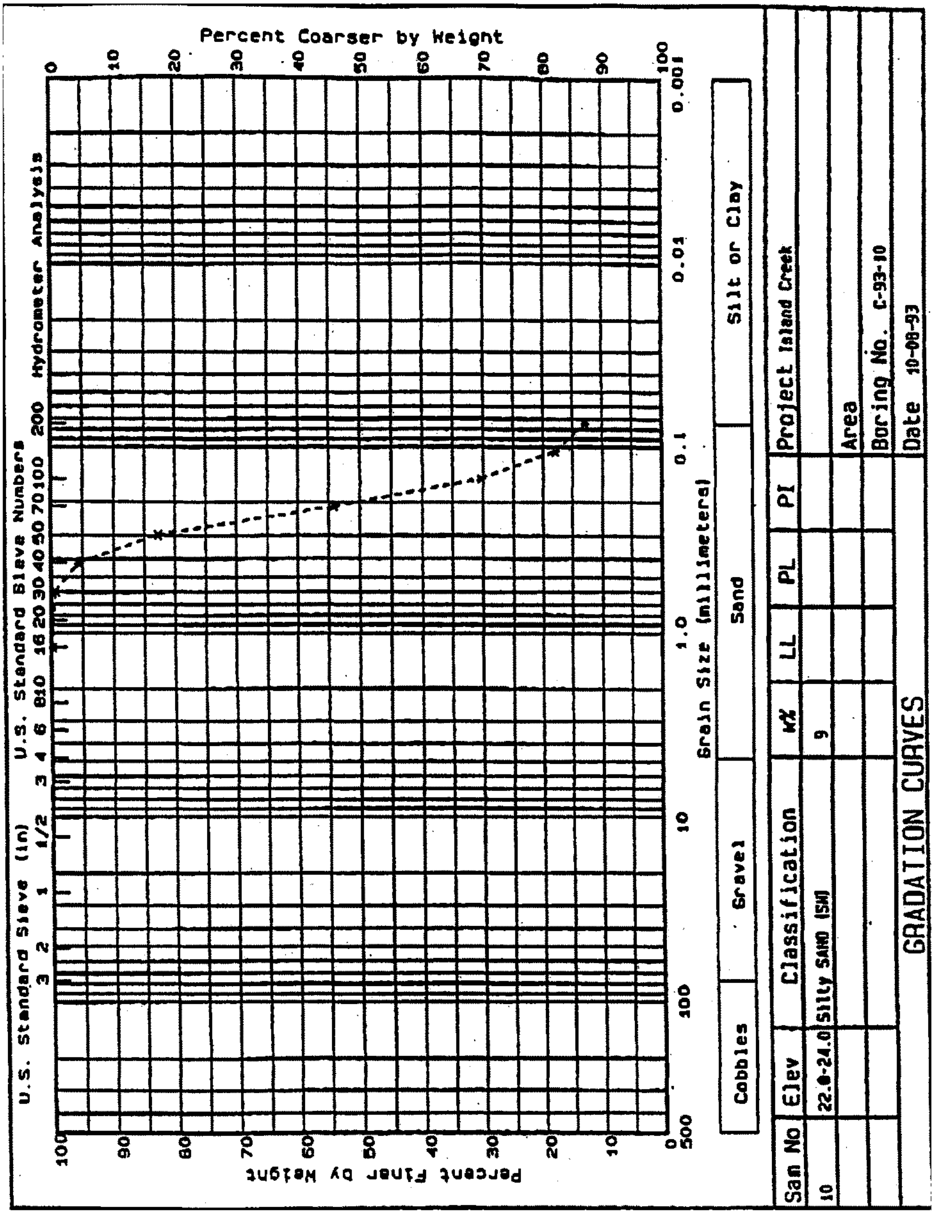
Sam No	Elev	Classification	W%	LL	PL	PI	Project Island Creek
7	18.0-21.0	Gravelly SAND (SW-SM)	25.7				
		Insufficient Material for Accurate Gradation					Area
							Boring No. C-93-8
GRADATION CURVES							Date 10-08-93

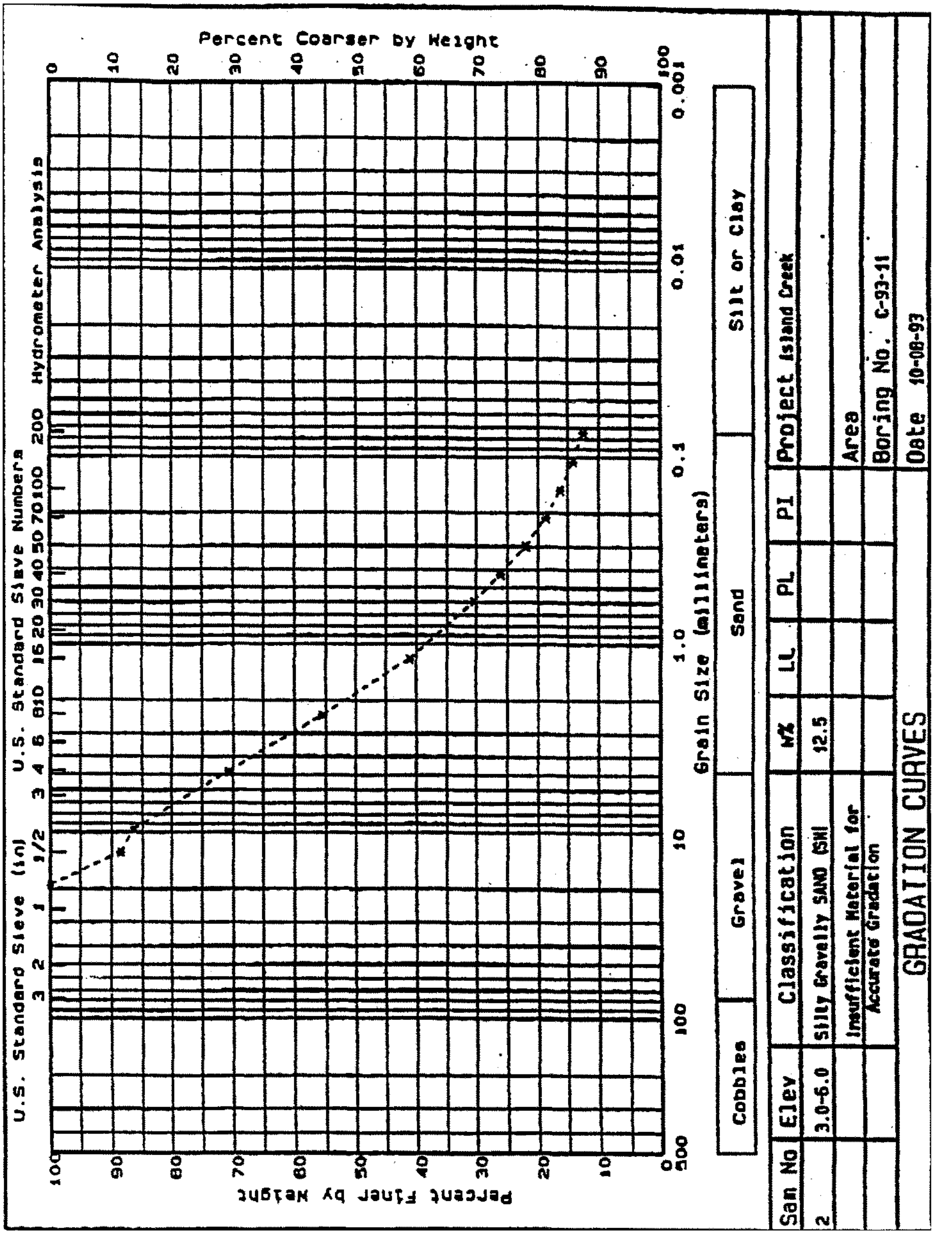


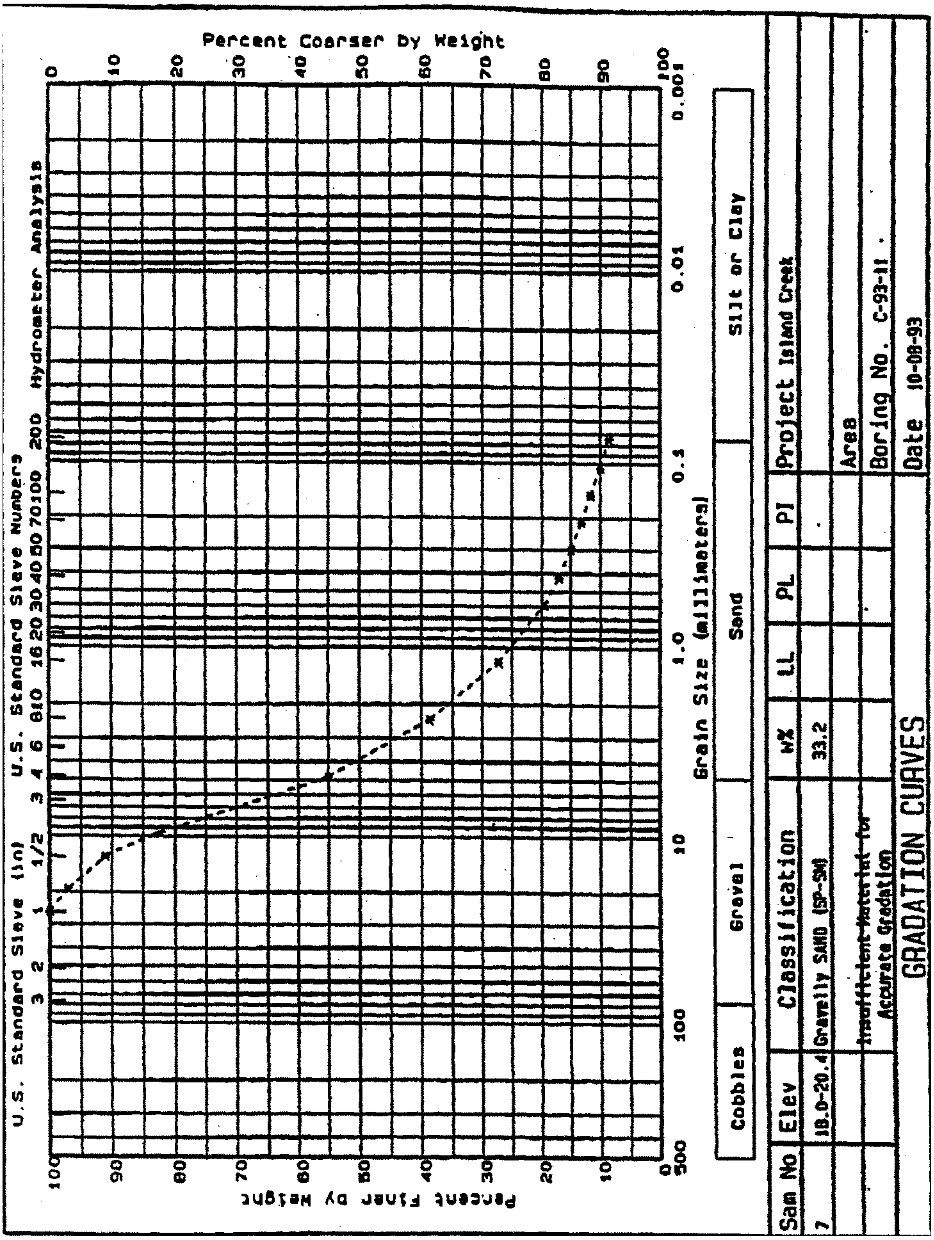
Percent Coarser by Weight
U.S. Standard Sieve (in)
3 2 1 1/2 3 4 6 810 16 20 30 40 50 70 100 200
U.S. Standard Sieve Numbers
Hydrometer Analysis
0 10 20 30 40 50 60 70 80 90 100
100 90 80 70 60 50 40 30 20 10 0
Percent Finer by Weight
500 100 10 1.0 0.1 0.01 0.001
Grain Size (millimeters)
Cobbles
Gravel
Sand
Silt or Clay
Sam No
Elev
Classification
W%
LL
PL
PI
Project Island Creek
14
36.0-39.0
Gravelly SAND (SP-SM)
15.2
Insufficient Material for Accurate Gradation
Area
Boring No. C-93-8
Date 10-08-93
GRADATION CURVES

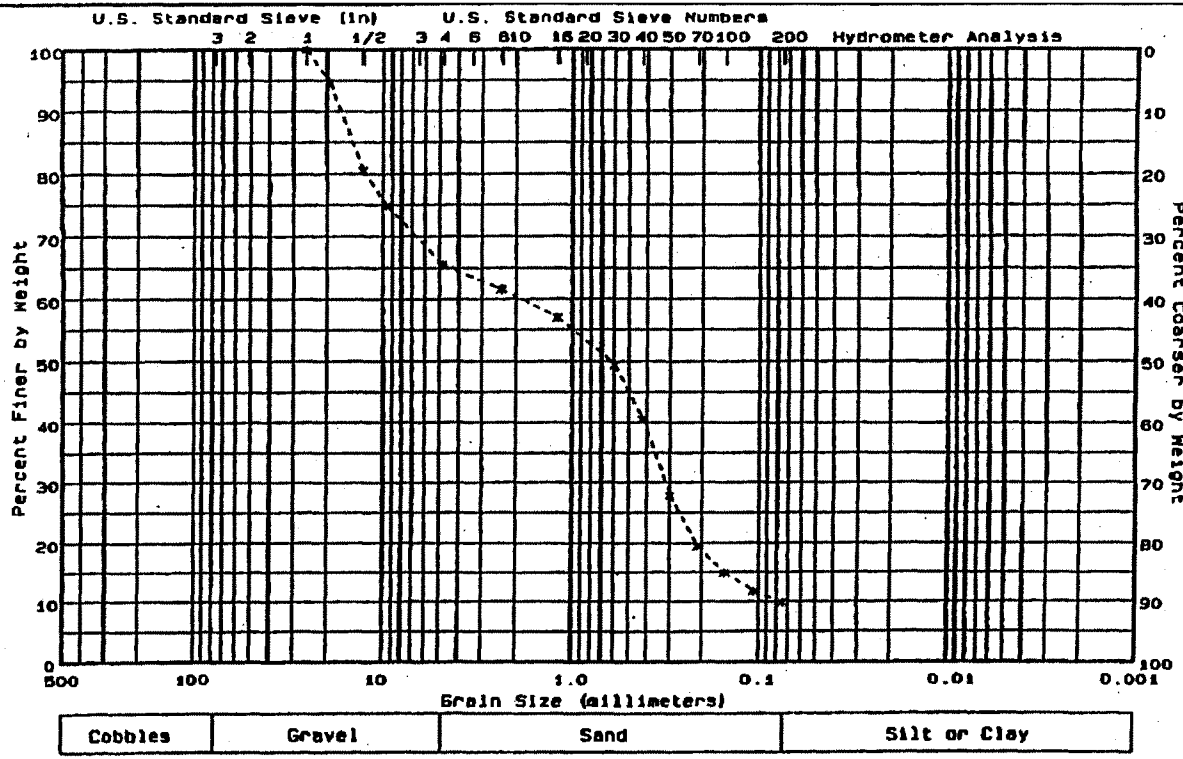

Percent Coarser by Weight
U.S. Standard Sieve (in)
U.S. Standard Sieve Numbers
Hydrometer Analysis
Percent Finer by Weight
Grain Size (millimeters)
Cobbles
Gravel
Sand
Silt or Clay
Sam No
Elev
Classification
W%
LL
PL
PI
Project Island Creek
2
3.0-6.0
Silty Gravelly SAND (SM)
17.7
Insufficient Material for ~~Accurate Gradation~~
Area
Boring No. C-93-10
Date 10-08-93
GRADATION CURVES


U.S. Standard Sieve (in)
3 2 1 1/2
U.S. Standard Sieve Numbers
3 4 6 8 10 16 20 30 40 50 70 100 200
Hydrometer Analysis
Percent Finer by Weight
100 90 80 70 60 50 40 30 20 10 0
Percent Coarser by Weight
0 10 20 30 40 50 60 70 80 90 100
500 100 10 1.0 0.1 0.01 0.001
Grain Size (millimeters)
Cobbles
Gravel
Sand
Silt or Clay
Sam No
Elev
Classification
W%
LL
PL
PI
Project Island Creek
6
15.0-18.0
Sandy GRAVEL (GW)
21.5
Area
Insufficient Material for
Accurate Gradation
Boring No. C-93-10
GRADATION CURVES
Date 10-08-93

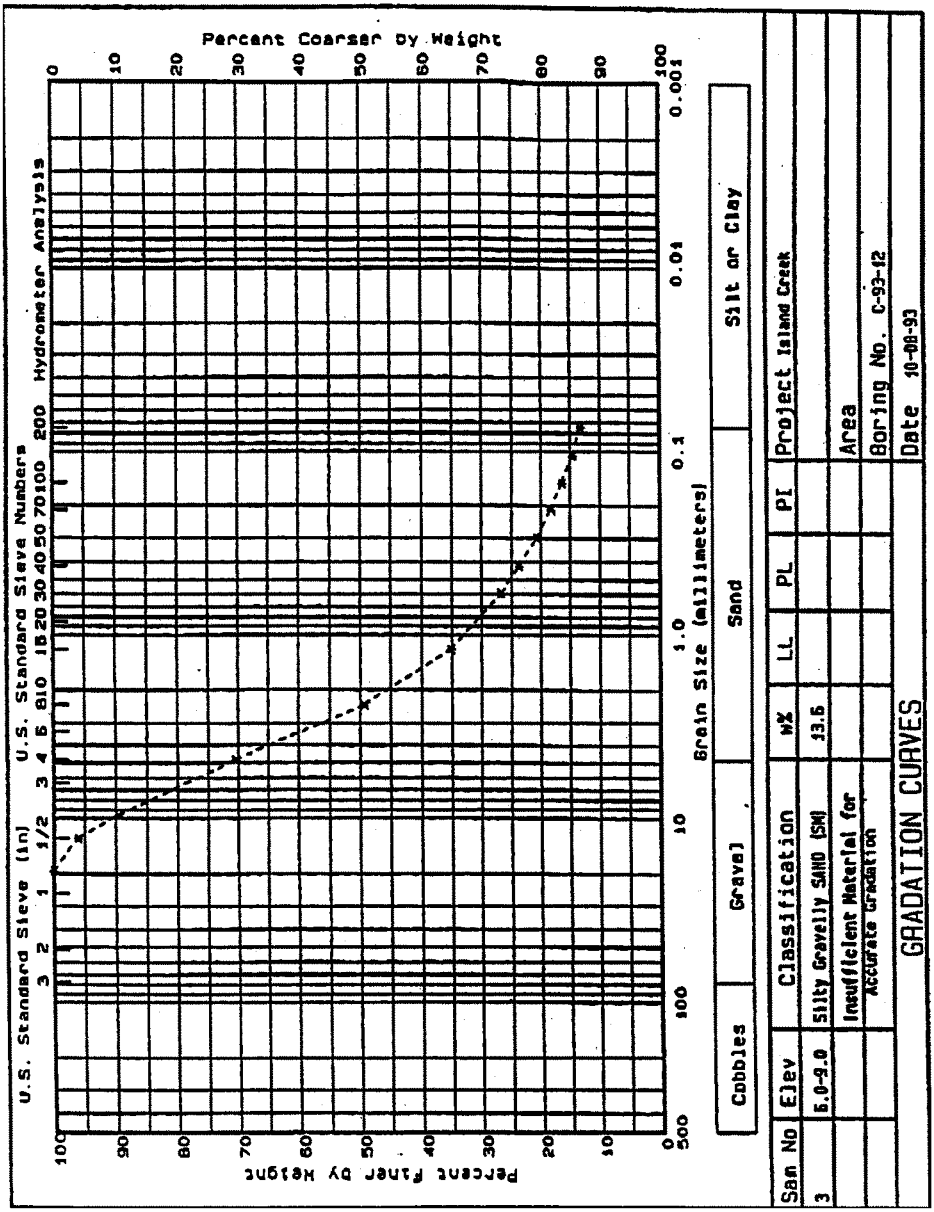

Percent Coarser by Weight
U.S. Standard Sieve (in)
U.S. Standard Sieve Numbers
Hydrometer Analysis
Percent Finer by Weight
Grain Size (millimeters)
Cobbles
Gravel
Sand
Silt or Clay
San No
Elev
Classification
W%
LL
PL
PI
Project Island Creek
Area
Boring No. C-93-10
Date 10-08-93
10
22.0-24.0
Silty SAND (SM)
9
GRADATION CURVES

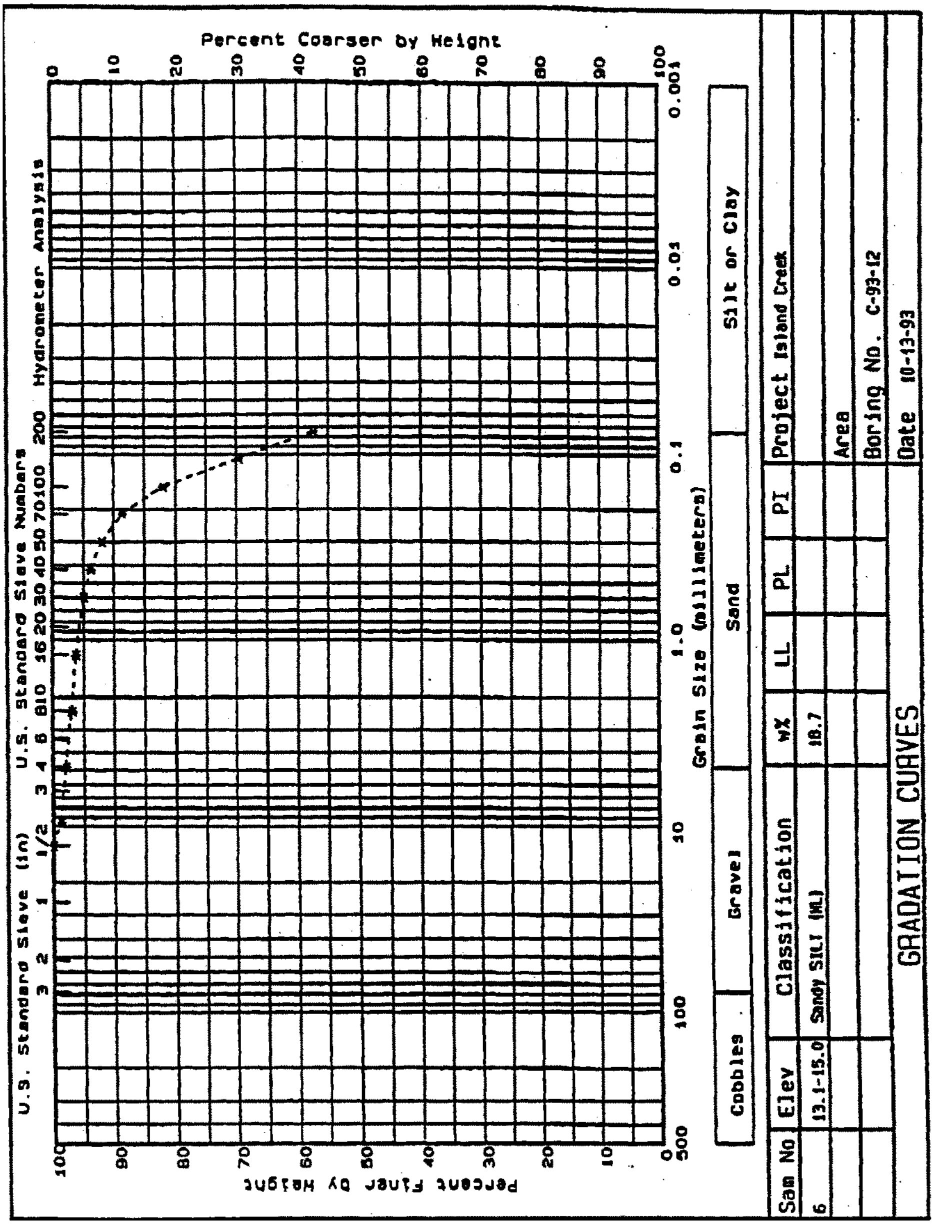

Percent Coarser by Weight
U.S. Standard Sieve (in)
U.S. Standard Sieve Numbers
Hydrometer Analysis
Percent Finer by Weight
Grain Size (millimeters)
Cobbles
Gravel
Sand
Silt or Clay
San No
Elev
Classification
W%
LL
PL
PI
Project Island Creek
2
3.0-6.0
Silty Gravelly SAND (SM)
12.5
Insufficient Material for Accurate Gradation
Area
Boring No. C-93-11
Date 10-08-93
GRADATION CURVES

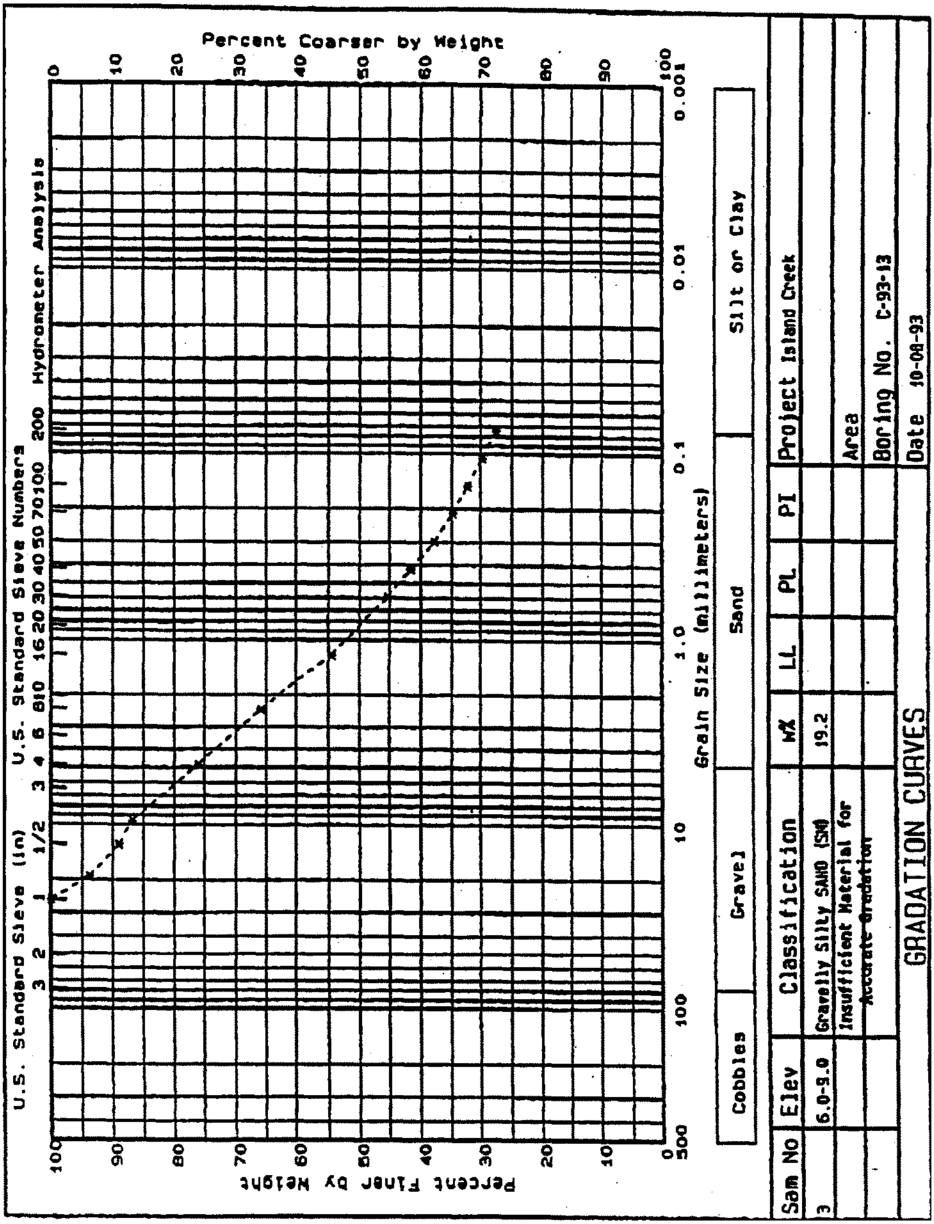

Percent Coarser by Weight
U.S. Standard Sieve (in) 3 2 1 1/2 3
U.S. Standard Sieve Numbers 4 6 810 16 20 30 40 50 70 100 200
Hydrometer Analysis
Percent Finer by Weight
Grain Size (millimeters)
500 100 10 1.0 0.1 0.01 0.001
Cobbles
Gravel
Sand
Silt or Clay
Sam No
Elev
Classification
W%
LL
PL
PI
Project Island Creek
7
18.0-20.4
Gravelly SAND (SP-SM)
33.2
Area
~~Insufficient Material for~~ Accurate Gradation
Boring No. C-93-11
Date 10-08-93
GRADATION CURVES

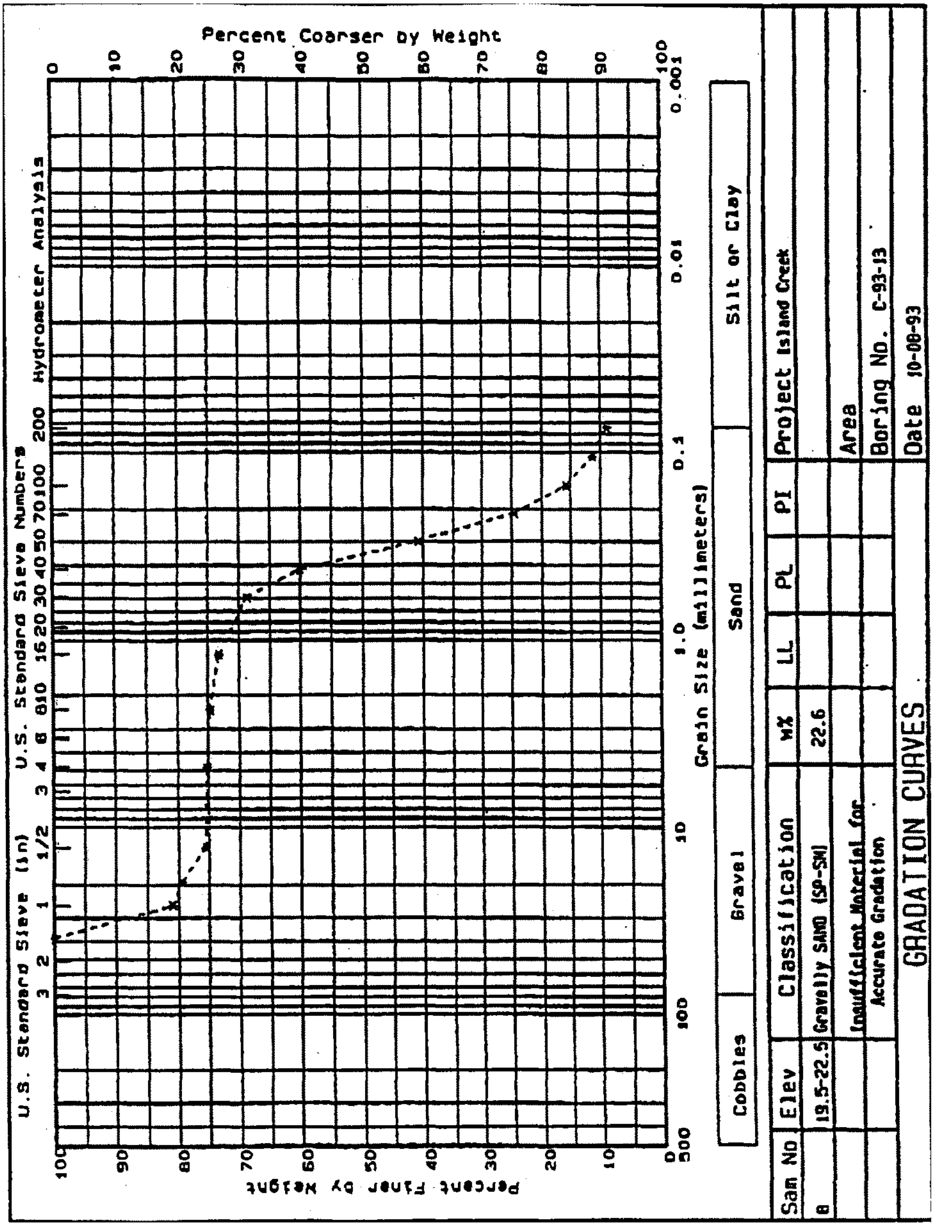


Sam No	Elev	Classification	W%	LL	PL	PI	Project Island Creek
10	25.5-27.8	Gravelly SAND (SP-SW)	15.4				
		Insufficient Material for Accurate Gradation					Area
							Boring No. C-93-11
GRADATION CURVES							Date 10-08-93

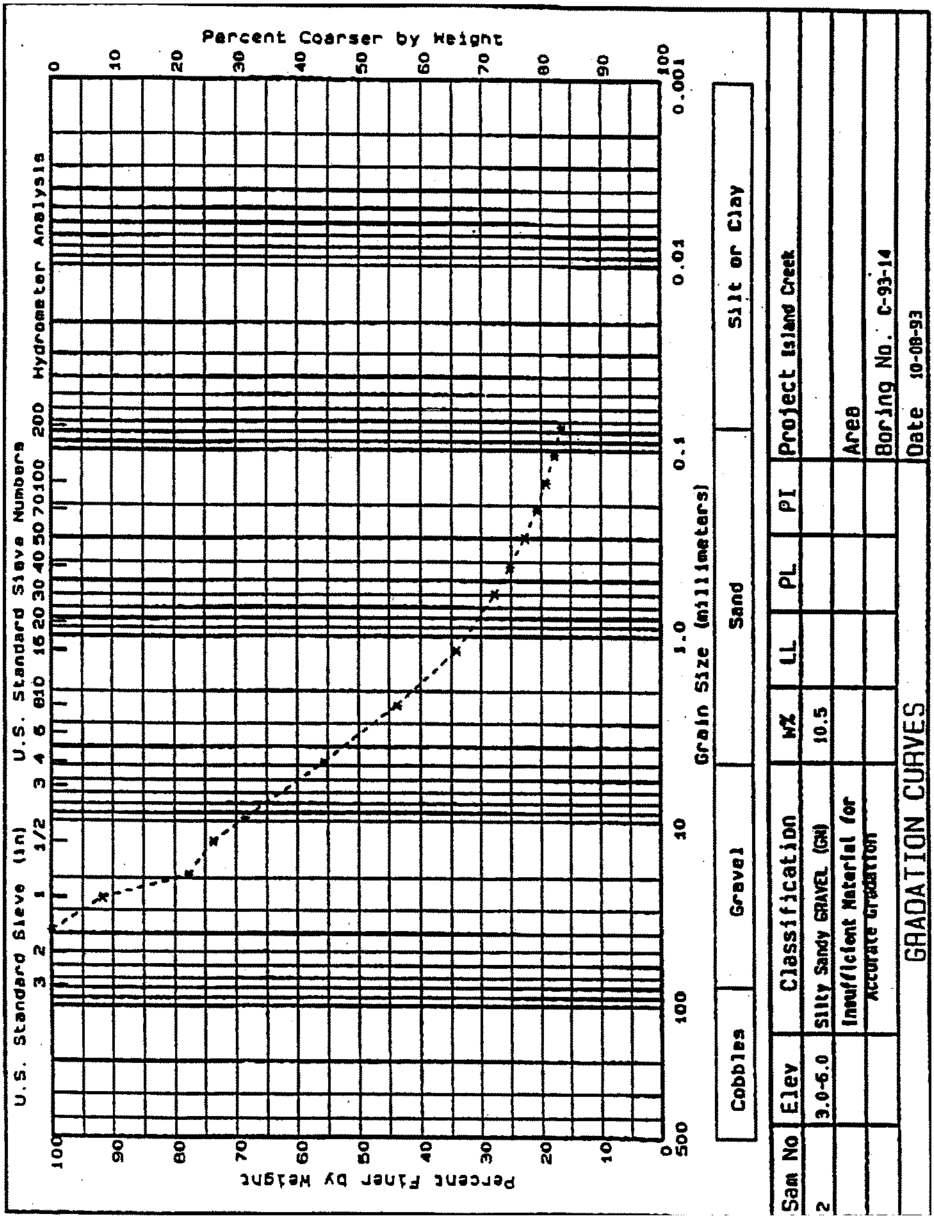

Percent Coarser by Weight
U.S. Standard Sieve (in)
U.S. Standard Sieve Numbers
Hydrometer Analysis
Percent Finer by Weight
Grain Size (millimeters)
Cobbles
Gravel
Sand
Silt or Clay
San No
Elev
Classification
W%
LL
PL
PI
Project Island Creek
3
5.0-9.0
Silty Gravelly SAND (SM)
13.6
Insufficient Material for Accurate Gradation
Area
Boring No. C-93-12
Date 10-08-93
GRADATION CURVES

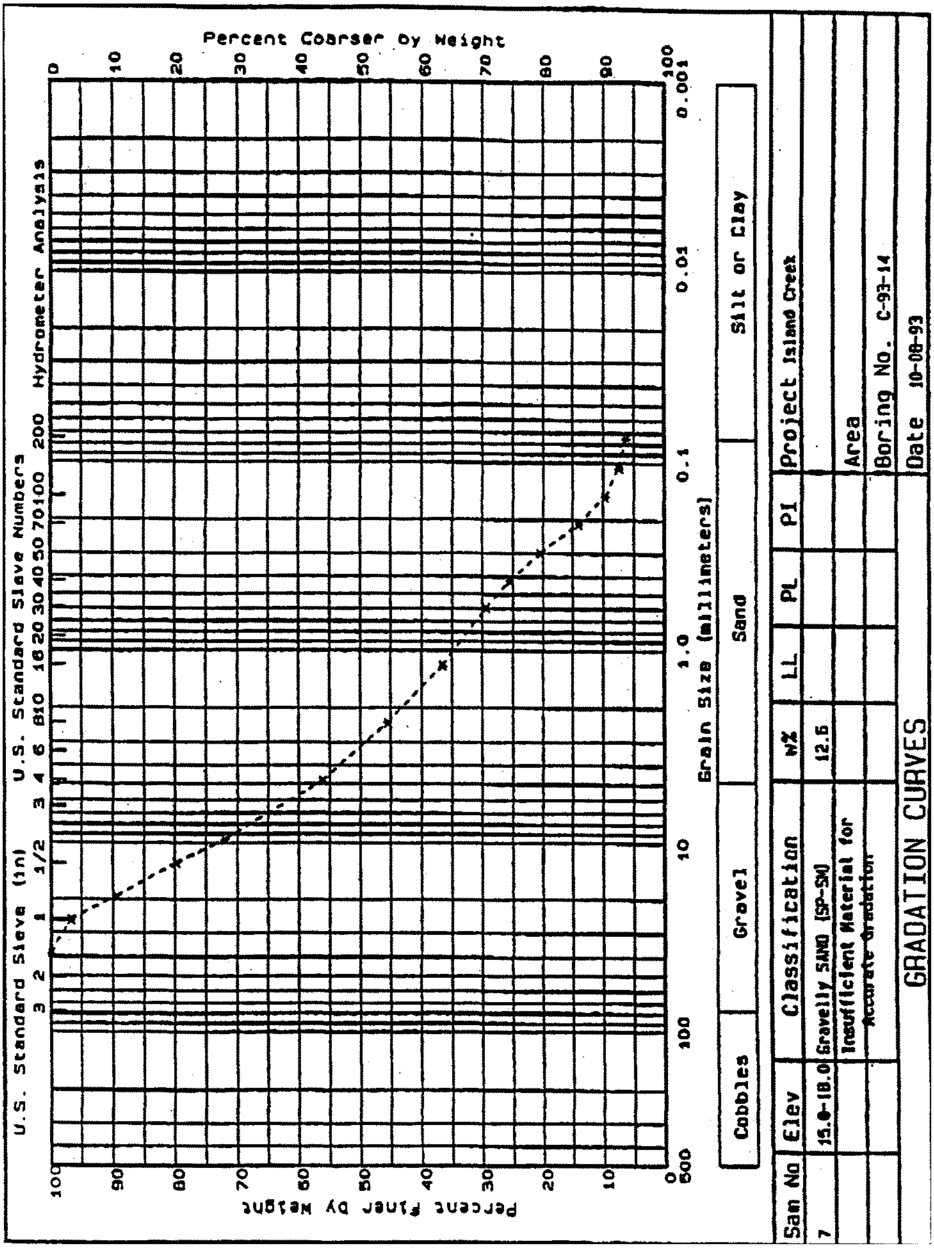

Percent Coarser by Weight
U.S. Standard Sieve (in)
3 2 1 1/2
U.S. Standard Sieve Numbers
3 4 6 8 10 16 20 30 40 50 70 100 200
Hydrometer Analysis
Percent Finer by Weight
Grain Size (millimeters)
500 100 10 1.0 0.1 0.01 0.001
Cobbles
Gravel
Sand
Silt or Clay
Sam No
Elev
Classification
w%
LL
PL
PI
6
13.1-15.0
Sandy SILT (ML)
18.7
Project Island Creek
Area
Boring No. C-93-12
Date 10-13-93
GRADATION CURVES


Percent Coarser by Weight
U.S. Standard Sieve (in)
3 2 1 1/2 3
U.S. Standard Sieve Numbers
4 6 810 16 20 30 40 50 70100 200
Hydrometer Analysis
Percent Finer by Weight
Grain Size (millimeters)
500 100 10 1.0 0.1 0.01 0.001
Cobbles
Gravel
Sand
Silt or Clay
Sam No
3
Elev
6.0-9.0
Classification
Gravelly Silty SAND (SM)
Insufficient Material for Accurate Gradation
W%
19.2
LL
PL
PI
Project Island Creek
Area
Boring No. C-93-13
Date 10-08-93
GRADATION CURVES



Percent Coarser by Weight
U.S. Standard Sieve (in)
U.S. Standard Sieve Numbers
Hydrometer Analysis
Percent Finer by Weight
Grain Size (millimeters)
Cobbles
Gravel
Sand
Silt or Clay
Sam No
Elev
Classification
W%
LL
PL
PI
Project Island Creek
8
19.5-22.5
Gravelly SAND (SP-SM)
22.6
Insufficient Material for Accurate Gradation
Area
Boring No. C-93-13
Date 10-08-93
GRADATION CURVES


Percent Coarser by Weight
U.S. Standard Sieve (in)
U.S. Standard Sieve Numbers
Hydrometer Analysis
Grain Size (millimeters)
Percent Finer by Weight
Cobbles
Gravel
Sand
Silt or Clay
Sam No
2
Elev
3.0-6.0
Classification
Silty Sandy GRAVEL (GM)
Insufficient Material for Accurate Gradation
W%
10.5
LL
PL
PI
Project Island Creek
Area
Boring No. C-93-14
Date 10-08-93
GRADATION CURVES


Percent Coarser by Weight
U.S. Standard Sieve (in)
3 2 1 1/2 3
U.S. Standard Sieve Numbers
4 6 810 16 20 30 40 50 70100 200
Hydrometer Analysis
Percent Finer by Weight
Grain Size (millimeters)
500 100 10 1.0 0.1 0.01 0.001
Cobbles
Gravel
Sand
Silt or Clay
Sam No
Elev
Classification
W%
LL
PL
PI
Project Island Creek
7
15.0-18.0
Gravelly SAND (SP-SM)
12.5
Insufficient Material for
Accurate Gradation
Area
Boring No. C-93-14
Date 10-08-93
GRADATION CURVES

ISLAND CREEK

LOCAL PROTECTION PROJECT

ENGINEERING TECHNICAL APPENDIX

TO THE

GENERAL REEVALUATION REPORT

TAB IV

GEOTECHNICAL

SECTION D – DESIGN STRENGTHS

Department of the Army
Huntington District, Corps of Engineers
Huntington, West Virginia

Blows/FT
4-10
10-30
30-50

Table 3.3. Typical values of specific gravities G_s of solids, natural water contents w in %, and bulk densities ρ in g/ml (after Polish Standard PN-59/B-03020, 1959)

		Type of soil	State of saturation (Table 3.7)	Specific gravity of solids G_s	Water content w / Bulk density ρ	State of compaction of cohesionless soils: Dense	Medium dense	Loose
					Density index I_D	1·0 – 0·67	0·67 – 0·33	0·33 – 0
cohesionless	inorganic	gravels, tills, hoggins, residual rock debris (granite), etc.	damp	2·65	w/ρ	3/1·85	4/1·75	5/1·70
			moist		w/ρ	10/2·00	12/1·90	15/1·85
			wet		w/ρ	14/2·10	18/2·05	23/2·00
		quartzitic sands: coarse and medium (silt content < 10%, clay content < 2%)	damp	2·65	w/ρ	4/1·80	5/1·70	6/1·65
			moist		w/ρ	12/1·90	14/1·85	16/1·80
			wet		w/ρ	18/2·05	22/2·00	25/1·95
		sands: fine and silty (silt content < 30%, clay content < 2%)	damp	2·65	w/ρ	5/1·70	6/1·65	7/1·60
			moist		w/ρ	14/1·85	16/1·75	19/1·70
			wet		w/ρ	22/2·00	24/1·90	28/1·85
	organic	sands: organic	damp	2·64	w/ρ	5/1·60	6/1·55	7/1·50
			moist		w/ρ	16/1·75	18/1·70	21/1·65
			wet		w/ρ	24/1·90	28/1·85	30/1·75

Blows/FT
0–4
4–8
8–15

Table 3.3 (contd.)

		Type of soil	Specific gravity of solids G_s	Water content $\frac{w}{\text{Bulk density } \rho}$	Consistency of cohesive soils (5-30) Hard or very stiff	Stiff	Firm	Soft to very soft
					Consistency index I_c: w_s 1·0	0·75	0·50	0
cohesive	inorganic	slightly clayey sand	2·65	$\frac{w}{\rho}$	$\frac{10^*}{2{\cdot}20}$	$\frac{13}{2{\cdot}15}$	$\frac{16}{2{\cdot}10}$	$\frac{19}{2{\cdot}05}$
		sandy silt	2·66	$\frac{w}{\rho}$	$\frac{14^*}{2{\cdot}15}$	$\frac{17}{2{\cdot}10}$	$\frac{19}{2{\cdot}05}$	$\frac{22}{2{\cdot}00}$
		silt	2·67	$\frac{w}{\rho}$	$\frac{18^*}{2{\cdot}10}$	$\frac{21}{2{\cdot}05}$	$\frac{23}{2{\cdot}00}$	$\frac{26}{1{\cdot}95}$
		clayey sand	2·67	$\frac{w}{\rho}$	$\frac{9}{2{\cdot}25}$	$\frac{12}{2{\cdot}20}$	$\frac{17}{2{\cdot}10}$	$\frac{24}{2{\cdot}00}$
		clayey sandy silt	2·67	$\frac{w}{\rho}$	$\frac{13}{2{\cdot}20}$	$\frac{16}{2{\cdot}15}$	$\frac{21}{2{\cdot}05}$	$\frac{27}{1{\cdot}95}$
		clayey silt	2·68	$\frac{w}{\rho}$	$\frac{17}{2{\cdot}15}$	$\frac{20}{2{\cdot}10}$	$\frac{25}{2{\cdot}00}$	$\frac{32}{1{\cdot}90}$
		sand–clay	2·68	$\frac{w}{\rho}$	$\frac{11}{2{\cdot}25}$	$\frac{14}{2{\cdot}15}$	$\frac{20}{2{\cdot}05}$	$\frac{30}{1{\cdot}95}$
		sand–silt–clay	2·69	$\frac{w}{\rho}$	$\frac{15}{2{\cdot}20}$	$\frac{18}{2{\cdot}10}$	$\frac{24}{2{\cdot}00}$	$\frac{35}{1{\cdot}90}$
		silt–clay	2·71	$\frac{w}{\rho}$	$\frac{18}{2{\cdot}15}$	$\frac{22}{2{\cdot}00}$	$\frac{28}{1{\cdot}90}$	$\frac{42}{1{\cdot}80}$
		sandy clay	2·70	$\frac{w}{\rho}$	$\frac{14}{2{\cdot}20}$	$\frac{18}{2{\cdot}10}$	$\frac{25}{1{\cdot}95}$	$\frac{40}{1{\cdot}80}$
		clay	2·72	$\frac{w}{\rho}$	$\frac{17}{2{\cdot}15}$	$\frac{22}{2{\cdot}00}$	$\frac{30}{1{\cdot}85}$	$\frac{45}{1{\cdot}75}$
		silty clay	2·75	$\frac{w}{\rho}$	$\frac{20}{2{\cdot}05}$	$\frac{25}{1{\cdot}90}$	$\frac{33}{1{\cdot}80}$	$\frac{50}{1{\cdot}70}$
	organic	silts with traces of organic matter	2·30	$\frac{w}{\rho}$	$\frac{20-40}{2{\cdot}00-1{\cdot}80}$			
		organic alluvial muds	2·15 to 2·60	$\frac{w}{\rho}$	$\frac{20-150}{1{\cdot}90-1{\cdot}30}$			
		peats	1·50 to 2·15	$\frac{w}{\rho}$	$\frac{25-400}{1{\cdot}80-1{\cdot}00}$			

* For slightly cohesive soils having smaller water contents than tabulated natural densities are lower and depend on the degree of saturation–see nomograms in Chapter 7.

Table 5.7. Typical values of strength parameters ϕ and c in kN/m²* (after Polish Code PN-59/B-03020, 1959)

		Type of soil		Density index of cohesionless soils			
				50-30	30-10	10-4	← Blows/FT
			I_D=	1.0	0.67	0.33	0
cohesionless	inorganic	gravels, tills, hoggins, etc.	ϕ'	45°–40°	40°–37°	37°–35°	
	inorganic	sands: coarse and medium	ϕ'	40°–38°	38°–35°	35°–32°	
	inorganic	sands: fine and silty	ϕ'	37°–35°	35°–32°	32°–28°	
	organic	sands, organic	ϕ'	30°–25°	25°–22°	22°–18°	
				Consistency of cohesive soils			
				hard or very stiff	stiff	firm	soft to very soft
				30-15	15-8	8-4	4-0 ← Blows/FT
			$w = w_s$ I_c =	1.0	0.75	0.50	0.0
cohesive	inorganic	slightly clayey sands, sandy silts, silts $J < 10\%$	ϕ'	28°–24°	24°–22°	22°–19°	19°–5°
			c'	40°–30	30–20	20–15	15–2
			ϕ_u	25°–20°	20°–16°	16°–10°	10°–7°
	inorganic	clayey sands, clayey sandy silts, clayey silts, $J = 10–20\%$	ϕ'	26°–22°	22°–19°	19°–15°	15°–12°
			c'	50–40	40–30	30–20	20–3
			ϕ_u	20°–16°	16°–12°	12°–7°	7°–5°
	inorganic	sand–clays, sand–silt–clays, silt–clays $J = 20–30\%$	ϕ'	23°–20°	20°–17°	17°–12°	12°–8°
			c'	60–50	50–40	40–30	30–5
			ϕ_u	15°–12°	12°–9°	9°–5°	5°–2°
	inorganic	sandy clays, clays, silty clays $J > 30\%$	ϕ'	19°–17°	17°–14°	14°–5°	10°–5°
			c'	80–60	60–50	50–40	40–10
			ϕ_u	10°–8°	8°–5°	5°–2°	2°–0°
	organic	organic silts, peats, etc.		all strength parameters to be determined from laboratory tests			

* For approximate conversion from kN/m² to lbf/ft² multiply by 21 and to kgf/cm² by 0·01.
For computation of safe bearing capacity undrained cohesive resistance c_u can be taken as equal to c' – this assumption is on the safe side.

DESIGN S STRENGTHS

SANDS AND GRAVELS

DENSITY	γ_m^{Lb/ft^3}	C^{Lbf/ft^2}	ϕ^{o}
VERY DENSE TO DENSE	127	0	35
MEDIUM	114	0	32
LOOSE TO VERY LOOSE	110	0	28

CLAYS AND SILTS

DENSITY	γ_m^{Lb/ft^3}	C^{Lbf/ft^2}	ϕ^{o}
HARD OR VERY STIFF	127	0	30
STIFF	123	0	30
MEDIUM	116	0	30
SOFT TO VERY SOFT	116	0	30

DESIGN R STRENGTH

SILTS

CONSISTENCY	γ_m Lb/ft^3	C Lbf/ft^2	ϕ°
HARD OR VERY STIFF	132	600	20
STIFF	117	400	16
MEDIUM	121	300	10

CLAYS

CONSISTENCY	γ_m Lb/ft^3	C Lbf/ft^2	ϕ°
HARD OR VERY STIFF	127	1200	0
STIFF	123	1000	0
MEDIUM	116	800	0
SOFT TO VERY SOFT	116	200	0

ISLAND CREEK

LOCAL PROTECTION PROJECT

ENGINEERING TECHNICAL APPENDIX

TO THE

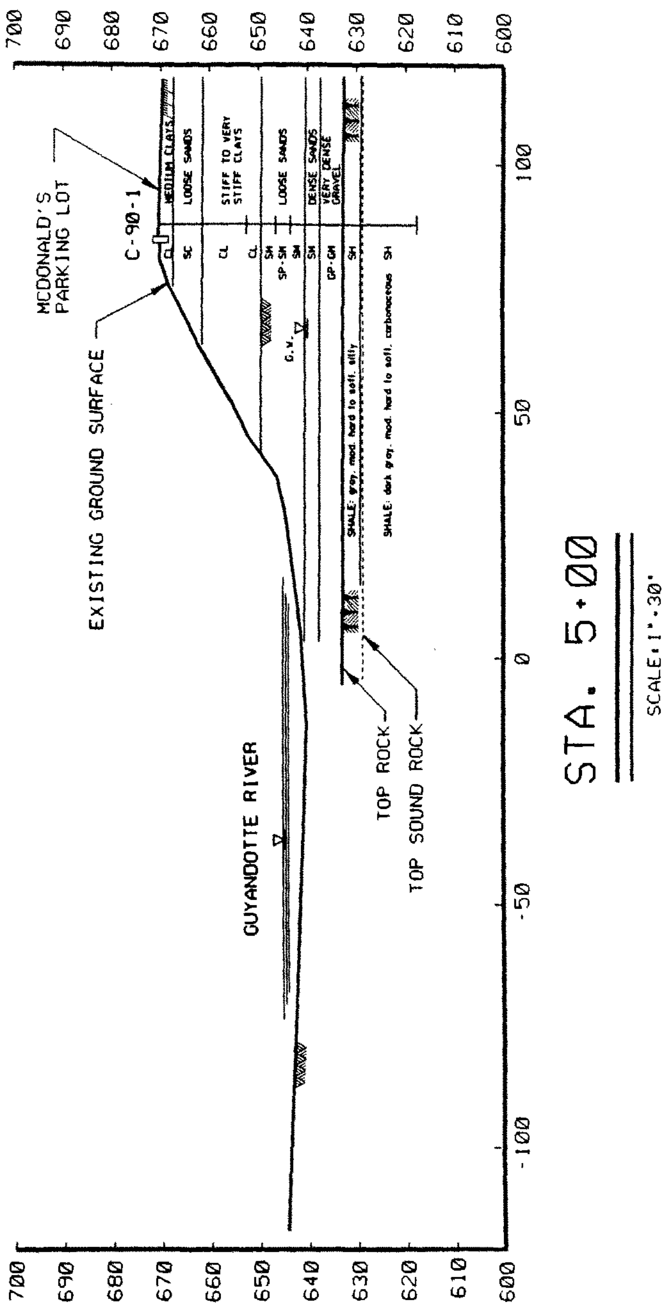
GENERAL REEVALUATION REPORT

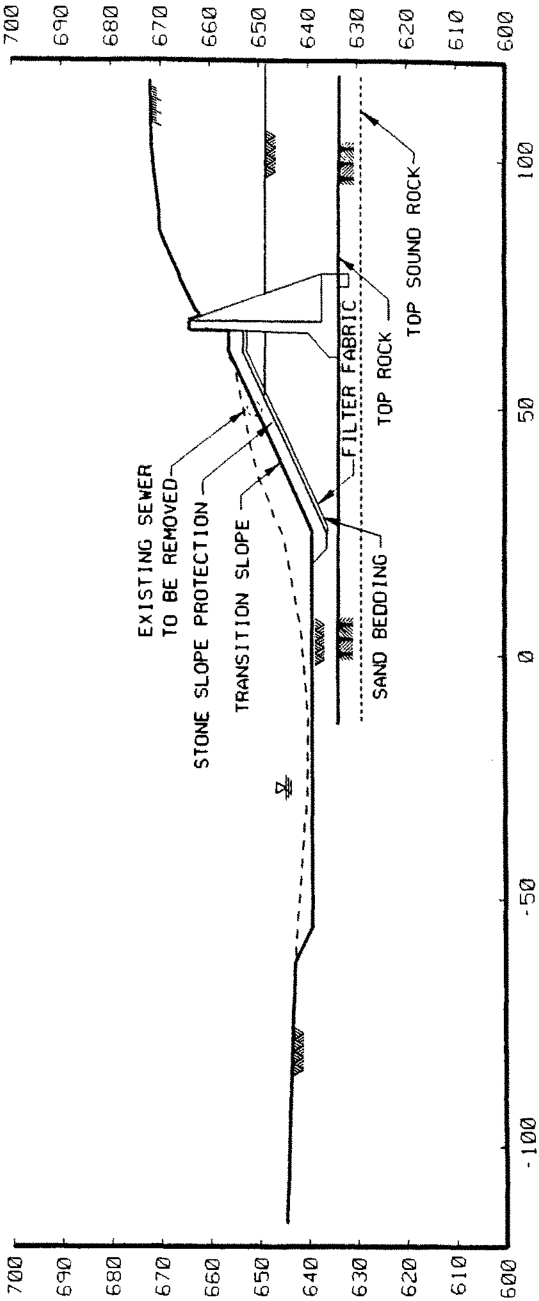
TAB IV

GEOTECHNICAL

SECTION E - GEOLOGIC SECTIONS

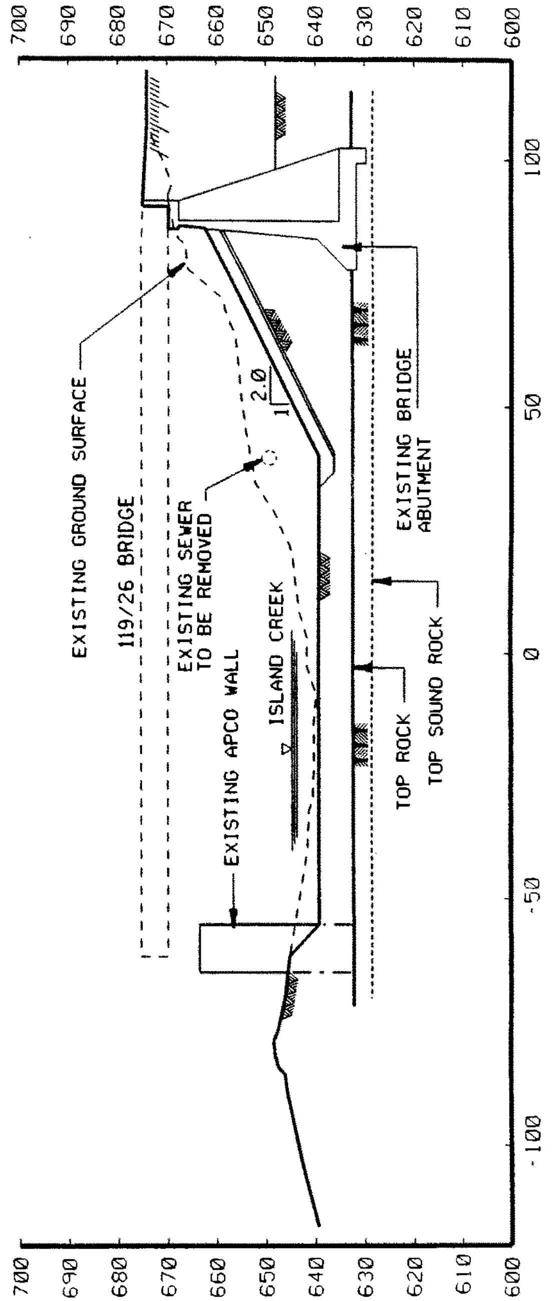
Department of the Army
Huntington District, Corps of Engineers
Huntington, West Virginia


MCDONALD'S PARKING LOT
EXISTING GROUND SURFACE
C-90-1
MEDIUM CLAYS
LOOSE SANDS
STIFF TO VERY STIFF CLAYS
LOOSE SANDS
DENSE SANDS
VERY DENSE GRAVEL
CL
SC
CL
CL
SM
SP-SM
SM
GP-GM
SH
SH
G.W.
SHALE: gray, mod. hard to soft, silty
SHALE: dark gray, mod. hard to soft, carbonaceous
GUYANDOTTE RIVER
TOP ROCK
TOP SOUND ROCK
700
690
680
670
660
650
640
630
620
610
600
100
50
0
-50
-100
STA. 5+00
SCALE: 1"=30'



STA. 5+50

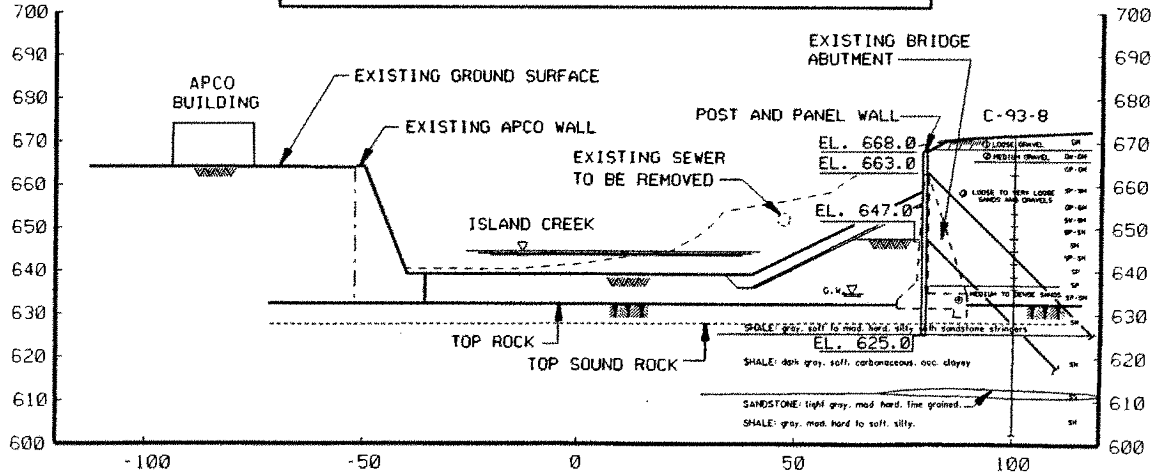
SCALE: 1"=30'


EXISTING GROUND SURFACE
119/26 BRIDGE
EXISTING SEWER TO BE REMOVED
EXISTING APCO WALL
ISLAND CREEK
2.0
1
EXISTING BRIDGE ABUTMENT
TOP ROCK
TOP SOUND ROCK
700
690
680
670
660
650
640
630
620
610
600
100
50
0
-50
-100

STA. 6+00

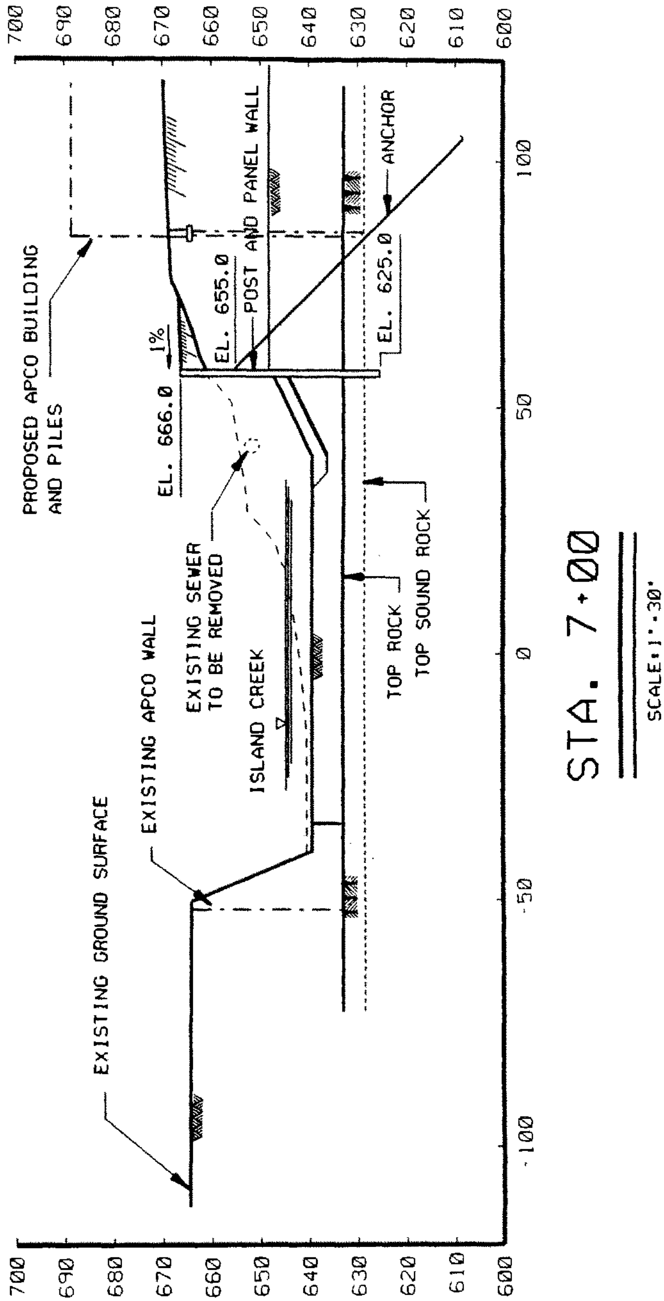
S_a = SOILS STIFFNESS COEFFICIENT

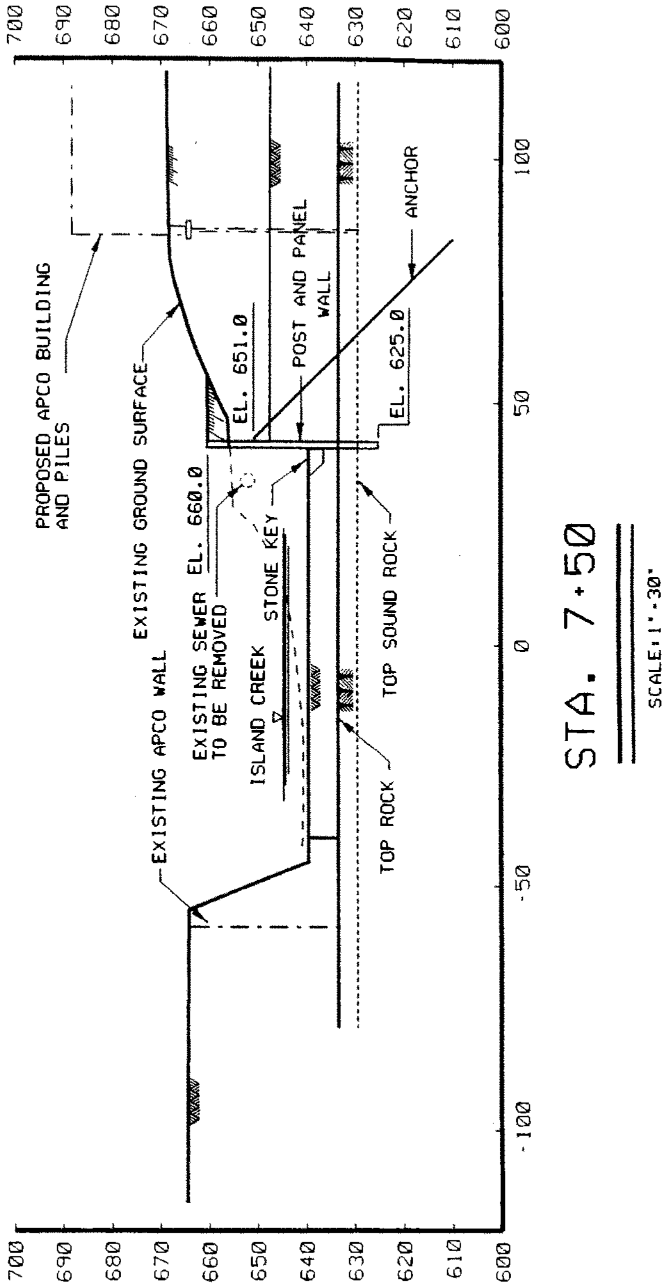
MAT.	γ_m lb/ft³	γ_s lb/ft³	C lb/ft²	ϕ°	S_a lb/in³
1	110	145	0	28	3.0
2	114	145	0	32	9.3
3	110	130	0	28	3.0
4	114	130	0	32	5.8



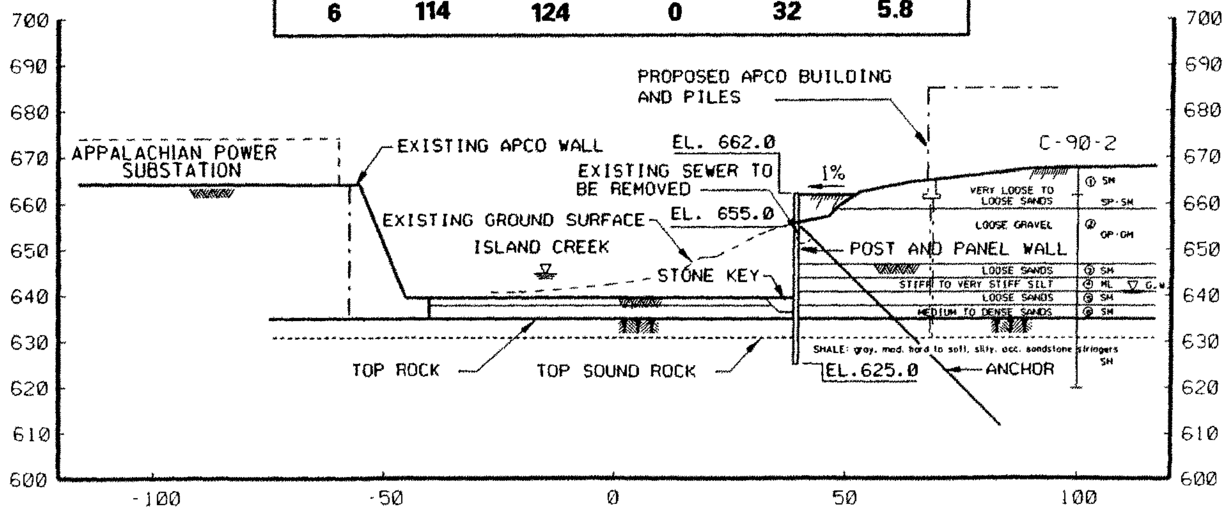
STA. 6+50

SCALE: 1"-30'


PROPOSED APCO BUILDING AND PILES
EXISTING GROUND SURFACE
EXISTING APCO WALL
EXISTING SEWER TO BE REMOVED
ISLAND CREEK
EL. 666.0
1%
EL. 655.0
POST AND PANEL WALL
ANCHOR
EL. 625.0
TOP ROCK
TOP SOUND ROCK
STA. 7+00
SCALE: 1" = 30'

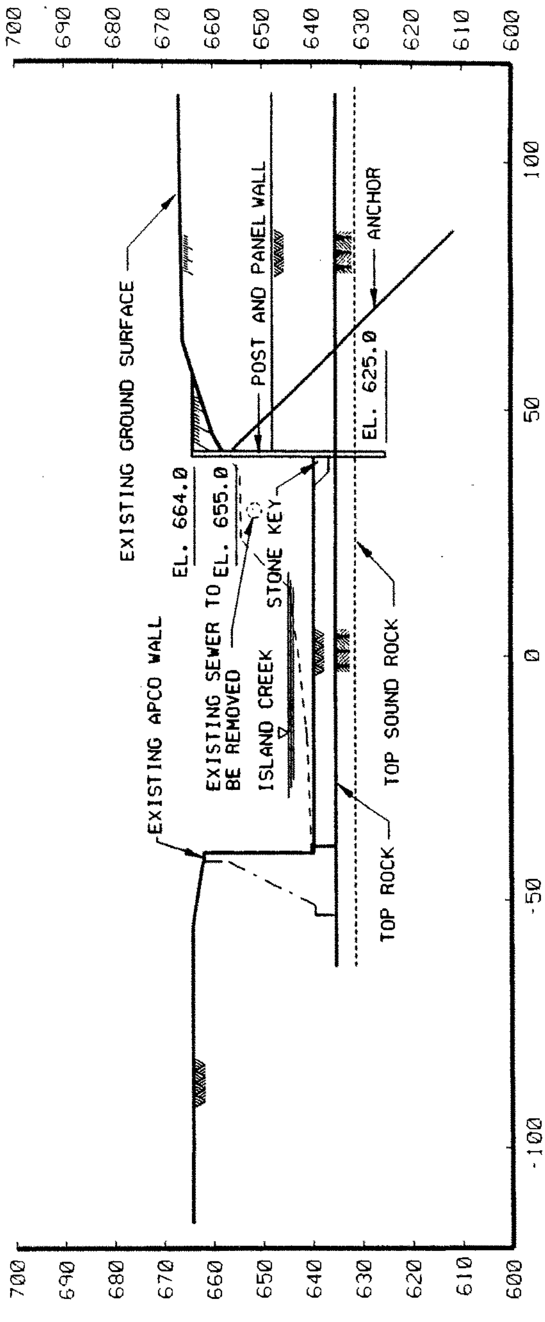

PROPOSED APCO BUILDING
AND PILES
EXISTING GROUND SURFACE
EL. 651.0
POST AND PANEL
WALL
EL. 625.0
ANCHOR
EL. 660.0
EXISTING SEWER
TO BE REMOVED
STONE KEY
EXISTING APCO WALL
ISLAND CREEK
TOP SOUND ROCK
TOP ROCK
700
690
680
670
660
650
640
630
620
610
600
100
50
0
-50
-100
STA. 7+50
SCALE: 1"=30'

MAT.	γ_m lb/ft^3	γ_s lb/ft^3	C lb/ft^2	ϕ^0	S_a lb/in^3
1	110	136	0	28	3.0
2	110	129	0	28	3.0
3	110	122	0	28	3.0
4	123	131	0	30	87
5	110	123	0	28	1.8
6	114	124	0	32	5.8



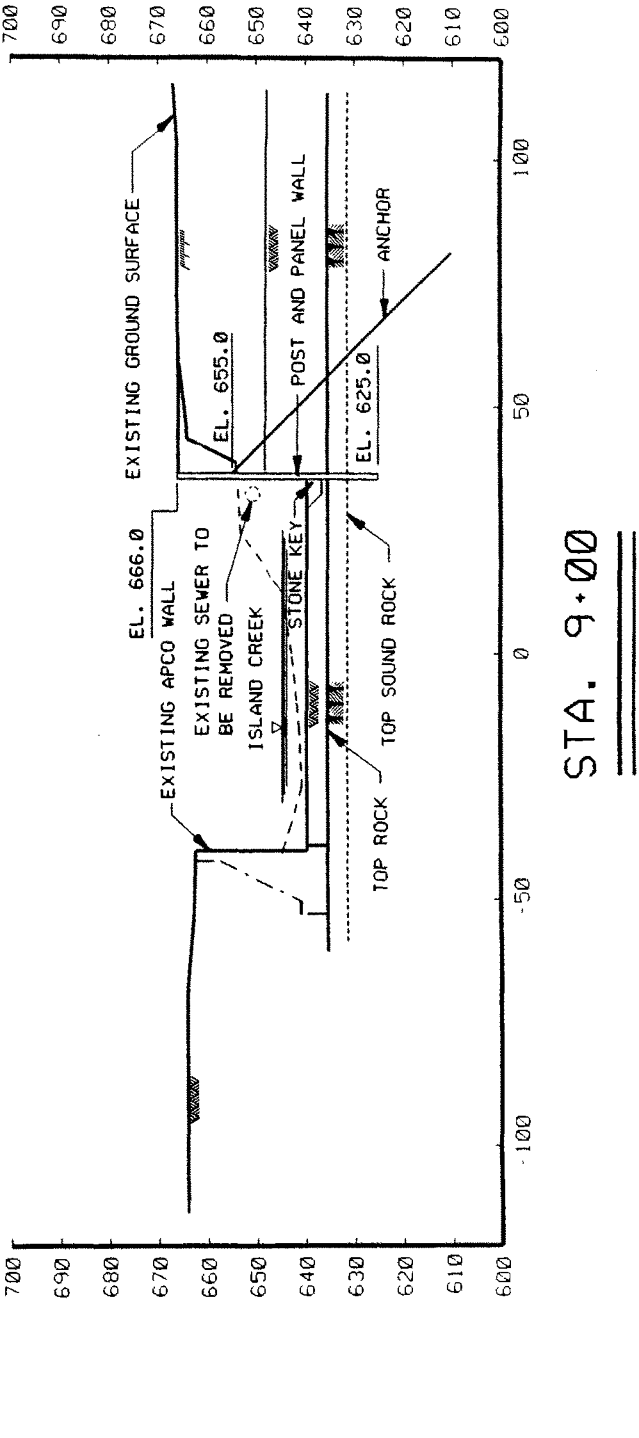
STA. 8+00

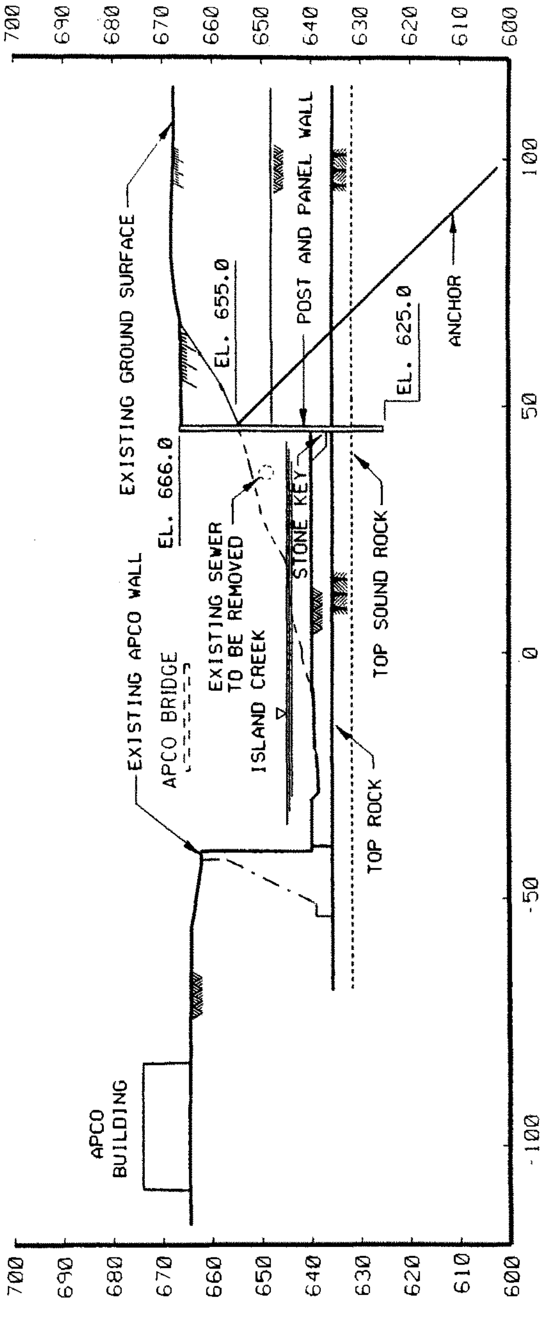
SCALE: 1" - 30'



STA. 8+50

SCALE: 1"=30'

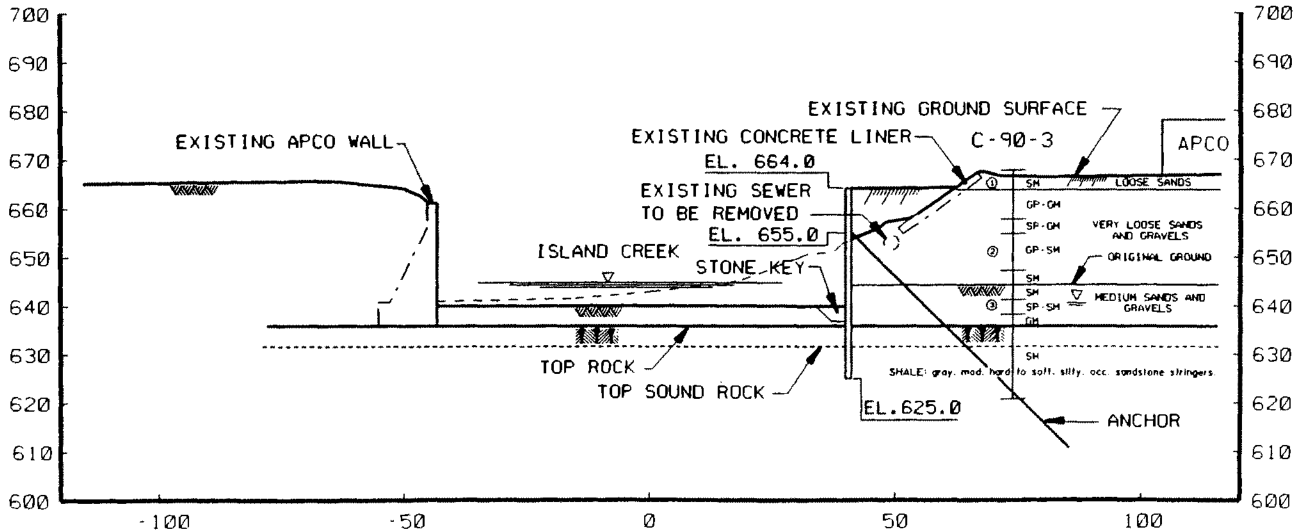

EXISTING GROUND SURFACE
EL. 655.0
POST AND PANEL WALL
ANCHOR
EL. 625.0
EL. 666.0
EXISTING APCO WALL
EXISTING SEWER TO BE REMOVED
ISLAND CREEK
STONE KEY
TOP SOUND ROCK
TOP ROCK
700 690 680 670 660 650 640 630 620 610 600
100 50 0 -50 -100
STA. 9+00
SCALE: 1"=30'



STA. 9+50

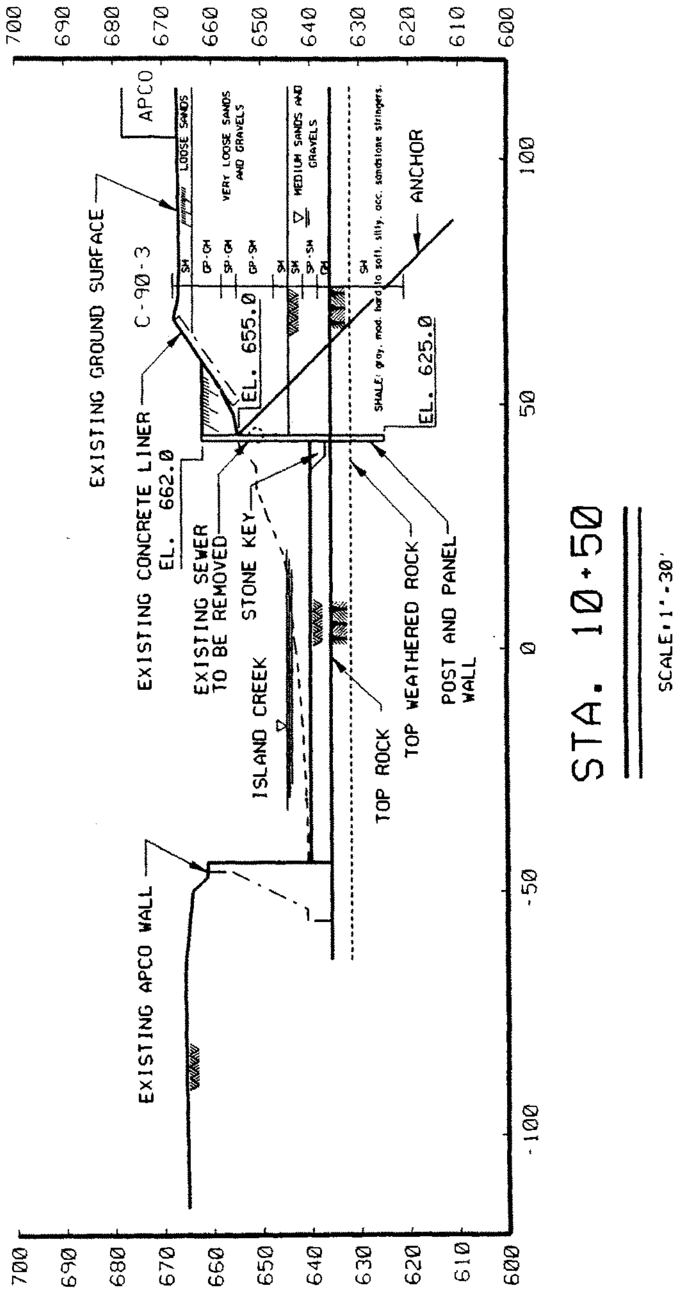
SCALE: 1"=30'

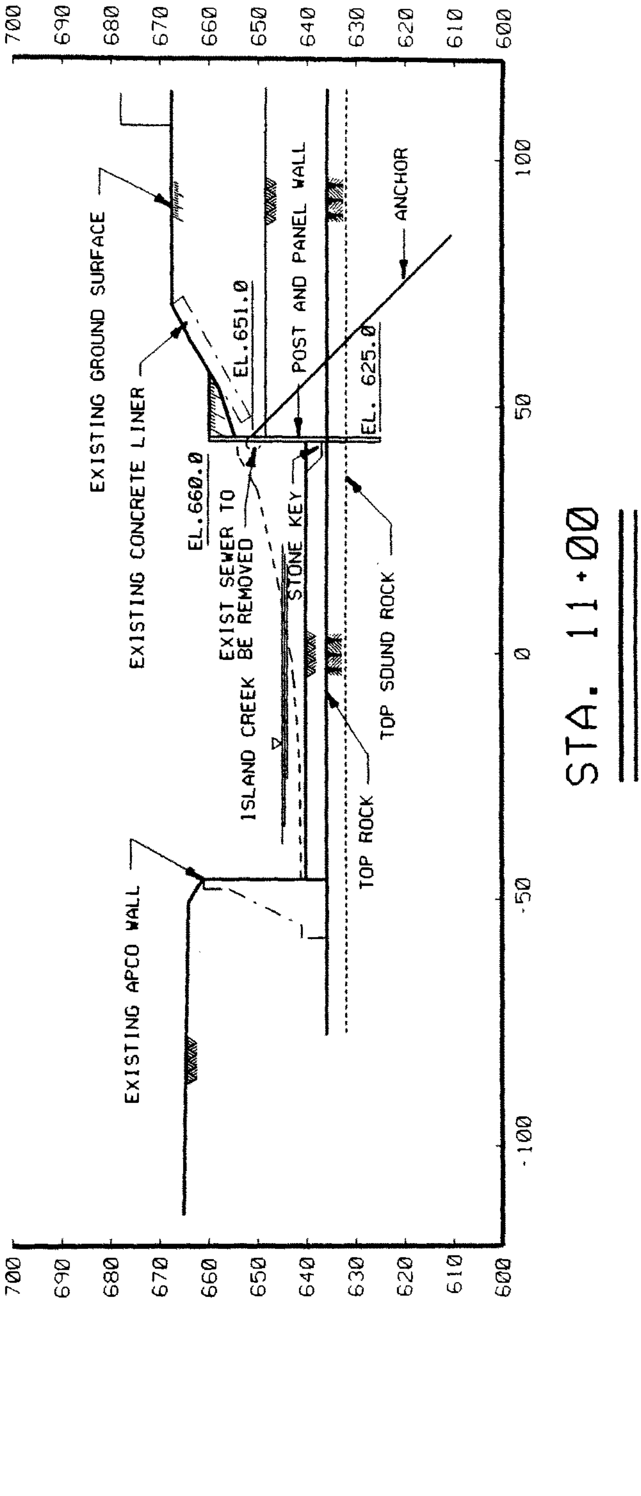
MAT.	γ_m lb/ft³	γ_s lb/ft³	C lb/ft²	ϕ °	S_a lb/in³
1	110	140	0	28	3.0
2	110	130	0	28	3.0
3	114	129	0	32	5.8



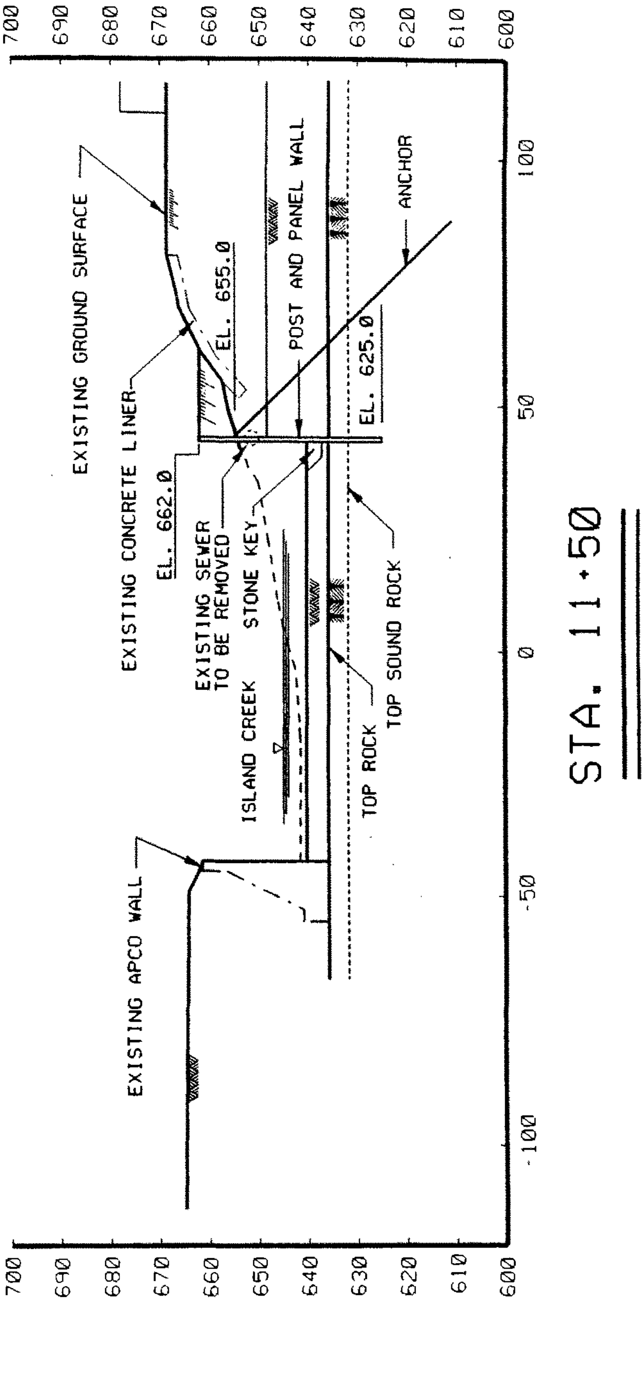
STA. 10+00

SCALE: 1" = 30'

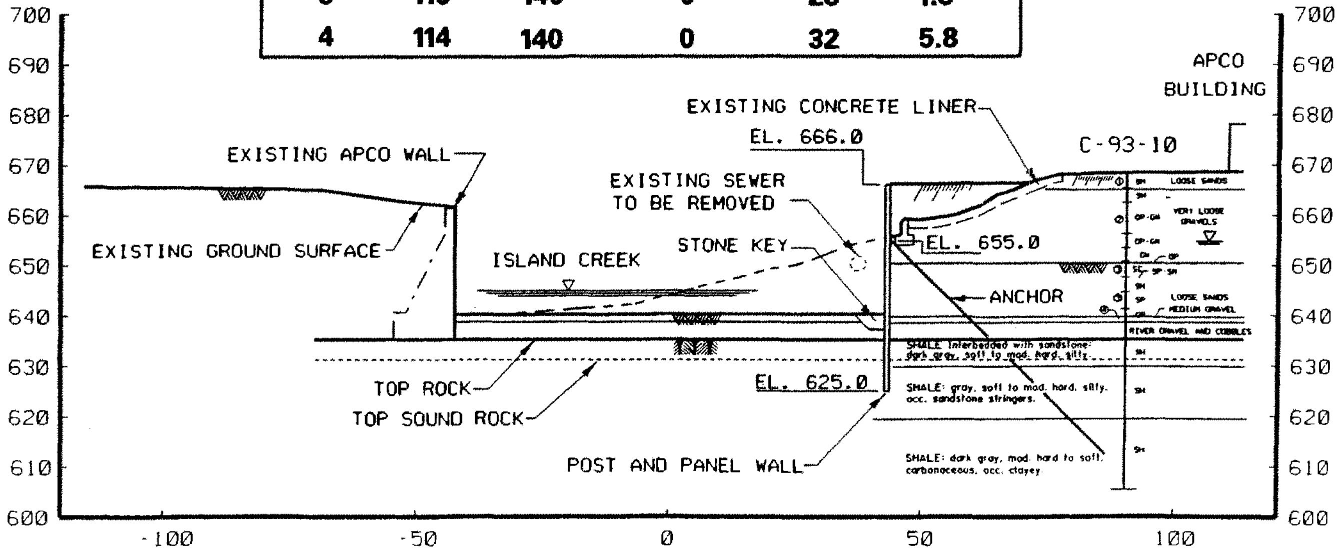

APCO
LOOSE SANDS
VERY LOOSE SANDS AND GRAVELS
MEDIUM SANDS AND GRAVELS
SHALE: gray, mod. hard to soft, silty, occ. sandstone stringers.
ANCHOR
EXISTING GROUND SURFACE
C-90-3
EL. 655.0
EL. 625.0
EXISTING CONCRETE LINER
EL. 662.0
EXISTING SEWER
TO BE REMOVED
STONE KEY
ISLAND CREEK
TOP ROCK
TOP WEATHERED ROCK
POST AND PANEL
WALL
EXISTING APCO WALL
STA. 10+50
SCALE: 1"=30'



700
690
680
670
660
650
640
630
620
610
600
100
50
0
-50
-100
EXISTING GROUND SURFACE
EXISTING CONCRETE LINER
EL. 660.0
EXIST SEWER TO BE REMOVED
EL. 651.0
STONE KEY
POST AND PANEL WALL
ISLAND CREEK
ANCHOR
EL. 625.0
TOP SOUND ROCK
TOP ROCK
EXISTING APCO WALL
STA. 11+00
SCALE: 1"=30'

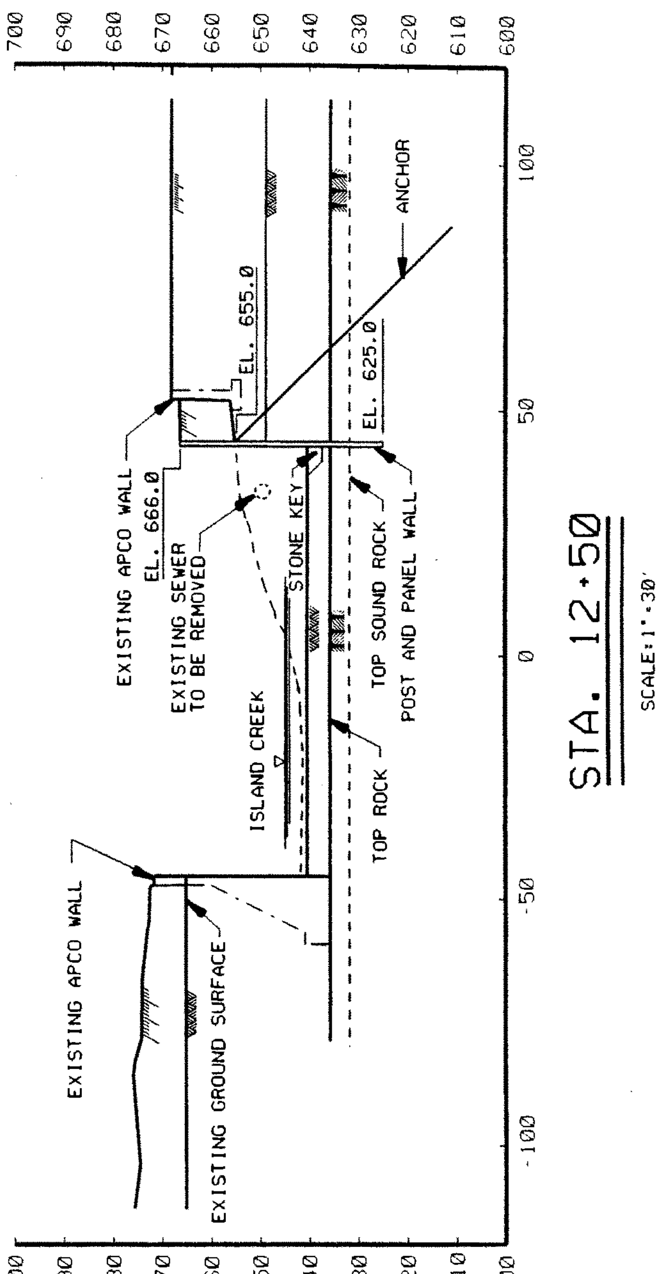

EXISTING GROUND SURFACE
EXISTING CONCRETE LINER
EL. 655.0
POST AND PANEL WALL
ANCHOR
EL. 625.0
EL. 662.0
EXISTING SEWER TO BE REMOVED
STONE KEY
TOP SOUND ROCK
ISLAND CREEK
TOP ROCK
EXISTING APCO WALL
700 690 680 670 660 650 640 630 620 610 600
100 50 0 -50 -100
STA. 11+50
SCALE: 1"=30'

MAT.	γ_m lb/ft³	γ_s lb/ft³	C lb/ft²	Ø°	S_a lb/in³
1	110	126	0	28	3.0
2	110	130	0	28	1.8
3	110	140	0	28	1.8
4	114	140	0	32	5.8

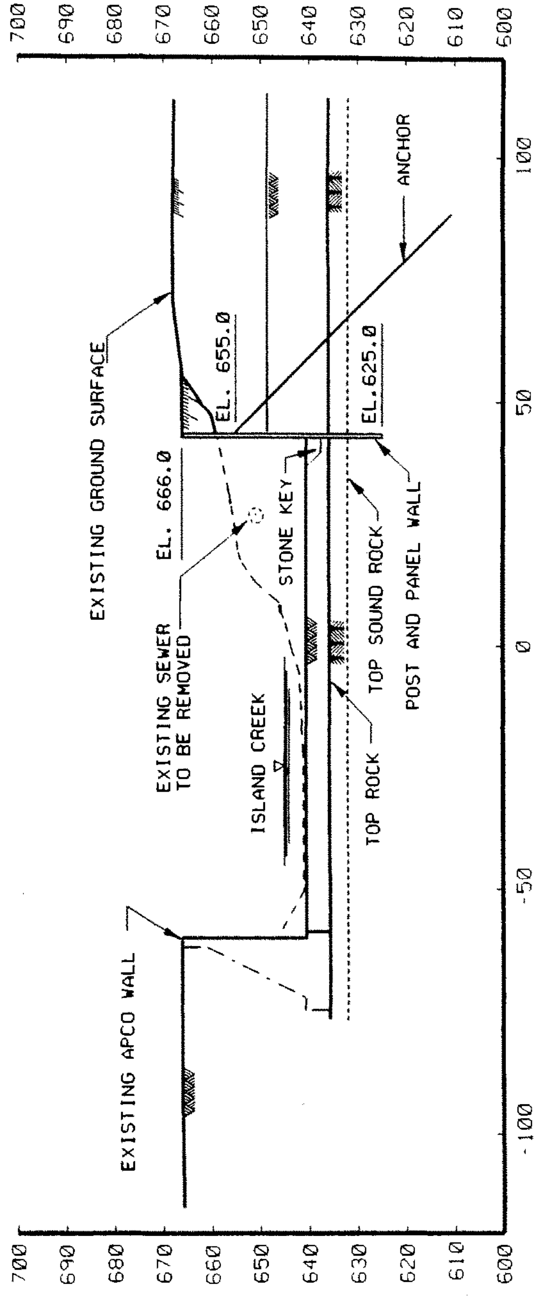


STA. 12+00

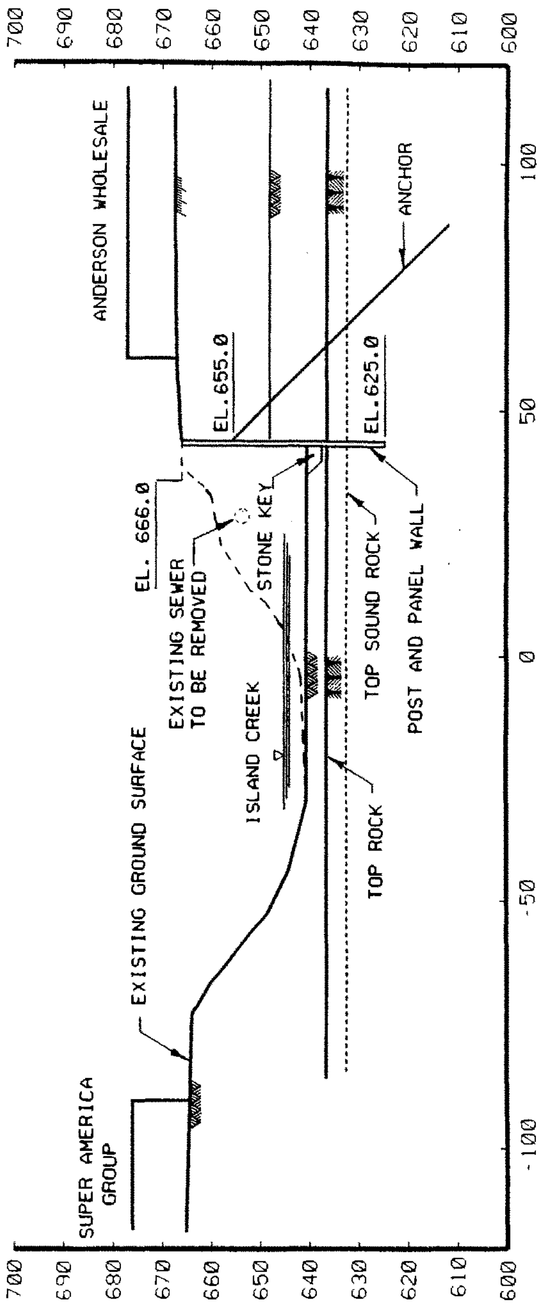
SCALE: 1" = 30'



EXISTING APCO WALL
EL. 666.0
EXISTING SEWER
TO BE REMOVED
EL. 655.0
ANCHOR
EL. 625.0
STONE KEY
TOP SOUND ROCK
POST AND PANEL WALL
ISLAND CREEK
TOP ROCK
EXISTING APCO WALL
EXISTING GROUND SURFACE
700
690
680
670
660
650
640
630
620
610
600
100
50
0
-50
-100
STA. 12+50
SCALE: 1" = 30'

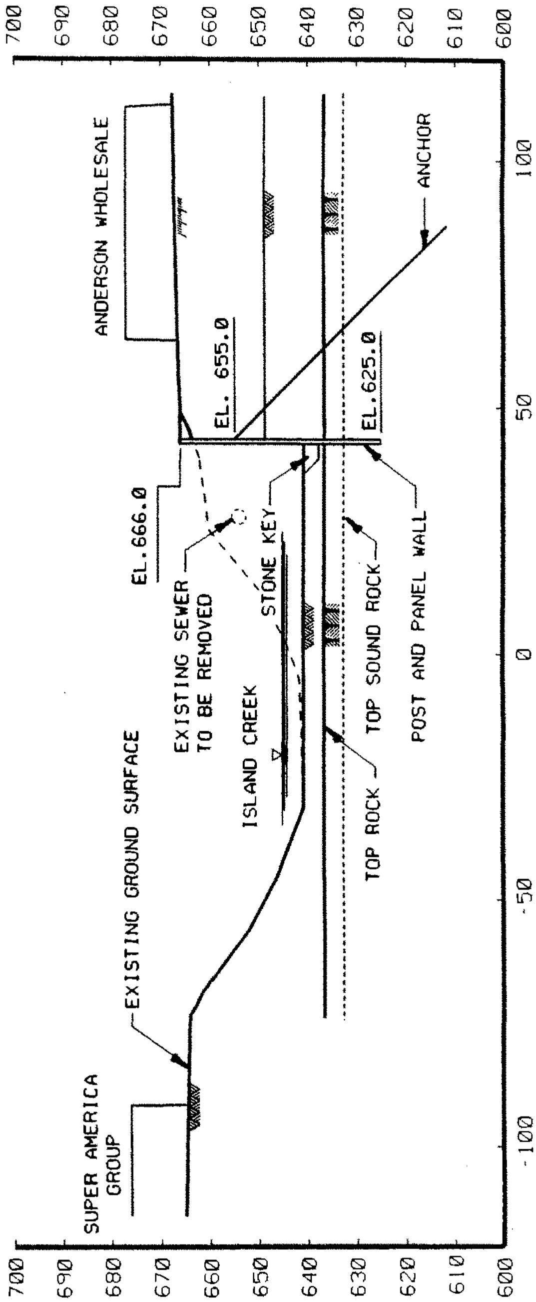

700
690
680
670
660
650
640
630
620
610
600
100
50
0
-50
-100
EXISTING GROUND SURFACE
EL. 666.0
EL. 655.0
EL. 625.0
ANCHOR
STONE KEY
EXISTING SEWER TO BE REMOVED
ISLAND CREEK
TOP SOUND ROCK
POST AND PANEL WALL
TOP ROCK
EXISTING APCO WALL

STA. 13+00



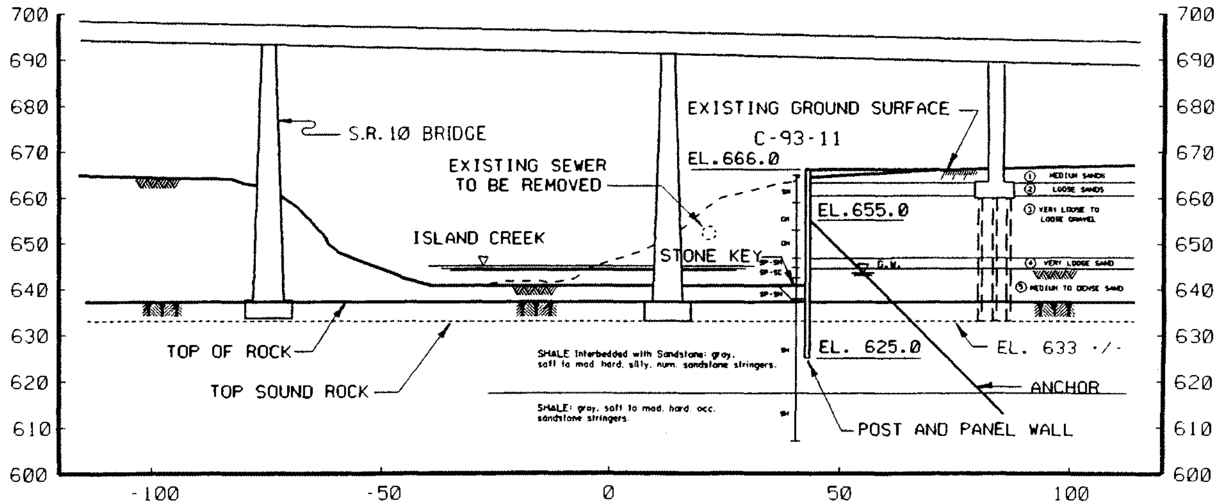
STA. 13+50

SCALE: 1"=30'


ANDERSON WHOLESALE
ANCHOR
EL. 655.0
EL. 625.0
EL. 666.0
EXISTING SEWER
TO BE REMOVED
STONE KEY
TOP SOUND ROCK
POST AND PANEL WALL
ISLAND CREEK
TOP ROCK
EXISTING GROUND SURFACE
SUPER AMERICA
GROUP
700
690
680
670
660
650
640
630
620
610
600
100
50
0
-50
-100

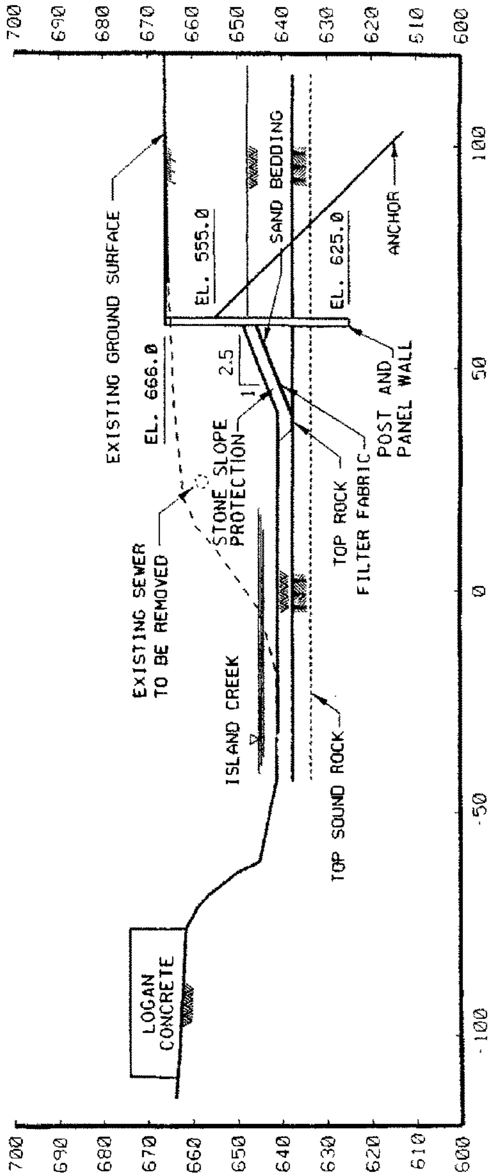
STA. 14+00

MAT.	γ_m lb/ft^3	γ_s lb/ft^3	C lb/ft^2	ϕ^0	S_a lb/in^3
1	114	140	0	32	9.3
2	110	140	0	28	3.0
3	110	130	0	28	3.0
4	110	120	0	28	3.0
5	114	140	0	32	5.8



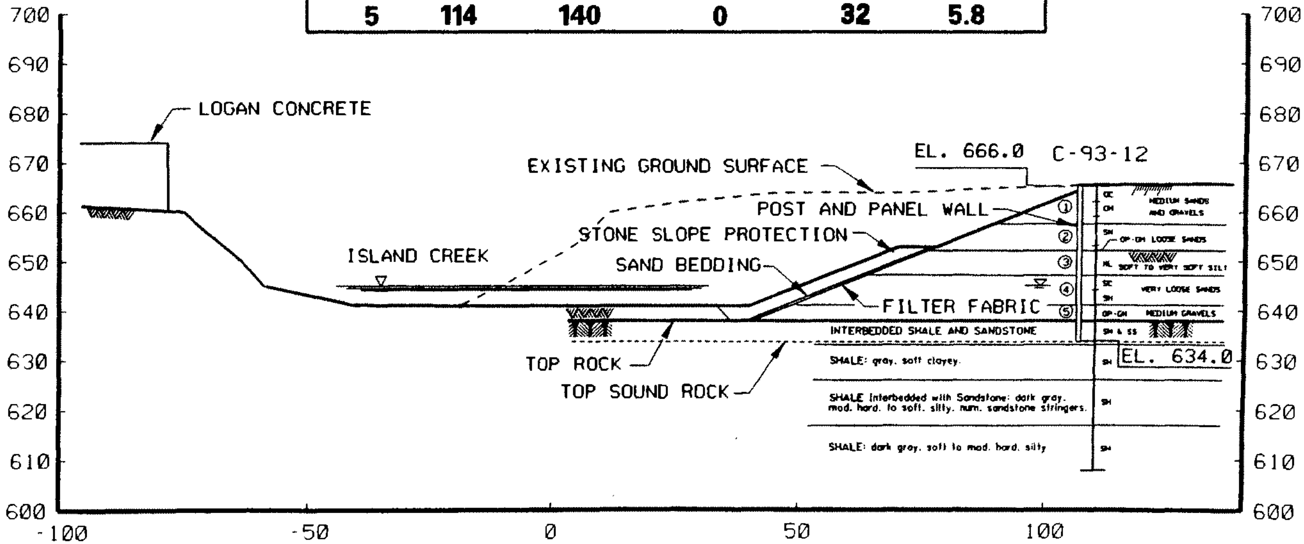
STA. 14+50

SCALE: 1" = 30'


EXISTING GROUND SURFACE
EL. 666.0
EL. 555.0
SAND BEDDING
EL. 625.0
ANCHOR
2.5
1
POST AND
PANEL WALL
STONE SLOPE
PROTECTION
TOP ROCK
FILTER FABRIC
EXISTING SEWER
TO BE REMOVED
ISLAND CREEK
TOP SOUND ROCK
LOGAN
CONCRETE
700
690
680
670
660
650
640
630
620
610
600
100
50
0
-50
-100

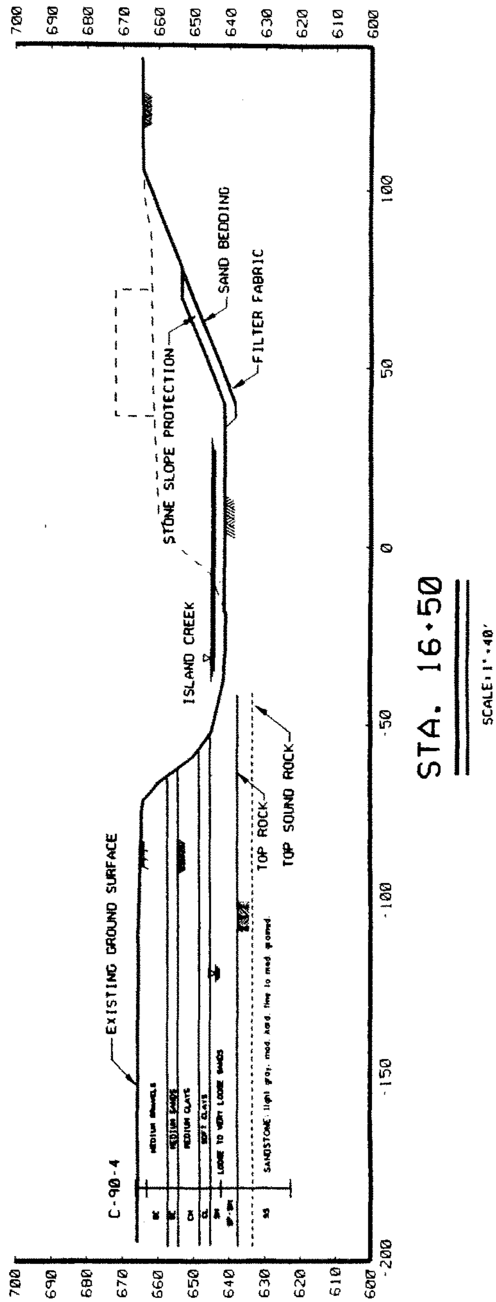
STA. 15+00

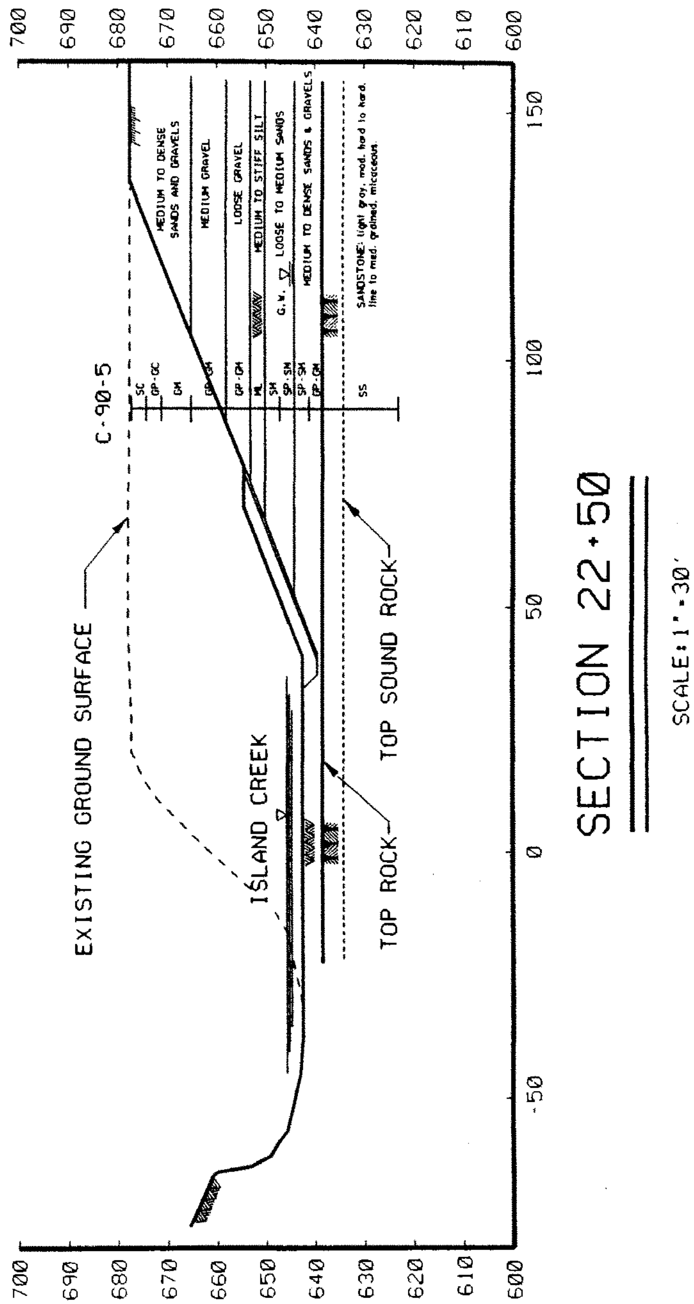
MAT.	γ_m lb/ft³	γ_s lb/ft³	C lb/ft²	Ø °	S_a lb/in³
1	114	140	0	32	9.3
2	110	140	0	28	3.0
3	116	130	0	30	50
4	110	120	0	28	1.8
5	114	140	0	32	5.8



STA. 15+50

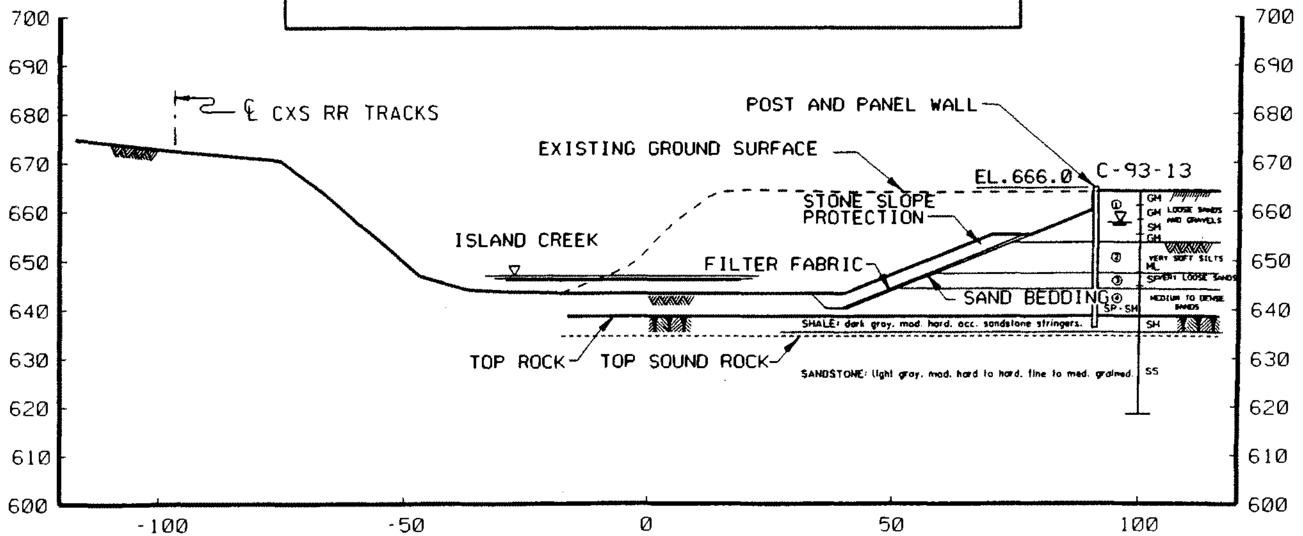
SCALE: 1" = 30'


EXISTING GROUND SURFACE
C-90-4
TOP ROCK
TOP SOUND ROCK
ISLAND CREEK
STONE SLOPE PROTECTION
SAND BEDDING
FILTER FABRIC
STA. 16+50
SCALE: 1"=40'



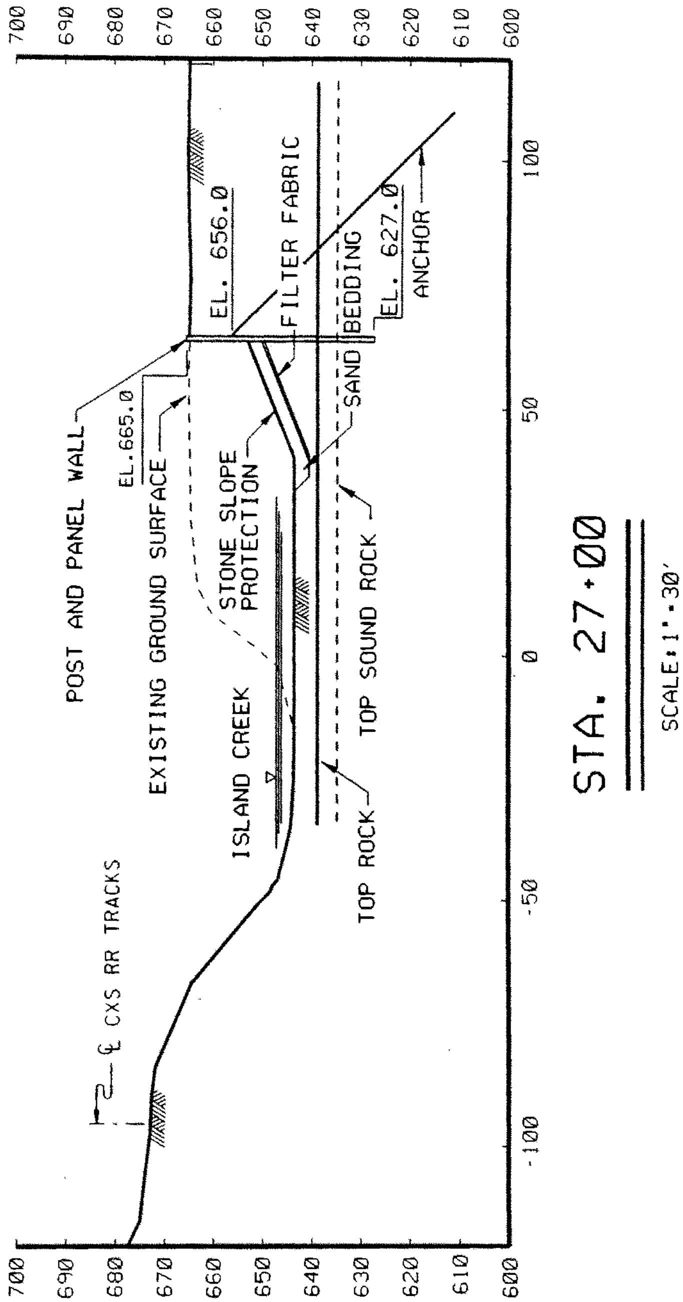
EXISTING GROUND SURFACE
C-90-5
ISLAND CREEK
TOP ROCK
TOP SOUND ROCK
MEDIUM TO DENSE SANDS AND GRAVELS
MEDIUM GRAVEL
LOOSE GRAVEL
MEDIUM TO STIFF SILT
G.W. LOOSE TO MEDIUM SANDS
MEDIUM TO DENSE SANDS & GRAVELS
SANDSTONE: light gray, mod. hard to hard, fine to med. grained, micaceous.
SC
GP-GC
GM
GP-GM
GP-GM
ML
SM
SP-SM
SP-SM
GP-GM
SS
SECTION 22+50
SCALE: 1"=30'

MAT.	γ_m lb/ft^3	γ_s lb/ft^3	C lb/ft^2	ø^0	S_a lb/in^3
1	110	130	0	28	1.8
2	116	120	0	30	1.8
3	110	120	0	28	1.8
4	114	130	0	32	5.8



STA. 26+50

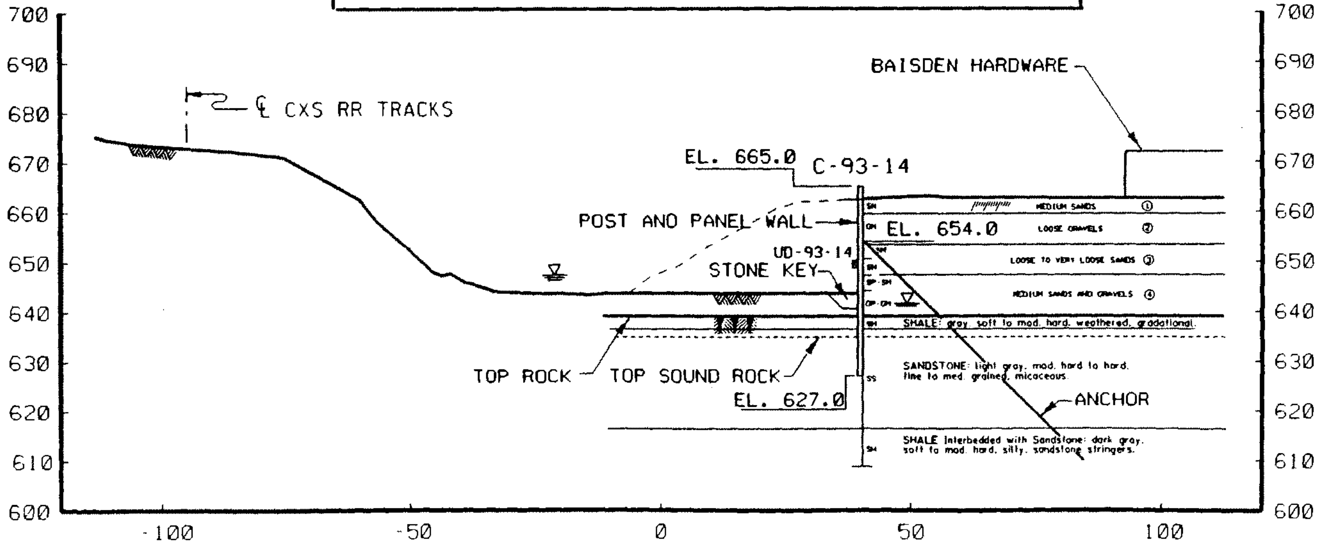
SCALE: 1" = 30'



STA. 27+00

SCALE: 1" = 30'

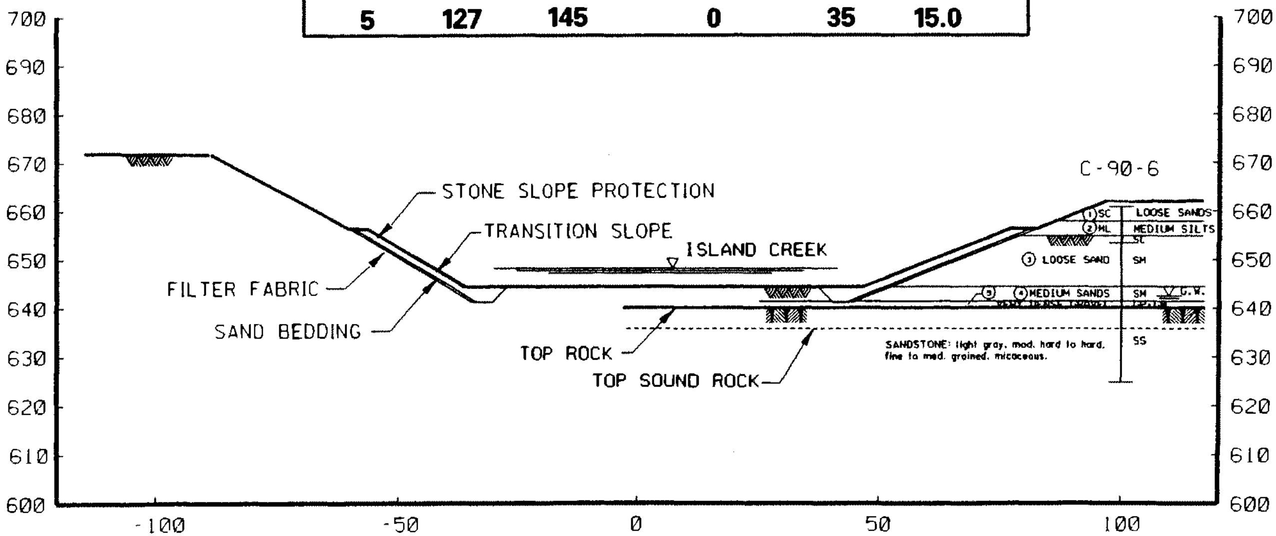
MAT.	γ_m lb/ft^3	γ_s lb/ft^3	C lb/ft^2	Ø°	S_a lb/in^3
1	114	140	0	32	9.3
2	110	145	0	28	3.0
3	110	130	0	28	3.0
4	114	140	0	32	5.8



STA. 28+00

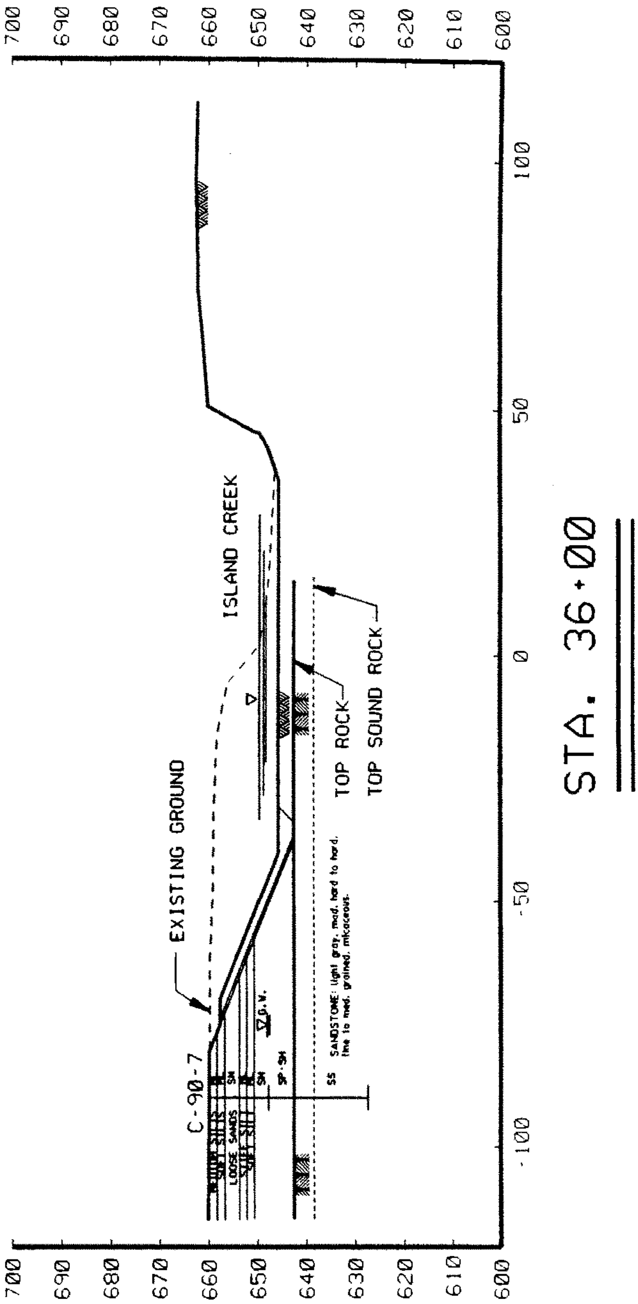
SCALE: 1"=30'

MAT.	γ_m lb/ft³	γ_s lb/ft³	C lb/ft²	ϕ^0	S_a lb/in³
1	110	130	0	28	3.0
2	116	125	0	30	85
3	110	130	0	28	3.0
4	114	125	0	32	5.8
5	127	145	0	35	15.0



STA. 30+50

SCALE: 1"=30'


STA. 36+00
EXISTING GROUND
ISLAND CREEK
TOP ROCK
TOP SOUND ROCK
C-90-7
SANDSTONE: Light gray, med. hard to hard, fine to med. grained, micaceous.
700
690
680
670
660
650
640
630
620
610
600
100
50
0
-50
-100

ISLAND CREEK

LOCAL PROTECTION PROJECT

ENGINEERING TECHNICAL APPENDIX

TO THE

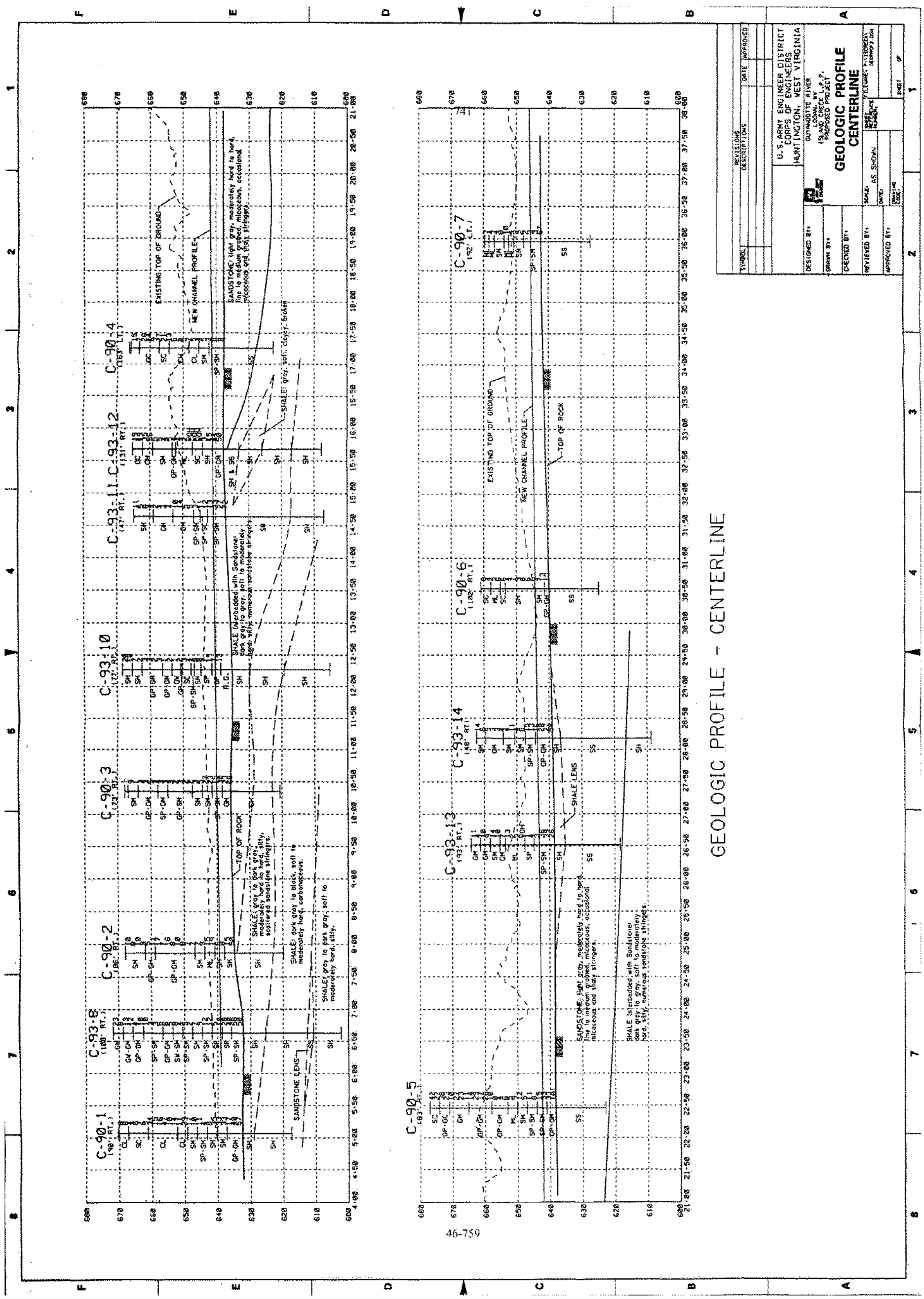
GENERAL REEVALUATION REPORT

TAB IV

GEOTECHNICAL

SECTION F - GEOLOGIC PROFILE

Department of the Army
Huntington District, Corps of Engineers
Huntington, West Virginia


GEOLOGIC PROFILE - CENTERLINE
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
GEOLOGIC PROFILE
CENTERLINE
46-759

ISLAND CREEK

LOCAL PROTECTION PROJECT

ENGINEERING TECHNICAL APPENDIX

TO THE

GENERAL REEVALUATION REPORT

TAB V

REAL ESTATE PLAN

Department of the Army
Huntington District, Corps of Engineers
Huntington, West Virginia

Island Creek Local Protection Project
Logan, West Virginia

REAL ESTATE PLAN
(REP)
ISLAND CREEK, LPP
LOGAN, WEST VIRGINIA

CONTENTS

EXHIBITS

ENCLOSURES

TAB V
REAL ESTATE PLAN
(REP)
ISLAND CREEK, L. P. P.
LOGAN, WEST VIRGINIA

1. PURPOSE: The purpose of this Real Estate Plan (REP) is to cover the lands included within the Island Creek Local Protection Project (LPP) General Reevaluation Report, Logan, West Virginia. This report is limited to land requirements for the construction, operation, and maintenance of the proposed channel improvement, the associated spoil area and the proposed Flood Warning System. This report has been prepared in accordance with Chapter 12, ER 405-1-12, and is being submitted as TAB V of the Engineering Technical Appendix for review and approval. This plan is to be considered tentative in nature and for planning purposes only. Both the Final Real Property Acquisition Line and the estimated costs are subject to change, even after this report is approved.

2. GENERAL DESCRIPTION OF AREA: The proposed project area is located at the confluence of Island Creek and the Guyandotte River, within the city limits of Logan, West Virginia. The project consists of widening the channel of Island Creek from its confluence with the Guyandotte River, upstream for approximately 0.7 miles. There are 93 tracts, containing about 125 acres involved in this report. The enclosed maps are designated Exhibit A and Exhibit B. Exhibit A shows the Channel Improvement area. Exhibit B shows the required spoil area.

3. PROJECT AUTHORIZATION: The Island Creek Local Protection Project was authorized by Section 401 of the Water Resources Development Act of 1986 (Public Law 99-662) dated 17 November 1986.

4. GOVERNMENT OR SPONSOR-OWNED LAND: There is no known Government or sponsor-owned land within the project area.

5. FACILITIES TO BE RELOCATED: Construction of the proposed channel improvement will affect facilities owned by Pure Water Company of Logan, Allegheny Power Company, City of Logan, American Electric Power Company, CSX Railroad, West Virginia Department of Highways, and Verizon. Plans for the relocation or adjustment of bridges and sections of water, gas, sewer, power and telephone lines are based on field investigations of the project area and utility maps provided by the companies. The Logan County Commission, as the proposed sponsor, will be responsible for all relocations and adjustments to the facilities as part of LERRDs. Where utility companies are vested with a compensable interest, the sponsor will receive a LERRD credit for the cost of relocating the utilities. Where no compensable interest exists and the sponsor can compel the utilities to relocate at their own cost, no LERRDs credit will be allowed. It is anticipated that the sponsor will request the assistance of the Government in accomplishing relocations. It will be necessary for the Government to enter into a Memorandum of Agreement for this work. Preliminary Attorney's Opinions of Compensability have been completed. These investigations preliminarily indicate that a compensable interest exists in these facilities. Any conclusion or categorization contained in this report that an item is a utility of facility relocation to be performed by the non-federal sponsor as part of its LERRD responsibilities is preliminary only. The Government will make a final determination of the relocations necessary for the construction, operation, and maintenance of the project after further analysis and completion and approval of the Final Attorney's Opinions of Compensability for each of the impacted utilities and facilities. There are no known cemeteries in the area of this project. This project does not constitute a town relocation.

6. ACQUISITION CRITERIA:

a. Acquisition of lands, easements, rights-of-ways, relocations and disposal lands (LERRD) is the responsibility of the non-Federal sponsor. For this project, the proposed sponsor is the Logan County Commission (Commission). A Sponsor Capability Assessment Checklist has been completed and is attached at the end of this appendix. In coordination with the Sponsor it has been determined that the Sponsor currently lacks the ability to meet project schedules. This is due to their staffing size, contract support limitations and the extent of this project. The project schedules are driven by a desire to provide flood protection at the earliest practical date and to avoid cost growth in the project due to inflation over time. It is anticipated that the sponsor will request the Corps to accomplish acquisitions of all necessary interests in lands on their behalf. Following execution of the Project Cooperation Agreement, a Memorandum of Agreement will be entered into between the Corps and the Commission that will specify the details of this acquisition service. Generally, all project lands will be acquired in the name of the Commission, with the exception of lands acquired through condemnation proceedings. The Corps will initiate condemnation with title taken in the name of the Government. Title will be quitclaimed to the Commission at the earliest practical date.

b. The proposed acquisition limits shown on Exhibits A and B conform to currently identified construction, operation, and maintenance requirements. The required area is comprised of 93 tracts, containing approximately 125 acres.

c. It is proposed to acquire the standard fee and easement estates, as set forth in Chapter 5 of ER 405-1-12. Perpetual channel improvement easements will be acquired for most of project area. Additionally, temporary work area easements, a perpetual pipeline easement, and perpetual access road easements are also required. It is proposed to acquire mineral easements within the CWL to protect the integrity of the project. The estimated cost to acquire these mineral easements is $25,000, which includes contingencies and administrative costs. One tract to be utilized for spoil area is proposed to be acquired in fee less minerals. This tract is required for both construction and O&M. Mineral interests are not proposed to be acquired in the spoil area, as the outstanding mineral interests will not affect the construction, operation, or maintenance of the project. Minable coal in the area of this site has already been extracted by deep mine techniques. The supporting pillars were removed during mining. This virtually excludes any further extraction potential. Oil and gas production in the area of this site has been minimal. There is a slight chance that gas exploration in the area of this site may take place at sometime in the future however, even if that were to occur it would not effect future O&M uses of this site, including the tree and grass species which will be planted to replace lost habitat along the Island Creek Channel. The tabulation below shows the breakout by estate, tracts involved, and acres.

ESTATE	**TRACTS**	**ACRES**
Fee (less minerals)	1	105
Perp. Channel Improv. Ease.	66	17
Perp. Access Road Ease.	9	.5
Perp. Pipeline Ease.	1	1
Temp. Work Area Ease.	16	2
TOTAL	**93**	**125**

d. In addition to the channel improvements a flood warning system is also proposed. Real estate requirements are limited to the installation of ten new stream/rain gage stations. The locations of these gages are shown in the table following this paragraph. In all cases these gages are to be placed on State highway bridges. It is proposed that the sponsor would obtain permits from the West Virginia Department of Highways (WVDOH) for these gages. This is considered the only practical approach in that the State's rights are dominant over the County's in any acquisition scenario. Risk to the Government investment is considered negligible due to the fact that this is the standard practice for placement of this type of equipment and the fact that the equipment can be moved should bridge replacement or repair ever be required. Cost for any future moves or modifications are an O&M responsibility of the Sponsor. The estimated administrative cost for obtaining the permits is included in the real estate cost estimate. No land payment amounts are expected or included in the estimate.

IFLOWS RIVER GAGE INSTALLATION LOCATIONS			
LOCATION	LATITUDE	LONGITUDE	ELEVATION
Guyandotte River @ Logan, WV*	37°50′ 32″	81° 58′ 37″	640.49″
Island Creek @ Shamrock	37°48′12″	81°58′58″	
Island Creek above Rossmore, WV	37°46′01″	81°59′19″	
Island Creek @ Chauncey, WV	37°45′33″	81°59′49″	
Island Creek @ Omar, WV	37°50′10″	82°01′43″	
Copperas Mine Fork @ Cora, WV	37°49′41″	82°02′52″	
Copperas Mine Fork @ Trace Junction	37°49′30″	82°03′36″	
Copperas Mine Fork @ Holden, WV	37°49′23″	82°03′33″	
Trace Fork @ Holden, WV	37°50′47″	82°50′47″	
Mud Fork @ Hedgeview	37°50′32″	81°58′34″	
New sites are located at highway bridges maintained by the State of West Virginia Department of Highways			

7. NAVIGATIONAL SERVITUDE: The issue of Navigational servitude is not applicable to this channel improvement project as Island Creek is non-navigable.

8. P.L. 91-646 RELOCATION DATA: Public Law 91-646, Title II, authorizes payment of relocation benefits to persons displaced from their homes, businesses, or farms by federal and federally-assisted programs. Those benefits comprise moving expenses and replacement housing benefits that are separate from and in addition to the acquisition payments for real property. There are no residences to be relocated as the result of this project. Relocation benefits for nonresidential displacements are limited to moving and related expenses, including search expenses and, if applicable, re-establishment expenses. Project displacement within the project area amounts to one commercial relocation, (Motel 8). The total estimated cost for relocation benefits for this motel is $50,000 including contingencies. Additionally, a property identified as Gaylock Wrecker Service occasionally stores salvaged automobiles within the temporary work area easement limits. If there are cars in this area at the time of acquisition, minimal expense may be incurred to move the cars out of the project limits during construction. This potential for an additional relocation payment expense is minimal and is covered in the real estate estimate's contingencies.

9. ENVIRONMENTAL CONSIDERATIONS:

a. HAZARDOUS, TOXIC AND RADIOACTIVE WASTE (HTRW):

(1) A Phase I HTRW (Hazardous, Toxic, and Radioactive Waste) Investigation of the study area was completed in May 1991. The Investigation consisted of a physical inspection of the study area, a research of the historical land use and ownership, and a regulatory records review. From this investigation, four Areas of Concern (AOC) were identified within the project limits.

AOC#1 This is the present site of the American Electric Power (AEP) Logan Substation located at the confluence of Island Creek and the Guyandotte River. There is a transformer storage area on the upper left descending bank adjacent to Island Creek. Potential contaminants identified in this area include PCBs.

AOC#4 This is a large vacant area with large amounts of fill material visible including metal debris, concrete rubble, auto parts, and miscellaneous construction debris. Potential contaminants identified in this area include metals and petroleum from scrap autos.

AOC#5 Baisden Brothers Hardware is located on this site. A kerosene underground storage tank (UST) is present near the rear of the hardware store adjacent to a small privately owned dog kennel. Potential contaminants identified in this area include petroleum products from the potentially leaking UST.

AOC#6 Gaylock Wrecker Service occupies this property and currently operates a salvage yard on the site. Several scrap cars and buses are present. Potential contaminants identified in this area include petroleum.

(2) Based on the findings presented in the 1991 Phase I report, in April 1992, the Nashville District (LRN), Great Lakes Ohio River Division's HTRW Design District, performed sampling and testing in these four areas in order to confirm or deny the presence of any hazardous or toxic substances within the construction work limits (CWL). LRN's report recommended further testing in some of the areas of concern based on lab analyses. However, the report did recommend eliminating one area of concern (AOC#1) based on the data collected and the excavation limits proposed for that reach of Island Creek. The report also identified a kerosene UST and a salvage yard in AOC#5 and AOC#6 respectively. The removal of the UST and scrap auto and bus bodies will be performed prior to construction and will be included as a project cost as per Division policy for petroleum contaminated media. The LRN report recommendation for the remaining area of concern (AOC#4) was to excavate and test soils for metals and petroleum contamination during the construction phase and dispose of the material accordingly.

(3) Based on the large volume of excavation required within AOC#4, in January 1993 an A-E for the Huntington District performed a Phase II investigation to determine extents of potential contamination within the CWL. A phased approach was implemented with 5 borings drilled to depths of 25-40 feet at upper bank locations along AOC#4. The borings revealed 10-15 feet of relatively clean fill over most of the area of concern. Coal, mine waste, wood fragments, and metal debris was encountered at depth. Contaminant levels for metals, semi-volatiles and volatiles, and petroleum constituents indicated that the soils in this reach could be treated as non-hazardous.

(4) Due to funding issues, the Island Creek project had been placed on hold. Recently, funds became available to restart the project. Because of the amount of time lapsed

between the 1993 HTRW investigation and the present, the project site was revisited in November 1999 by personnel from the Huntington District (LRH). The purpose of the site visit was to walk the CWL of the project to visually observe any changes in site conditions since 1993. No changes in site conditions were noted at AOCs 5 and 6. However, based upon the site visit, further investigations on AOCs 1 and 4 were warranted. In July 2000 an A-E for the Huntington District performed a Phase II HTRW investigation to determine extents of potential contamination in the two areas. A phased approach was implemented with 4 soil borings in AOC#1 and 6 additional borings drilled to depths of 40 feet at upper bank locations along AOC#4, supplementing the previous borings. The results of the Phase II investigation eliminated AOC#1 as an area of concern. The results of the Phase II investigation of AOC#4 revealed contaminant levels for metals, semi-volatiles and volatiles, and petroleum constituents indicating that the soils in this reach could be treated as non-hazardous special waste. The A-E, utilizing data from the previous Phase II, was able to define the depth and extents of soil needing removed, and reduce the amount of special waste for disposal in a state permitted landfill.

(5) The spoil site for the LPP was changed to an alternate location along State Route 73. A Phase I HTRW investigation was conducted in accordance with established ACOE HTRW policies. Based on the findings from the investigation, the spoil site was determined to contain no potential HTRW concerns, nor were any adjacent properties observed to contain any HTRW concerns that would impact the tract. Therefore, no further HTRW investigations on the spoil site are warranted at this time.

(6) In summary, no remediation of AOC#1 is necessary, and no significant amount of soil excavated during construction should require special treatment, however, car and bus bodies and scrap metal in AOC#6 may be disposed of at another local salvage yard or state permitted landfill. Some isolated pockets of surficial petroleum contamination may be present in soils in and around the area of AOC#6, and there may be a small amount of petroleum contaminated soil associated with the removal of the kerosene UST in AOC#5. These concerns will be addressed during the development of Plans and Specifications for this project, as will the excavation plan for AOC#4. Should the CWL deviate drastically from the current plan, further investigations may be warranted. In all cases HTRW investigations will be

completed and any concerns will be resolved prior to acquisition of any real estate interests.

b. STATUS OF NEPA: Currently the draft Environmental Assessment (EA) is nearing the end of the required review period. To date no significant comments have been received and it is anticipated that a Finding of No Significant Impact (FONSI) will be signed.

10. ACQUISITION ESTIMATE AND SCHEDULE: It would be planned to initiate real estate acquisitions immediately following execution of the PCA and entering into an MOA for acquisition services. The current schedule dictates that the real estate be acquired over a 42-month period. The table on the following page shows the Baseline Cost Estimate for Real Estate broken down by fiscal year and Chart of Accounts.

Island Creek LPP					10-Jan-01
TASK	**FY 2002*** 5 Tracts	**FY 2003** 40 Tracts	**FY 2004** 40 Tracts	**FY 2005**** 7 Tracts	**Totals** 93 Tracts
PROJECT PLANNING	$20,000	$2,000	$2,000	$2,000	**$26,000**
ACQUISITION	$100,000	$120,000	$120,000	$80,000	**$420,000**
CONDEMNATION	$0	$0	$10,000	$16,000	**$26,000**
APPRAISAL	$60,000	$80,000	$60,000	$4,000	**$204,000**
RELOCATIONS ASSISTANCE	$1,000	$1,000	$2,000	$5,000	**$9,000**
TEMPORARY PERMITS	$500	$500	$500	$500	**$2,000**
AUDITS	$500	$500	$500	$500	**$2,000**
ENCROACHMENTS	$0	$0	$0	$0	**$0**
DISPOSAL	$0	$0	$500	$500	**$1,000**
PROJECT RELATED ADMIN.	$60,000	$60,000	$60,000	$60,000	**$240,000**
ADMIN. SUB-TOTAL	**$242,000**	**$264,000**	**$255,500**	**$168,500**	**$930,000**
ADMIN. CONTINGENCIES	$36,300	$39,600	$38,325	$25,275	**$139,500**
ADMIN. TOTALS	**$278,300**	**$303,600**	**$293,825**	**$193,775**	**$1,069,500**
LAND PAYMENTS					
Channel CWL	$200,000	$1,400,000	$1,400,000	$603,800	**$3,603,800**
Spoil Area (fee, less minerals)	$0	$0	$245,500	$0	**$245,500**
Pipeline Easement	$1,000	$0	$0	$0	**$1,000**
91-646 PAYMENTS					
Channel CWL	$0	$0	$40,000	$0	**$40,000**
Spoil Area	$0	$0	$0	$0	**$0**
Pipeline Easement	$0	$0	$0	$0	**$0**
PAYMENTS SUBTOTAL	**$201,000**	**$1,400,000**	**$1,685,500**	**$603,800**	**$3,890,300**
PAYMENT CONTINGENCIES	$50,250	$350,000	$421,500	$150,950	**$972,700**
R - PAYMENTS TOTALS	**$251,250**	**$1,750,000**	**$2,107,000**	**$754,750**	**$4,863,000**
GRAND TOTALS	**$529,550**	**$2,053,600**	**$2,400,825**	**$948,525**	**$5,932,500**

* Assumes a December 2001 PCA Execution

** Scheduled June 2005 Real Estate Availability

CERLH-RE-A (405-10f) 7 August 2001
STEPHENS/jds/5271

MEMORANDUM FOR RECORD

SUBJECT: Assessment of the Real Estate Acquisition Capability of the County Commission of the County of Logan, West Virginia, in accordance with CERE-AP Memorandum, dated 2 May 1996, Subject: Real Estate Policy Guidance Letter No. 12 - Capability Assessments of Potential Non-Federal Sponsors of Cost-Shared Civil Works Projects

I. Legal Authority:

a. Does the sponsor have legal authority to acquire and hold title to real property for project purposes? (yes/~~no~~)

b. Does the sponsor have the power of eminent domain for this project? (yes/~~no~~)

c. Does the sponsor have "quick-take" authority for this project? (~~yes~~/**no**)

d. Are any of the lands/interests in land required for the project located outside the sponsor's political boundary? (~~yes~~/**no**)

e. Are any of the lands/interests in land required for the project owned by an entity whose property the sponsor cannot condemn? (yes/~~no~~) **The Sponsor will seek permits from the West Virginia Division of Highways (WVDOH) in lieu of obtaining an easement over WVDOH property.**

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? (yes/~~no~~)

b. If the answer to II.a. is yes, has a reasonable plan been developed to provide such training? (~~yes~~/~~no~~) **not applicable: Sponsor voiced desire to have CELRH perform the task.**

c. Does the sponsor's in-house staff have sufficient real estate acquisition experience to meet its responsibilities for the project? (~~yes~~/**no**)

d. Is the sponsor's projected in-house staffing level sufficient considering other work load, if any, and the project schedule? (~~yes~~/**no**)

e. Can the sponsor obtain contractor support, if required, in a timely fashion? (~~yes~~/**no**)

f. Will the sponsor likely request USACE assistance in acquiring real estate? (yes/~~no~~) (If yes, provide description): **Logan County Administrator Paul Hardesty stated that due to the Logan Prosecutor's small staff, the Commission believes it is unable to perform within the requisite time frame. Furthermore, contract support in the region is not readily available for this sort of endeavor. Therefore, Sponsor will request that CELRH perform the work.**

III. Other Project Variables:

a. Will the sponsor's staff be located within reasonable proximity to the project site? (<u>yes</u>/~~no~~)

b. Has the sponsor approved the project/real estate schedule/ milestones? (<u>yes</u>/~~no~~)

IV. Overall Assessment:

a. Has the sponsor performed satisfactorily on other USACE projects? (~~yes/no~~/**<u>not applicable</u>**)

b. With regard to this project, the sponsor is anticipated to be: ~~highly capable/fully capable~~/**<u>moderately capable</u>**/~~marginally capable/insufficiently capable~~. (If sponsor is believed to be insufficiently capable, provide explanation).

V. Coordination:

a. Has this assessment been coordinated with the sponsor? (<u>yes</u>/~~no~~)

b. Does the sponsor concur with this assessment? (<u>yes</u>/~~no~~) (If no, provide explanation).

Prepared by:

James D. Stephens

James Daniel Stephens
Attorney-Advisor
Condemnation/ Relocations Section

Reviewed and approved by:

William G. Graham

William G. Graham
Chief, Real Estate Division

Dated 16 July 1996

HUNTINGTON DISTRICT
REAL ESTATE
QUALITY CONTROL PLAN FOR:

CIVIL WORKS REAL ESTATE PLANNING DOCUMENTS

PROJECT: Island Creek LPP

PROJECT TEAM MEMBER: Garry Walker/Steven Shideler Realty Specialist/Chief, Planning and Control Branch
Name/Title

REAL ESTATE TECHNICAL MANAGER: Ralph W. Ackerman, Chief, Planning Section
Name/Title

REAL ESTATE BRANCH: Planning and Control Branch

OTHER REAL ESTATE TEAM MEMBERS:

CADASTRAL: Tom Baker

APPRAISAL: James Whaley

ATTORNEY/ADVISOR: ______________________

SCOPE OF PLANNING DOCUMENT:

Real Estate Appendix to the Engineering Technical Appendix for the Island Creek LPP Reevaluation Report.

The following procedures and actions will be accomplished for all Real Estate Planning Documents completed by the District:

A. EVALUATION PREPARATION:

1. A technical check of preliminary activity descriptions, cost estimates, and schedules formulated by the Real Estate Team has been completed. Cost estimates have been approved by the appropriate Branch Chiefs, and they have committed to the delivery of their respective products in accordance with the approved schedule. (Approved documentation is on file)

4-18-01
Date

Steven Shideler, Chief, Planning and Control Branch

2. A technical review of the Real Estate Section to be included in the PMP has been completed. The document is complete and has been fully coordinated.

4-18-01
Date

Steven B. Shideler, Chief, Planning & Control Br

3. Where appropriate, a technical check of local sponsor coordination and assessment has been completed. (Approved documentation is on file)

Date

N/A

4. A technical check of contractor work limits has been completed and coordinated with Engineer Division. Preliminary mapping has been completed and certified correct. Work limits adequately depict all required Real Estate. (Approved documentation is on file)

4-18-01
Date

Steven B. Shideler, Chief, Planning & Control Br

5. A technical review of gross estimate has been completed. The estimate is approved within delegated authorities and is in accordance with ER 405-1-12. (Review Appraiser's summary is on file)

4-18-01
Date

Robert R. Jeter, Chief, Appraisal Branch

6. A technical review of Replacement Housing Survey, where appropriate, is complete and was performed in conformance with P.L. 91-646 and applicable regulations. (Approved documentation is on file)

N/A

Date

7. A technical review of public facility/utility relocation study, where appropriate, has been completed and coordinated with Engineering Division. Associated costs (if any) are identified. (Approved documentation is on file)

2 MAY 2001 John Warren Cline

Date — John Warren Cline II, Chief, Acquisition Br.

8. A technical review of REP text has been completed. The document is complete, in concert with appropriate laws, regulations and guidance, has been fully coordinated within Real Estate and with other District elements, and was completed without exceeding available funding. The REP was forwarded for Independent Technical Review this date.

4-18-01

Date — Steven B. Shideler, Chief, Planning & Control Br

B. INDEPENDENT TECHNICAL REVIEW

1. Real Estate participated on the District Independent Technical Review Team or established an internal Independent Technical Review Team.

5-2-01	Ralph Ackerman
Date	Ralph Ackerman, Chief, Planning Section

2. All ITR Team comments and resolutions attached.

5-2-01	Ralph Ackerman
Date	Ralph Ackerman, Chief, Planning Section
5-2-01	
Date	Steven B. Shideler, Chief, Planning & Control Br

( ) The complexity of this project requires additional QC measures.
Additional milestones are attached.

Shideler, Steven B LRH

From: Bock, John R LRH
Sent: 01 May 2001 3:37 PM
To: Ackerman, Ralph W LRH
Cc: Shideler, Steven B LRH; Bock, John R LRH
Subject: Island Creek Response to ITR Comment

Ralph,

See below for the response to your Island Creek ITR Comment:

Comment: Relocations: The plans call for work around three bridges: Appalachian Power Company's bridge, a railroad bridge, and a highway bridge. The bridges are only generally addressed in the relocations section. Is there a need for relocations contracts with the power company, railroad and highway department for the work around and to the bridges?

Response: Yes. We currently anticipate relocations contracts with American Electric Power, the WV Department of Transportation, and CSX Transportation. Text will be added to the relocations section of the report to better describe this.

Let me know if you have any additional questions.

Thanks, John

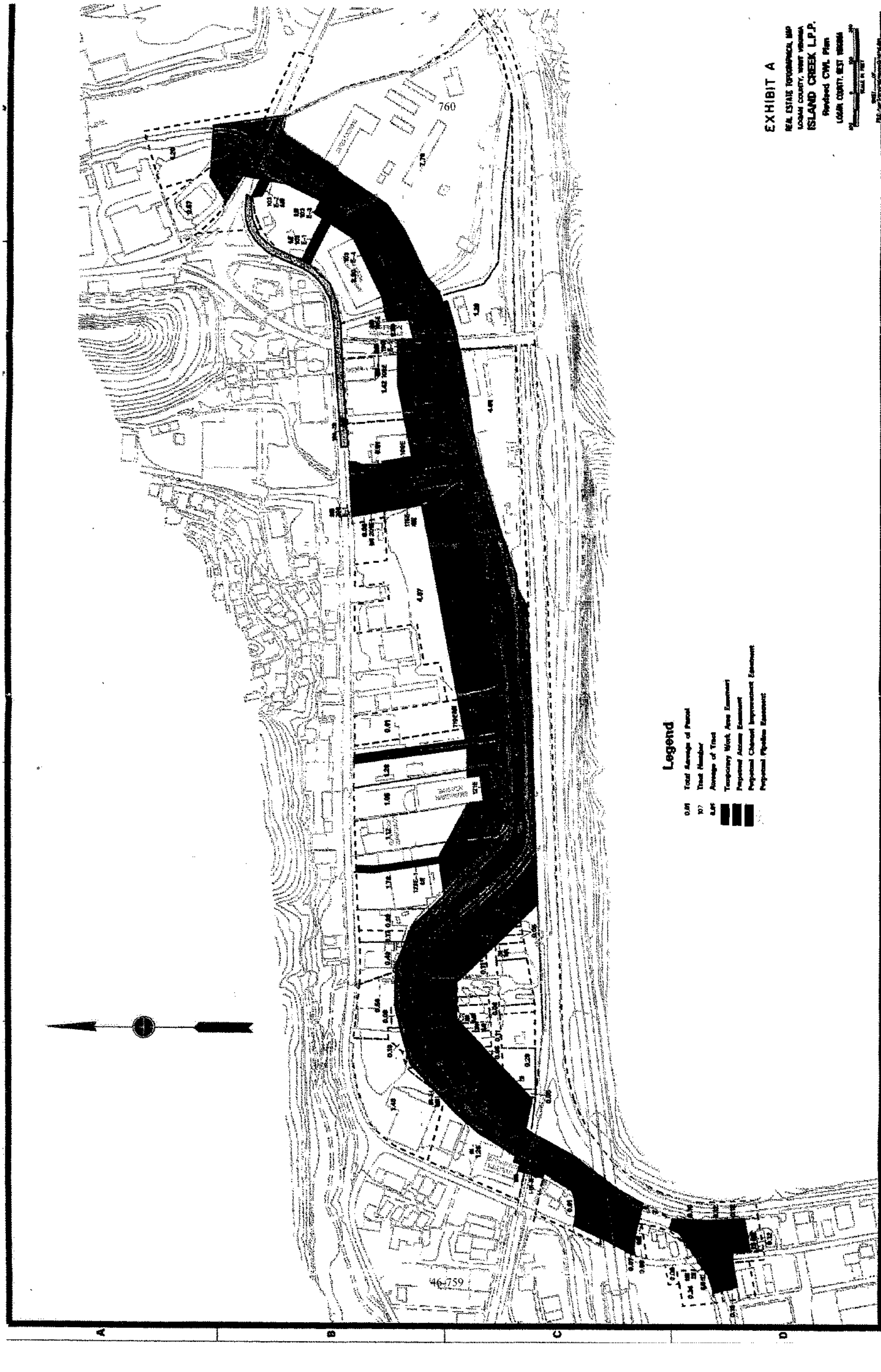
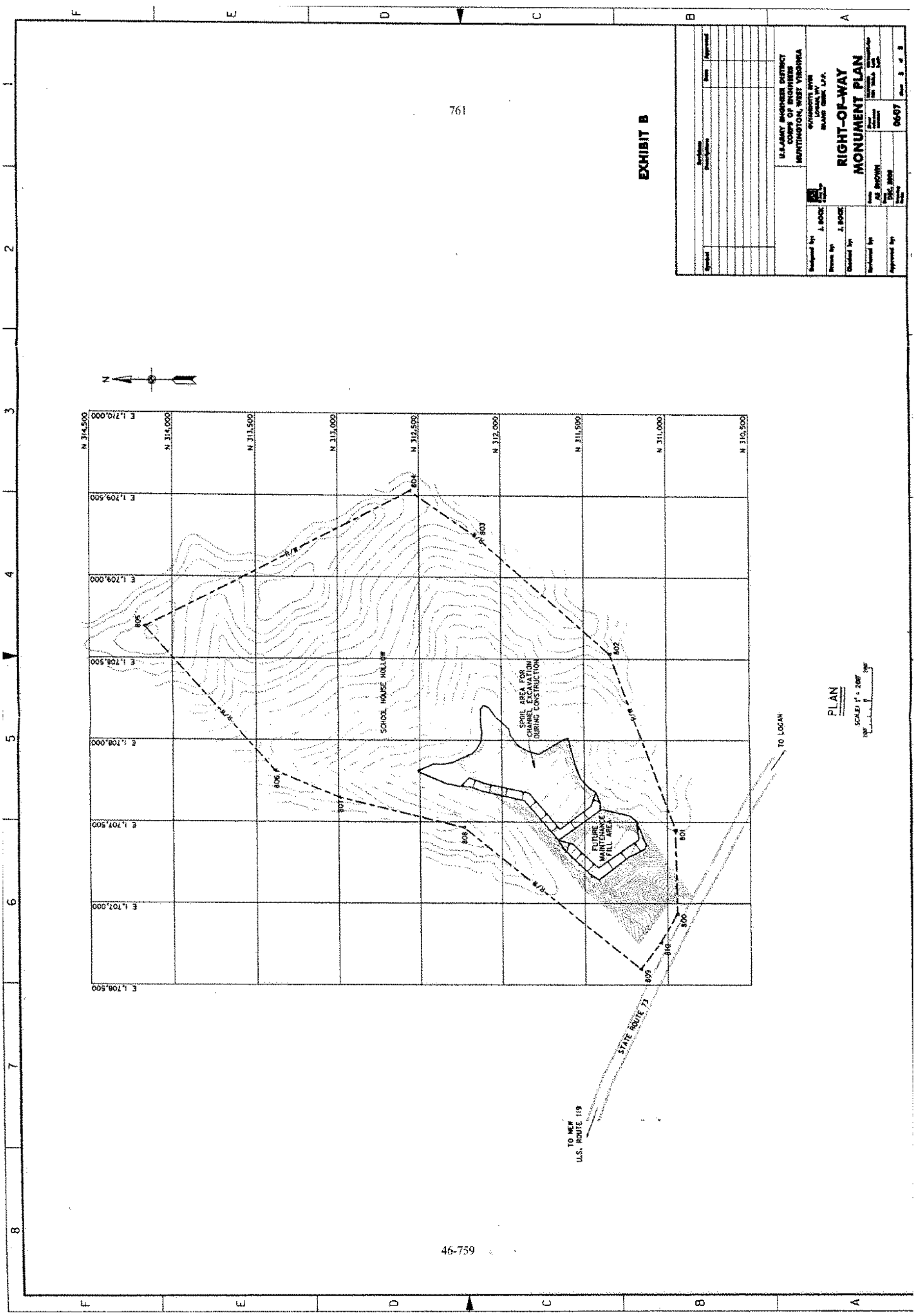


EXHIBIT A
ISLAND CREEK L.P.P.
Legend
760
46-759


761
EXHIBIT B
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
RIGHT-OF-WAY
MONUMENT PLAN
SCHOOL HOUSE HOLLOW
SPOIL AREA FOR
CHANNEL EXCAVATION
DURING CONSTRUCTION
FUTURE
MAINTENANCE
FILL AREA
PLAN
TO LOGAN
STATE ROUTE 73
TO NEW
U.S. ROUTE 119
N 314,500
N 314,000
N 313,500
N 313,000
N 312,500
N 312,000
N 311,500
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46-759

ISLAND CREEK

LOCAL PROTECTION PROJECT

ENGINEERING TECHNICAL APPENDIX

TO THE

GENERAL REEVALUATION REPORT

TAB VI

OPERATION AND MAINTENANCE

Department of the Army
Huntington District, Corps of Engineers
Huntington, West Virginia

ISLAND CREEK
LOCAL PROTECTION PROJECT

LOGAN, WEST VIRGINIA

TAB VI

OPERATION AND MAINTENANCE (OMRR & R)

1. SCOPE

a. General The proposed Island Creek Local Protection Project plan includes the channelization of approximately 0.7 miles of Island Creek at its confluence with the Guyandotte River in Logan, West Virginia. Components of the project include enlargement of the stream channel, sloping of stream banks, stabilization of stream banks with rock riprap, construction of post and panel streambank walls and removal of sand bars and debris, and clearing of streambanks. The Operation and Maintenance, Repair, Rehabilitation and Replacement Plan (OMRR & R) consists of the actions necessary to insure the functional operation and maintenance of the project for its design life.

2. OPERATION, REPAIR AND MAINTENANCE.

a. General Because of the simplicity of this Local Protection Project, operation and maintenance requirements will be primarily maintenance oriented and labor intensive. The most important feature of the Operation and Maintenance Plan will be the management of the project by the local sponsor to insure the project is properly inspected and maintained. The local sponsor must provide a Project Superintendent or Supervisor who has the responsibility and resources to insure the OMRR & R requirements outlined in the Operations and Maintenance Manual are followed and met. Since this project has no pump stations, gates or other mechanically operating components, the project will normally not require actions or manpower to operate during flooding conditions. Absence of mechanically operating features also reduces the complexity, scope and costs of project maintenance reuqirements. Access to the channel and all channel banks will be required to accomplish project maintenance.

b. Annual Maintenance Requirements. Regular, routine maintenance will be required to keep the project operational in accordance with the project design. The following regular routine maintenance actions will be required on an annual basis:

i. Three mechanical mowings each year of 3.7 acres of grassed riverbank on channel slopes.

ii. Periodic, handcut mowings (weedeater) of 5000 square feet of riverbank.

iii. Annual herbicide spraying of riprap areas to retard vegetation growth in the riprap and flush cutting of any brush, shrubs or trees that are growing in the riprap.

iv. Periodic (as required) clearing of sand bars; channel debris and channel vegetation to maintain the original project design channel cross-section.

The project sponsor will be required to provide a Project Superintendent or Supervisor, laborers, and equipment necessary to accomplish the periodic maintenance activities described above. Annual manpower and equipment costs for mowings, herbicide applications, and post and panel wall maintenance are anticipated to be limited (See paragraph 4. - Annual OMRR & R Costs).

Annual maintenance and clearing of the channel of sand bar build up, debris, and vegetation is anticipated to be the most difficult and expensive maintenance portion of this channel improvement project. The widened, flat bottomed channel is not a natural stream condition. Maintenance and clearing of the stream channel will require the project sponsor to provide dragline and/or an endloader, dump trucks, and equipment operators. A disposal site for the channel sediment will be required. In addition, other obstructions, such as fallen trees, appliances, etc., may require periodic removal to maintain the channel capacity of the original project channel design.

c. **Other**. Other annual and periodic maintenance requirements will include spot painting and concrete repair of the post and panel walls. While these are not anticipated to be significant, continued regular maintenance and prompt repair of damaged well areas is essential to the project being maintained for its project life.

For the project to be operated and maintained in accordance with the O&M manual, it is critical that the project sponsor provide the funding, manpower and resources described above.

3. **REPLACEMENT AND REHABILITATION.**

a. **General**. Because of the nature of this project design, it is not anticipated that formal replacement or rehabilitation will be required. While the riprap bank stabilization and post and panel walls are designed to last the life of the project, wall failure or washout and failure of the riprapped bank could occur. Such a failure would not prevent the project from meeting its design purpose if the project sponsor immediately repairs, rehabilitates or replaces any failed portion of the bank or wall. While the potential for bank or wall failures are small, the project sponsor should be prepared for the potential of such failure and have a contingency fund available to fund major maintenance and repairs.

4. ANNUAL OMRR & R COSTS.

a. Maintenance Costs Description. Unit prices for annual operation and maintenance costs for specific project features were developed by evaluating average annual costs for operating and maintaining flood protection projects with similar operating features and components (e.g. sand bar removal, post and panel walls, riprap and mowing). A majority of the costs associated with the operation and maintenance of the protection features are for the typical, routine, operational and maintenance activities that will be performed each year. Rehabilitation, replacement and major repairs may occur on an irregular and/or unpredictable basis and maintenance costs for these are difficult to predict. The average annual costs outlined on the attached table do not reflect costs associated with the periodic repair/rehab/replacement costs that could occur over the life of the project. Listed below is a short summary of the factors that were considered in deriving unit prices for average annual operation and maintenance costs. Certain annual operating costs are built into each price unit.

i. Average Cost of Post and Panel Wall. It is anticipated that the wall would be designed for the life of the project and rehab/replacement would not be required. Minor maintenance costs associated with the wall would include removal of trash and debris, removal of tree roots near the wall foundation, elimination of burrowing animals, and repair of cracks, crevices, or joints; painting posts and repairing concrete.

ii. Average Cost of Riprap/Acre/Year. Maintenance of riprap would require annual application of pesticides to prevent vegetation growth. Trees, woody growth, and saplings must be periodically removed. Areas of riprap may periodically fail or be damaged and must be repaired.

iii. Average Cost of Mowing/Acre/Year. Mowing costs reflect equipment acquisition, equipment maintenance and labor costs.

iv. Average Cost of Sand Bar Removal. The cost of sand bar removal will be significant compared to the other O&M costs.

b. Itemized Costs for Materials, Equipment and Labor.

i. MATERIALS AND EQUIPMENT

Approx. 5000 sq. ft. of river bank to be hand cut (Cost of trimmer, gas, line, etc.)	$ 50.00/yr.
Approx. 3.7 acres of river bank to be mowed (Cost of tractor, gas, maint. etc)	$ 1500.00/yr.
Approx. 2.0 acres of stone slope protection @ $500/ac/yr.	$ 1000.00/yr.
Approx. 1200' of post and panel wall @ $50.00/yr.	$ 50.00/yr.
Approx. 1500 cu. yd. of sand bar removal @ $8.67 per cubic yard	$13,000.00/yr.
TOTAL COST FOR MATERIALS AND EQUIPMENT	$15,600.00

ii. LABOR COSTS

WEED EAT RIVER BANK: 5000 sq. ft.	$ 50.00/yr.
RIVER BANK CUT WITH TRACTOR: 2 man days for each mowing and trimming - average 3 mowings/yr. 6 man days @ $100/man day	$ 600.00/yr.
STONE SLOPE PROTECTION: 1 man day for spraying	$ 100.00/yr.
POST AND PANEL WALL: Estimate 5 man days/yr. to spot paint and minor concrete repair @ $100/man day	$ 500.00/yr.
PROJECT SUPERVISOR AND INSPECTION COSTS (15 days @ 150.00/day)	$2250.00/yr.
TOTAL LABOR COSTS	$3500.00

iii. ESTIMATED COST OF MATERIALS, EQUIPMENT, LABOR AND MANAGEMENT $19,100.00

ISLAND CREEK

LOCAL PROTECTION PROJECT

ENGINEERING TECHNICAL APPENDIX

TO THE

GENERAL REEVALUATION REPORT

TAB VII

COST ESTIMATE

Department of the Army
Huntington District, Corps of Engineers
Huntington, West Virginia

ISLAND CREEK
LOCAL PROTECTION PROJECT
LOGAN, WEST VIRGINIA

ENGINEERING TECHNICAL APPENDIX

TO THE

GENERAL RE-EVALUATION REPORT

TAB VII

COST ESTIMATE

Department of the Army
Huntington District, Corps of Engineers
Huntington, West Virginia

January 2002

ISLAND CREEK LOCAL PROTECTION PROJECT
LOGAN, WEST VIRGINIA

BASELINE COST ESTIMATE
January 2002

TABLE OF CONTENTS

Section A

NARRATIVE

ISLAND CREEK LOCAL PROTECTION PROJECT
LOGAN, WEST VIRGINIA

BASELINE COST ESTIMATE
January 2002

1. GENERAL

A baseline cost estimate (BCE) was originally prepared in October 1993. That estimate was based on quantities prepared by CELRH-EC-DC at that time. Recent visits to the project vicinity showed that little has changed. Therefore, the engineering basis of the October 1993 BCE is considered valid.

An A-E contractor updated the October 1993 BCE cost estimate in December 1999. The project scope used for the A-E's updated cost estimate was the same as used for the October 1993 estimate. For the reevaluation report, the December 1999 cost estimate was updated to reflect the new spoil site and the disposal of HTRW contaminated soils at an approved landfill. The BCE was prepared at the October 2001 price level.

The construction cost estimate was prepared using MCACES for Windows v1.2 cost estimating software. Labor rates used in the estimate are from the latest MCACES national labor database. The *2000 RS Means Heavy Construction Cost Data* shows that West Virginia labor rates are slightly less than the national average. Equipment rates are taken from the latest MACES equipment database, based on EP 1110-1-8, *Construction Equipment Ownership and Operating Expense Schedule, Region II*. Crews and production rates for the earthwork hauling items were determined using the procedures found in the *Caterpillar Performance Handbook, Edition 24*. Crews and production rates for other items were taken from the *2000 Means Heavy Construction Cost Data*. The A-E's updated cost estimate used an older MCACES crew database. Therefore, in order to facilitate future updates of the BCE, crew ID numbers were revised to reflect the latest MCACES crew database. Material prices for the major cost items were obtained from vendors. Other material prices were taken from the *2000 Means Heavy Construction Cost Data*.

The project cost estimate used the following feature level accounts: 01 Lands & Damages, 02 Relocations, 09 Channels & Canals, 22 Feasibility Studies, 30 Engineering & Design and 31 Supervision and Administration. Title level ID numbers are taken from Appendix 8-A, ER 37-2-10, *Financial Administration, Accounting and Reporting, Civil Works Activities*.

The relative risk of each major cost item was evaluated and contingencies assigned accordingly. Section 7b, Appendix D of ER 1110-2-1302, *Civil Works Cost Engineering* was used as a guide for contingency allowances.

2. 01 LANDS & DAMAGES

Costs for lands and damages were provided by CELRH-RE. Estimated land payment costs are based on gross appraisals and include the new spoil site.

3. 02 RELOCATIONS

Costs for relocations address utilities that must be relocated to accommodate the project. Utilities to be relocated include power, telephone, water, sewer, and gas facilities. It was assumed that the project prime contractor would perform the necessary relocations of water and sewer facilities. The respective owners would relocate the remaining utilities. Estimated costs for utility relocations were updated from the October 1993 cost estimate to the 1 October 2001 price level using OMB budget factors.

4. 09 CHANNELS & CANALS

Costs for channels and canals constitute the majority of project construction costs. Principal quantities were provided by CELRH-EC-DC. Supplemental quantities were calculated using site plans provided by CELRH-EC-DC. Bank measure earthwork quantities provided by CELRH-EC-DC were used to estimate excavation costs. Bank measure quantities were modified by appropriate swell factors for estimating loading, hauling and spoiling costs. The hauling and spoil costs were based on a spoil site located in the project vicinity with an average haul distance of 0.5 mile.

Bank measure earthwork quantities for HTRW contaminated soils, modified by appropriate swell factors, were also provided by CELRH-EC-DC. This material must be disposed of in an approved landfill. The closest approved landfill is located near Charleston, West Virginia. Costs for hauling and disposal were calculated using a 70-mile, one-way haul distance. Pricing data for HTRW disposal were provided by CELRH-EC-CE. Currently, the landfill is limited to accepting 16,500 tons per month of contaminated material. This limit could impact the duration of project construction.

Costs for the environmental mitigation measures required for the project include seeding and planting trees and shrubs along the new channel and on the disposal site. The installation of stone riffles at four random locations in the new channel is also included. Quantities for mitigation features were provided by CELRH-EC-DC. Pricing data for plantings were provided by CELRH-PD-R.

Costs for a flood warning system were added under this feature account. The scope and estimated cost for this system were provided by CELRH-EC-W.

5. 22 FEASIBILITY STUDIES

Costs for prior expenditures are taken from CEFMS. Costs for post-feasibility activities are taken from the project 2101. Costs are included for the period ending 30 September 2001. No contingencies are assigned to this feature account.

6. 30 ENGINEERING & DESIGN

Costs for engineering and design were estimated using judgment. Separate costs were estimated for the major E&D activities such as geotechnical investigations, structural design, plans and specifications, etc. A 10% contingency was assigned to this feature account.

7. 31 SUPERVISION & ADMINISTRATION

Costs for supervision and administration are based on 7.5% of the total direct cost for the 02 Relocations and 09 Channels & Canals feature accounts. A 10% contingency was assigned to this feature account.

8. BASELINE COST ESTIMATE

Copies of the BCE summary sheets for the direct, owner and project costs are in Section C. The summary sheets are taken from the MCACES estimate, and costs are shown to the subfeature level. Supporting data for the BCE can be found in CELRH-EC-TC.

9. FULLY FUNDED COST ESTIMATE

A fully funded cost estimate was prepared using the current project schedule and OMB factors for construction and non-construction accounts. OMB budget factors were taken from EC 11-2-181.

The fully funded cost estimate is in Section D, and a fully funded cost distribution by FY is in Section E. Table 9.1 contains a summary of the fully funded cost estimate.

Table 9.1 - Island Creek LPP Cost Summary – Selected Plan (80B) (Fully Funded)

Feature Account	Description	Estimated Cost	Contingency	Total
01	Lands & Damages	$5,251,000	$1,210,000	$6,461,000
02	Relocations	$793,000	$360,000	$1,153,000
09	Channels & Canals	$8,958,000	$2,199,000	$11,157,000
22	Feasibility Studies	$2,200,000	$0	$2,200,000
30	Engineering & Design	$1,956,000	$196,000	$2,152,000
31	Construction Management	$621,000	$62,000	$683,000
	TOTAL COST	**$19,439,000**	**$3,926,000**	**$23,806,000**

10. ALTERNATIVE CHANNELS

Cost estimates were prepared in 1993 as part of a channel width optimization study. Estimates were prepared for 20 alternative configurations of the 60-ft wide channel, six alternative configurations of the 80-ft wide channel, and two alternative configurations of the 100-ft wide channel. The 1993 estimates were prepared using MCACES crew and equipment databases that are no longer valid. Therefore, the 1993 optimization estimates were updated to the October 2001 price level using the appropriate OMB budget factors. In order to validate the selected plan, new cost estimates were prepared for the 60E, the 80B, and the 100A channel alternatives. These were the least costly configurations for each channel width studied. Revised construction quantities for were provided by CELRH-EC-DC. Spreadsheets showing the comparison among the alternative channel configurations are included under Section F. Table 10.1 contains a comparison of total project costs for the best of the 60-ft, 80-ft and 100-ft channels.

Table 10.1 - Cost Comparison of Channel Alternatives
(Oct 01 Price Level Including Contingencies)

Feature Account	Description	Alternative 60E	Alternative 80B	Alternative 100A
01	Lands & Damages	$8,430,000	$6,120,000	$7,573,000
02	Relocations	$1,032,000	$1,032,000	$1,032,000
09	Channels & Canals	$8,746,000	$9,680,000	$11,398,000
22	Feasibility Studies	$2,200,000	$2,200,000	$2,200,000
30	Engineering & Design	$1,925,000	$1,925,000	$1,925,000
31	Construction Management	$510,000	$565,000	$659,000
	TOTAL COST	**$22,843,000**	**$21,522,000**	**$24,787,000**

All three channel alternatives include a tied-back post and panel retaining wall in the vicinity of the American Electric Power (AEP) facility near the mouth of Island Creek. The 60-ft channel includes an upstream extension. The 80-ft channel includes a tied-back post and panel wall at Baisden Hardware, while the 100-ft channel includes removal and replacement of the single-lane vehicle/pedestrian bridge at the AEP facility.

The 60-ft channel has the lowest construction cost due to decreased channel width. It has the highest real estate costs because the upstream extension requires additional tracts.

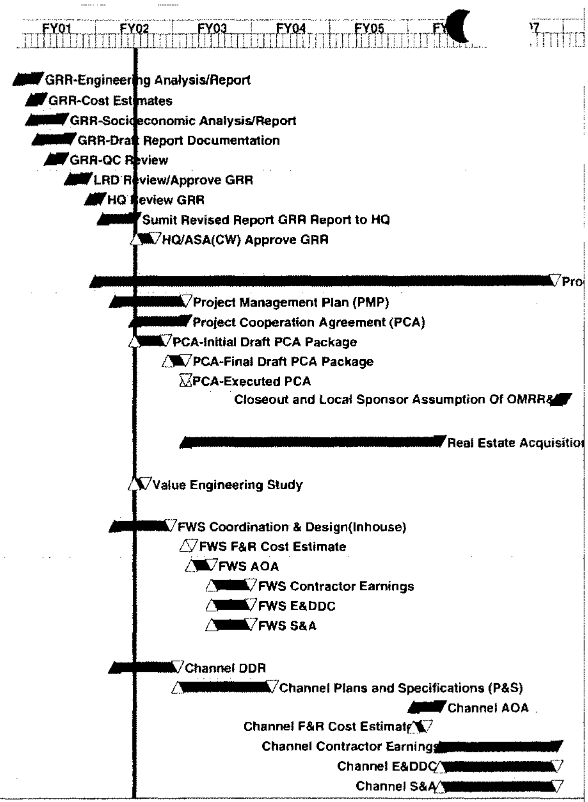
The 100-ft channel has the highest construction cost due to the increased channel width and the need to remove and replace the single-lane bridge owned by American Electric Power. Real estate costs are higher than those for the 80-ft channel due to the increased channel width.

Costs for the 02 Relocations and 30 Engineering & Design feature accounts are assumed to be the same for all three alternatives. Costs for the 31 Construction Management feature account are estimated as 7.5% of direct construction costs.

Section B

PROJECT SCHEDULE

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Ea Fin
General Reevaluation Report						
57	GRR-Engineering Analysis/Report	260	0	100	02OCT00A	29DEC00A
5	GRR-Cost Estimates	24	0	100	01DEC00A	15JAN01A
7	GRR-Socioeconomic Analysis/Report	133	0	100	01DEC00A	30APR01A
8	GRR-Draft Report Documentation	110	0	100	01JAN01A	31MAY01A
10	GRR-QC Review	44	0	100	01MAR01A	30APR01A
30	LRD Review/Approve GRR	56	0	100	01JUN01A	20AUG01A
31	HQ Review GRR	36	0	100	03SEP01A	23OCT01A
00005C	Sumit Revised Report GRR Report to HQ	112	0	100	01NOV01A	05APR02A
39	HQ/ASA(CW) Approve GRR	65	65	0	08APR02*	05JUL02
Project Management Activities						
29	Programs and Project Management Documents	1,535	1,402	0	01OCT01A	20AUG07
28	Project Management Plan (PMP)	63	171	0	02JAN02A	29NOV02
27	Project Cooperation Agreement (PCA)	171	171	0	05APR02*	29NOV02
000002	PCA-Initial Draft PCA Package	105	105	0	05APR02*	29AUG02
000008	PCA-Final Draft PCA Package	56	56	0	13SEP02	29NOV02
00000V	PCA-Executed PCA	0	0	0	02DEC02	29NOV02
00009F	Closeout and Local Sponsor Assumption Of	30	30	0	31AUG07	11OCT07
Real Estate Activities						
12	Real Estate Acquisition	848	848	0	02DEC02*	01MAR06
Value Engineering Studies						
24	Value Engineering Study	37	37	0	05APR02*	27MAY02
Flood Warning System Design & Installation						
26	FWS Coordination & Design(Inhouse)	499	121	0	02JAN02A	20SEP02
17	FWS F&R Cost Estimate	21	21	0	02DEC02*	30DEC02
15	FWS AOA	67	67	0	31DEC02	02APR03
19	FWS Contractor Earnings	129	129	0	03APR03	30SEP03
21	FWS E&DDC	129	129	0	03APR03	30SEP03
23	FWS S&A	129	129	0	03APR03	30SEP03
Channel Design & Construction						
25	Channel DDR	213	146	0	02JAN02A	25OCT02
11	Channel Plans and Specifications (P&S)	314	314	0	28OCT02*	08JAN04
14	Channel AOA	88	88	0	31OCT05	01MAR06
16	Channel F&R Cost Estimate	44	44	0	31OCT05*	29DEC05
18	Channel Contractor Earnings	391	391	0	02MAR06	30AUG07
20	Channel E&DDC	391	391	0	02MAR06	30AUG07
22	Channel S&A	391	391	0	02MAR06	30AUG07



ISLAND CREEK LPP
LOGAN, WV
PROJECT SCHEDULE

Section C

MCACES SUMMARY SHEETS

ISLAND CREEK LPP
80-Foot Wide Channel

Designed By: CELRH-EC-DC
Estimated By: CELRH-EC-TC

Prepared By: Fred E. Huff

Preparation Date: 12/07/00
Effective Date of Pricing: 10/01/00
Est Construction Time: 540 Days

Sales Tax: 6.00%

Currency in DOLLARS

DOCUMENTATION OF ESTIMATE

1. PURPOSE. This estimate will serve as the baseline cost estimate (BCE) for the Island Creek Local Protection Project. The BCE will be incorporated into the project reevaluation report which will be used to obtain project authorization. The estimate was originally prepared at the October 2000 price level. The estimate has been updated to the October 2001 price level using budget factors taken from EC 11-2-181, Army Programs, Corps of Engineers Civil Works Direct Program, Program Development Guidance, Fiscal Year 2003, March 2001.

2. SCOPE. The scope of the project includes construction of a new channel 80 feet in width over the first 0.7-mile reach of Island Creek at Logan, West Virginia. A tied-back post and panel retaining walls will be constructed in the vicinity of the American Electric Power facility.

The project will be primarily an earthwork project. About 168,000 cubic yards of material will be excavated and spoiled in the immediate vicinity of the project. An additional 11,000 cubic yards of HTRW contaminated soil will be excavated and hauled to an approved landfill near Charleston, West Virginia.

3. ASSUMPTIONS AND EXCLUSIONS. Quantities for the channel work were provided by CELRH-EC-DC. Quantities for mitigation work along the channel and at the spoil site were provided by CELRH-EC-DC and CELRH-PD-R. Pricing for trees, shrubs, lime and fertilizer was provided by CELRH-PD-R.

Labor rates used in the BCE are taken from the 1999 National labor rates MCACES database. Equipment rates are taken from the 1999 National equipment rates MCACES database. Material prices for significant cost items were obtained from vendors. Other material prices were either taken from RS Means Building Construction Cost Data or provided by others. Crews and production rates determined by the A-E contractor for the 1999 updated cost estimate were used for the BCE. Some of the A-E contractor's crews and production rates were modified based on the cost engineer's judgment.

4. TIME/COST ASSOCIATION. The project schedule calls for construction to begin the 4th Quarter of FY 2005 and require 18 months to complete. A separate, fully-funded cost estimate will be prepared.

5. CONTINGENCY DEVELOPMENT. The project is considered routine in nature. In accordance with Section 7, Appendix D, ER 1110-2-1302, Civil Works Cost Engineering, a contingency allowance of 20% was assigned to the construction feature accounts based on a design memorandum level of development and an estimated construction cost less than $10 million. Contingencies for the 01 Lands & Damages feature account were provided by CELRH-RE. A contingency allowance of 10% was used for the 30 Engineering $ Design and 31 Supervision & Administration feature accounts. Contingencies for the 02 Relocations feature account was the same as used in the October 1993 estimate.

6. SIGNIFICANT FINDINGS. None.

7. REVIEW CREDITS. Russell Craddock of CELRH-EC-TC performed a QC review of this cost estimate.

8. REFERENCES.

a. ER 1110-2-1302, Civil Works Cost Engineering.

b. Building Construction Cost Data, RS Means Company, January 2000.

Fri 05 Apr 200? Tri-Service Automated Cost ıg System (TRACES) :02:09
Eff. Date 10/0. PROJECT 80FT00: ISLAND CRE.. 80-Foot Wide Channel
BASELINE COST ES..MATE SUMMAR: rAGE 1
** PROJECT OWNER SUMMARY - Feature **

		QUANTY	UOM	CONTRACT	CONTINGN	ESCALATN	TOTAL COST	UNIT
01	LANDS & DAMAGES	1.00	EA	4,820,300	1,110,000	189,770	6,120,070	6120070
02	RELOCATIONS	1.00	EA	687,807	312,321	32,004	1,032,132	1032132
09	CHANNELS & CANALS	1.00	EA	7,530,634	1,849,315	300,158	9,680,107	9680107
22	FEASIBILITY STUDIES	1.00	EA	2,200,000	0	0	2,200,000	2200000
30	ENGINEERING & DESIGN	1.00	EA	1,750,000	175,000	0	1,925,000	1925000
31	SUPERVISION & ADMINISTRATION	1.00	EA	492,000	49,200	23,813	565,013	565013
TOTAL	ISLAND CREEK LPP	1.00	EA	17,480,741	3,495,836	545,745	21,522,321	21522321

Currency in DOLLARS

	QUANTY	UOM	CONTRACT	CONTINGN	ESCALATN	TOTAL COST	UNIT
01 LANDS & DAMAGES							
01_ A PROJECT PLANNING	1.00	EA	26,000	5,987	1,024	33,011	33011
01_ B ACQUISITIONS	1.00	EA	420,000	96,716	16,535	533,251	533251
01_ C CONDEMNATIONS	1.00	EA	26,000	5,987	1,024	33,011	33011
01_ E APPRAISALS	1.00	EA	204,000	46,976	8,031	259,008	259008
01_ F PL 91-646 ASSISTANCE	1.00	EA	9,000	2,072	354	11,427	11427
01_ G TEMPORARY PERMITS	1.00	EA	2,000	461	79	2,539	2539.29
01_ H AUDITS	1.00	EA	2,000	461	79	2,539	2539.29
01_ K DISPOSALS	1.00	EA	1,000	230	39	1,270	1269.64
01_ M PROJECT RELATED ADMIN.	1.00	EA	240,000	55,266	9,449	304,715	304715
01_ R REAL ESTATE PAYMENTS	1.00	EA	3,890,300	895,843	153,157	4,939,300	4939300
TOTAL LANDS & DAMAGES	1.00	EA	4,820,300	1,110,000	189,770	6,120,070	6120070
02 RELOCATIONS							
02_03 CEMETERIES, UTILITIES, STRUCTURE	1.00	EA	687,807	312,321	32,004	1,032,132	1032132
TOTAL RELOCATIONS	1.00	EA	687,807	312,321	32,004	1,032,132	1032132
09 CHANNELS & CANALS							
09_00 CHANNELS & CANALS	1.00	EA	7,271,298	1,817,825	290,852	9,379,975	9379975
09_01 FLOOD WARNING SYSTEM	1.00	EA	259,336	31,490	9,306	300,132	300132
TOTAL CHANNELS & CANALS	1.00	EA	7,530,634	1,849,315	300,158	9,680,107	9680107
22 FEASIBILITY STUDIES							
22_01 PRIOR EXPENDITURES	1.00	EA	1,767,000	0	0	1,767,000	1767000
22_02 FY01 ACTIVITIES	1.00	EA	433,000	0	0	433,000	433000
TOTAL FEASIBILITY STUDIES	1.00	EA	2,200,000	0	0	2,200,000	2200000
30 ENGINEERING & DESIGN							
30_01 ENGINEERING & DESIGN	1.00	EA	1,750,000	175,000	0	1,925,000	1925000
TOTAL ENGINEERING & DESIGN	1.00	EA	1,750,000	175,000	0	1,925,000	1925000
31 SUPERVISION & ADMINISTRATION							
31_01 SUPERVISION & ADMINISTRATION	1.00	EA	492,000	49,200	23,813	565,013	565013

Currency in DOLLARS

Fri 05 Apr 2002
Eff. Date 10/0.

Tri-Service Automated Cost ıg System (TRACES)
PROJECT 80FT00: ISLAND CREE. . 30-Foot Wide Channel
BASELINE COST ES..MATE
** PROJECT OWNER SUMMARY - Sub Feat **

:02:09
SUMMAR. .AGE 3

	QUANTY	UOM	CONTRACT	CONTINGN	ESCALATN	TOTAL COST	UNIT
TOTAL SUPERVISION & ADMINISTRATION	1.00	EA	492,000	49,200	23,813	565,013	565013
TOTAL ISLAND CREEK LPP	1.00	EA	17,480,741	3,495,836	545,745	21,522,321	21522321

Currency in DOLLARS

Fri 05 Apr 2002
Eff. Date 10/0.

Tri-Service Automated Cost g System (TRACES)
PROJECT 80FT00: ISLAND CRE... 0-Foot Wide Channel
BASELINE COST ES...ATE
** PROJECT INDIRECT SUMMARY - Feature **

·02:09
SUMMAR. ..GE 4

	QUANTY	UOM	DIRECT	FIELD OH	HOME OFC	PROFIT	BOND	TOTAL COST	UNIT
01 LANDS & DAMAGES	1.00	EA	4,820,300	0	0	0	0	4,820,300	4820300
02 RELOCATIONS	1.00	EA	478,000	39,775	124,555	41,696	3,781	687,807	687807
09 CHANNELS & CANALS	1.00	EA	6,084,789	491,613	328,820	561,677	63,735	7,530,634	7530634
22 FEASIBILITY STUDIES	1.00	EA	2,200,000	0	0	0	0	2,200,000	2200000
30 ENGINEERING & DESIGN	1.00	EA	1,750,000	0	0	0	0	1,750,000	1750000
31 SUPERVISION & ADMINISTRATION	1.00	EA	492,000	0	0	0	0	492,000	492000
TOTAL ISLAND CREEK LPP	1.00	EA	15,825,089	531,388	453,375	603,373	67,516	17,480,741	17480741
Contingency								3,495,836	
SUBTOTAL								20,976,577	
Escalation								545,745	
TOTAL INCL OWNER COSTS								21,522,321	

Currency in DOLLARS

ri 05 Apr 2002 Tri-Service Automated Cost g System (TRACES) 02:09
ff. Date 10/0. PROJECT 80FT00: ISLAND CREE. - 0-Foot Wide Channel
BASELINE COST ES...ATE SUMMAR. .E 5
** PROJECT INDIRECT SUMMARY - Sub Feat **

	QUANTY UOM	DIRECT	FIELD OH	HOME OFC	PROFIT	BOND	TOTAL COST	UNIT
01 LANDS & DAMAGES								
01_ A PROJECT PLANNING	1.00 EA	26,000	0	0	0	0	26,000	26000
01_ B ACQUISITIONS	1.00 EA	420,000	0	0	0	0	420,000	420000
01_ C CONDEMNATIONS	1.00 EA	26,000	0	0	0	0	26,000	26000
01_ E APPRAISALS	1.00 EA	204,000	0	0	0	0	204,000	204000
01_ F PL 91-646 ASSISTANCE	1.00 EA	9,000	0	0	0	0	9,000	9000.00
01_ G TEMPORARY PERMITS	1.00 EA	2,000	0	0	0	0	2,000	2000.00
01_ H AUDITS	1.00 EA	2,000	0	0	0	0	2,000	2000.00
01_ K DISPOSALS	1.00 EA	1,000	0	0	0	0	1,000	1000.00
01_ M PROJECT RELATED ADMIN.	1.00 EA	240,000	0	0	0	0	240,000	240000
01_ R REAL ESTATE PAYMENTS	1.00 EA	3,890,300	0	0	0	0	3,890,300	3890300
TOTAL LANDS & DAMAGES	1.00 EA	4,820,300	0	0	0	0	4,820,300	4820300
02 RELOCATIONS								
02_03 CEMETERIES, UTILITIES, STRUCTURE	1.00 EA	478,000	39,775	124,555	41,696	3,781	687,807	687807
TOTAL RELOCATIONS	1.00 EA	478,000	39,775	124,555	41,696	3,781	687,807	687807
09 CHANNELS & CANALS								
09_00 CHANNELS & CANALS	1.00 EA	5,882,337	471,368	317,685	538,294	61,614	7,271,298	7271298
09_01 FLOOD WARNING SYSTEM	1.00 EA	202,452	20,245	11,135	23,383	2,121	259,336	259336
TOTAL CHANNELS & CANALS	1.00 EA	6,084,789	491,613	328,820	561,677	63,735	7,530,634	7530634
22 FEASIBILITY STUDIES								
22_01 PRIOR EXPENDITURES	1.00 EA	1,767,000	0	0	0	0	1,767,000	1767000
22_02 FY01 ACTIVITIES	1.00 EA	433,000	0	0	0	0	433,000	433000
TOTAL FEASIBILITY STUDIES	1.00 EA	2,200,000	0	0	0	0	2,200,000	2200000
30 ENGINEERING & DESIGN								
30_01 ENGINEERING & DESIGN	1.00 EA	1,750,000	0	0	0	0	1,750,000	1750000
TOTAL ENGINEERING & DESIGN	1.00 EA	1,750,000	0	0	0	0	1,750,000	1750000
31 SUPERVISION & ADMINISTRATION								
31_01 SUPERVISION & ADMINISTRATION	1.00 EA	492,000	0	0	0	0	492,000	492000

Currency in DOLLARS

** PROJECT INDIRECT SUMMARY - Sub Feat **

	QUANTY	UOM	DIRECT	FIELD OH	HOME OFC	PROFIT	BOND	TOTAL COST	UNIT
TOTAL SUPERVISION & ADMINISTRATION	1.00	EA	492,000	0	0	0	0	492,000	492000
TOTAL ISLAND CREEK LPP	1.00	EA	15,825,089	531,388	453,375	603,373	67,516	17,480,741	17480741
Contingency								3,495,836	
SUBTOTAL								20,976,577	
Escalation								545,745	
TOTAL INCL OWNER COSTS								21,522,321	

Currency in DOLLARS

Fri 05 Apr 2002 Tri-Service Automated Cost ·g System (TRACES) :02:09
Eff. Date 10/0_ PROJECT 80FT00: ISLAND CRE.. . 30-Foot Wide Channel
BASELINE COST ESTIMATE SUMMARY PAGE 7
** PROJECT DIRECT SUMMARY - Feature **

	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
01 LANDS & DAMAGES	1.00	EA	0	0	0	0	4820300	4,820,300	4820300
02 RELOCATIONS	1.00	EA	0	0	0	0	478,000	478,000	478000
09 CHANNELS & CANALS	1.00	EA	53,346	1,714,363	1,273,711	2,134,061	962,654	6,084,789	6084789
22 FEASIBILITY STUDIES	1.00	EA	0	0	0	0	2200000	2,200,000	2200000
30 ENGINEERING & DESIGN	1.00	EA	0	0	0	0	1750000	1,750,000	1750000
31 SUPERVISION & ADMINISTRATION	1.00	EA	0	0	0	0	492,000	492,000	492000
TOTAL ISLAND CREEK LPP	1.00	EA	53,346	1,714,363	1,273,711	2,134,061	10702954	15,825,089	15825089
Prime Contractor's Field Overhead								531,388	
SUBTOTAL								16,356,477	
Prime's Home Office Expense								453,375	
SUBTOTAL								16,809,853	
Prime Contractor's Profit								603,373	
SUBTOTAL								17,413,225	
Prime Contractor's Bond								67,516	
TOTAL INCL INDIRECTS								17,480,741	
Contingency								3,495,836	
SUBTOTAL								20,976,577	
Escalation								545,745	
TOTAL INCL OWNER COSTS								21,522,321	

Currency in DOLLARS

** PROJECT DIRECT SUMMARY - Sub Feat **

	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
01 LANDS & DAMAGES									
01_ A PROJECT PLANNING	1.00	EA	0	0	0	0	26,000	26,000	26000
01_ B ACQUISITIONS	1.00	EA	0	0	0	0	420,000	420,000	420000
01_ C CONDEMNATIONS	1.00	EA	0	0	0	0	26,000	26,000	26000
01_ E APPRAISALS	1.00	EA	0	0	0	0	204,000	204,000	204000
01_ F PL 91-646 ASSISTANCE	1.00	EA	0	0	0	0	9,000	9,000	9000.00
01_ G TEMPORARY PERMITS	1.00	EA	0	0	0	0	2,000	2,000	2000.00
01_ H AUDITS	1.00	EA	0	0	0	0	2,000	2,000	2000.00
01_ K DISPOSALS	1.00	EA	0	0	0	0	1,000	1,000	1000.00
01_ M PROJECT RELATED ADMIN.	1.00	EA	0	0	0	0	240,000	240,000	240000
01_ R REAL ESTATE PAYMENTS	1.00	EA	0	0	0	0	3890300	3,890,300	3890300
TOTAL LANDS & DAMAGES	1.00	EA	0	0	0	0	4820300	4,820,300	4820300
02 RELOCATIONS									
02_03 CEMETERIES, UTILITIES, STRUCTURE	1.00	EA	0	0	0	0	478,000	478,000	478000
TOTAL RELOCATIONS	1.00	EA	0	0	0	0	478,000	478,000	478000
09 CHANNELS & CANALS									
09_00 CHANNELS & CANALS	1.00	EA	53,346	1,714,363	1,273,711	2,134,061	760,202	5,882,337	5882337
09_01 FLOOD WARNING SYSTEM	1.00	EA	0	0	0	0	202,452	202,452	202452
TOTAL CHANNELS & CANALS	1.00	EA	53,346	1,714,363	1,273,711	2,134,061	962,654	6,084,789	6084789
22 FEASIBILITY STUDIES									
22_01 PRIOR EXPENDITURES	1.00	EA	0	0	0	0	1767000	1,767,000	1767000
22_02 FY01 ACTIVITIES	1.00	EA	0	0	0	0	433,000	433,000	433000
TOTAL FEASIBILITY STUDIES	1.00	EA	0	0	0	0	2200000	2,200,000	2200000
30 ENGINEERING & DESIGN									
30_01 ENGINEERING & DESIGN	1.00	EA	0	0	0	0	1750000	1,750,000	1750000
TOTAL ENGINEERING & DESIGN	1.00	EA	0	0	0	0	1750000	1,750,000	1750000
31 SUPERVISION & ADMINISTRATION									
31_01 SUPERVISION & ADMINISTRATION	1.00	EA	0	0	0	0	492,000	492,000	492000

Currency in DOLLARS

Fri 05 Apr 2002 — Tri-Service Automated Cost System (TRACES) — 02:09
Eff. Date 10/01. — PROJECT 80FT00: ISLAND CREE.. _ 0-Foot Wide Channel
BASELINE COST ESTIMATE — SUMMARY PAGE 9
** PROJECT DIRECT SUMMARY - Sub Feat **

	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
TOTAL SUPERVISION & ADMINISTRATION	1.00	EA	0	0	0	0	492,000	492,000	492000
TOTAL ISLAND CREEK LPP	1.00	EA	53,346	1,714,363	1,273,711	2,134,061	10702954	15,825,089	15825089
Prime Contractor's Field Overhead								531,388	
SUBTOTAL								16,356,477	
Prime's Home Office Expense								453,375	
SUBTOTAL								16,809,852	
Prime Contractor's Profit								603,373	
SUBTOTAL								17,413,225	
Prime Contractor's Bond								67,516	
TOTAL INCL INDIRECTS								17,480,741	
Contingency								3,495,836	
SUBTOTAL								20,976,577	
Escalation								545,745	
TOTAL INCL OWNER COSTS								21,522,321	

Currency in DOLLARS

Section D

FULLY FUNDED COST ESTIMATE

U.S. Army Engineer District, Huntington
Island Creek LPP, Logan, WV
Baseline Cost Estimate - 60-ft Channel

Fully Funded Project Cost by Fiscal Year

ACC NO	ITEM DESCRIPTION	Pre Oct-01 Sunk Costs	Oct-01 Price Level	10/01-9/02 FY02	10/02-9/03 FY03	10/03-9/04 FY04	10/04-9/05 FY05	10/05-9/06 FY06	10/06-9/07 FY07	10/07-9/08 FY08	FULLY FUNDED
	OMB FACTOR			1.032	1.032	1.065	1.099	1.134	1.171	1.208	
01.-.	Lands & Damages	$0	$6,804,000	0	816,480	2,109,240	2,109,240	1,769,040	0	0	
	FULLY FUNDED			$0	$842,607	$2,246,341	$2,318,055	$2,006,091	$0	$0	$7,413,000
	Contingency	$0	$1,626,000	$0	195,120	504,060	504,060	422,760	0	0	
	FULLY FUNDED			$0	$201,364	$536,824	$553,962	$479,410	$0	$0	$1,772,000
	OMB FACTOR			1.032	1.032	1.065	1.099	1.134	1.171	1.208	
02.-.	Relocation	$0	$710,000	0	0	0	0	355,000	355,000	0	
	FULLY FUNDED			$0	$0	$0	$0	$402,570	$415,705	$0	$818,000
	Contingency	$0	$322,000	0	0	0	0	161,000	161,000	0	
	FULLY FUNDED			$0	$0	$0	$0	$182,574	$188,531	$0	$371,000
	OMB FACTOR			1.032	1.032	1.065	1.099	1.134	1.171	1.208	
09.-.	Channels & Canals	$0	$7,025,000	0	179,560	88,440	0	2,635,230	4,121,770	0	
	FULLY FUNDED			$0	$185,306	$94,189	$0	$2,988,351	$4,826,593	$0	$8,094,000
	Contingency	$0	$1,721,000	0	43,989	21,666	0	645,584	1,009,760	0	
	FULLY FUNDED			$0	$45,397	$23,074	$0	$732,092	$1,182,429	$0	$1,983,000
	OMB FACTOR			1.000	1.000	1.000	1.000	1.000	1.000	1.000	
22.-.	Feasibility Studies	$2,200,000	$2,200,000	0	0	0	0	0	0	0	
	FULLY FUNDED			$0	$0	$0	$0	$0	$0	$0	$2,200,000
	Contingency	$0	$0	0	0	0	0	0	0	0	
	FULLY FUNDED			$0	$0	$0	$0	$0	$0	$0	$0
	OMB FACTOR			1.044	1.039	1.081	1.128	1.177	1.228	1.281	
30.-.	Engineering & Design	$0	$1,750,000	262,500	297,500	297,500	297,500	297,500	297,500	0	
	FULLY FUNDED			$274,050	$309,103	$321,598	$335,580	$350,158	$365,330	$0	$1,956,000
	Contingency	$0	$175,000	26,250	29,750	29,750	29,750	29,750	29,750	0	
	FULLY FUNDED			$27,405	$30,910	$32,160	$33,558	$35,016	$36,533	$0	$196,000
	OMB FACTDR			1.044	1.039	1.081	1.128	1.177	1.228	1.281	
31.-.	Supervision & Administration	$0	$464,000	0	0	0	0	180,960	283,040	0	
	FULLY FUNDED			$0	$0	$0	$0	$212,990	$347,573	$0	$561,000
	Contingency	$0	$46,000	0	0	0	0	17,940	28,060	0	
	FULLY FUNDED			$0	$0	$0	$0	$21,115	$34,458	$0	$56,000
	TOTAL PROJECT COST	$ 2,200,000	$ 22,843,000	$ 301,455	$ 1,614,687	$ 3,254,186	$ 3,241,155	$ 7,410,367	$ 7,397,152	$ -	$ 25,419,002

U.S. Army Engineer District, Huntington
Island Creek LPP, Logan, WV
Baseline Cost Estimate

Fully Funded Project Cost by Fiscal Year

ACC NO	ITEM DESCRIPTION	Pre Oct-01 Sunk Costs	Oct-01 Price Level	10/01-9/02 FY02	10/02-9/03 FY03	10/03-9/04 FY04	10/04-9/05 FY05	10/05-9/06 FY06	10/06-9/07 FY07	10/07-9/08 FY08	FULLY FUNDED
	OMB FACTOR			1.032	1.032	1.065	1.099	1.134	1.171	1.208	
01.-.	Lands & Damages	$0	$4,974,000	0	578,400	1,494,200	1,494,200	1,253,200	0	0	
	FULLY FUNDED			$0	$596,909	$1,591,323	$1,642,126	$1,421,129	$0	$0	$5,251,000
	Contingency	$0	$1,146,000	$0	133,262	344,261	344,261	288,735	0	0	
	FULLY FUNDED			$0	$137,526	$366,638	$378,343	$327,425	$0	$0	$1,210,000
	OMB FACTOR			1.032	1.032	1.065	1.099	1.134	1.171	1.208	
02.-.	Relocation	$0	$710,000	0	0	0	0	344,000	344,000	0	
	FULLY FUNDED			$0	$0	$0	$0	$390,096	$402,824	$0	$793,000
	Contingency	$0	$322,000	0	0	0	0	156,011	156,011	0	
	FULLY FUNDED			$0	$0	$0	$0	$176,916	$182,689	$0	$360,000
	OMB FACTOR			1.032	1.032	1.065	1.099	1.134	1.171	1.208	
09.-.	Channels & Canals	$0	$7,772,000	0	179,560	88,440	0	2,926,560	4,577,440	0	
	FULLY FUNDED			$0	$185,306	$94,189	$0	$3,318,719	$5,360,182	$0	$8,958,000
	Contingency	$0	$1,908,000	0	44,081	21,712	0	718,461	1,123,746	0	
	FULLY FUNDED			$0	$45,492	$23,123	$0	$814,735	$1,315,907	$0	$2,199,000
	OMB FACTOR			1.000	1.000	1.000	1.000	1.000	1.000	1.000	
22.-.	Feasibility Studies	$2,200,000	$2,200,000	0	0	0	0	0	0	0	
	FULLY FUNDED			$0	$0	$0	$0	$0	$0	$0	$2,200,000
	Contingency	$0	$0	0	0	0	0	0	0	0	
	FULLY FUNDED			$0	$0	$0	$0	$0	$0	$0	$0
	OMB FACTOR			1.044	1.039	1.081	1.128	1.177	1.228	1.281	
30.-.	Engineering & Design	$0	$1,750,000	262,500	297,500	297,500	297,500	297,500	297,500	0	
	FULLY FUNDED			$274,050	$309,103	$321,598	$335,580	$350,158	$365,330	$0	$1,956,000
	Contingency	$0	$175,000	26,250	29,750	29,750	29,750	29,750	29,750	0	
	FULLY FUNDED			$27,405	$30,910	$32,160	$33,558	$35,016	$36,533	$0	$196,000
	OMB FACTOR			1.044	1.039	1.081	1.128	1.177	1.228	1.281	
31.-.	Supervision & Administration	$0	$514,000	0	0	0	0	200,460	313,540	0	
	FULLY FUNDED			$0	$0	$0	$0	$235,941	$385,027	$0	$621,000
	Contingency	$0	$51,000	0	0	0	0	19,890	31,110	0	
	FULLY FUNDED			$0	$0	$0	$0	$23,411	$38,203	$0	$62,000
	TOTAL PROJECT COST	$ 2,200,000	$ 21,522,000	$ 301,455	$ 1,305,246	$ 2,429,031	$ 2,389,607	$ 7,093,546	$ 8,086,595	$ -	$ 23,805,580

U.S. Army Engineer District, Huntington
Island Creek LPP, Logan, WV
Baseline Cost Estimate - 100-ft Channel

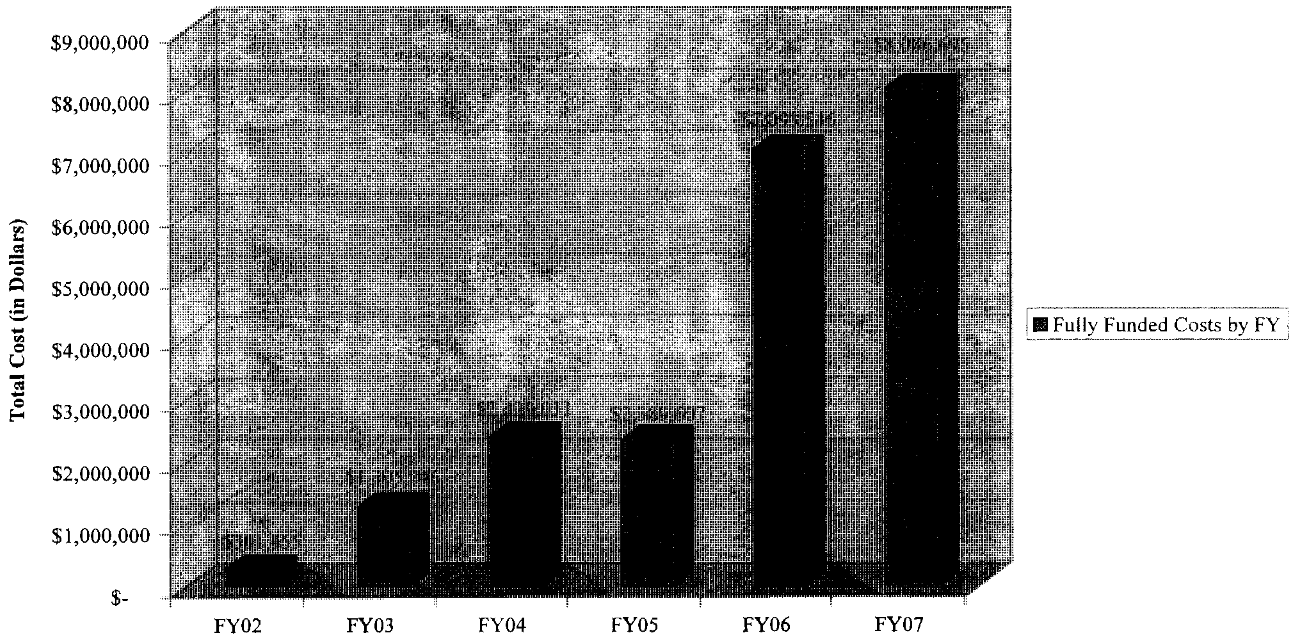
Fully Funded Project Cost by Fiscal Year

ACC NO	ITEM DESCRIPTION	Pre Oct-01 Sunk Costs	Oct-01 Price Level	10/01-9/02 FY02	10/02-9/03 FY03	10/03-9/04 FY04	10/04-9/05 FY05	10/05-9/06 FY06	10/06-9/07 FY07	10/07-9/08 FY08	FULLY FUNDED
	OMB FACTOR			1.032	1.032	1.065	1.099	1.134	1.171	1.208	
01.-.	Lands & Damages	$0	$6,125,000	0	735,000	1,898,750	1,898,750	1,592,500	0	0	
	FULLY FUNDED			$0	$758,520	$2,022,169	$2,086,726	$1,805,895	$0	$0	$6,673,000
	Contingency	$0	$1,448,000	$0	173,760	448,880	448,880	376,480	0	0	
	FULLY FUNDED			$0	$179,320	$478,057	$493,319	$426,928	$0	$0	$1,578,000
	OMB FACTOR			1.032	1.032	1.065	1.099	1.134	1.171	1.208	
02.-.	Relocation	$0	$710,000	0	0	0	0	355,000	355,000	0	
	FULLY FUNDED			$0	$0	$0	$0	$402,570	$415,705	$0	$818,000
	Contingency	$0	$322,000	0	0	0	0	161,000	161,000	0	
	FULLY FUNDED			$0	$0	$0	$0	$182,574	$188,531	$0	$371,000
	OMB FACTOR			1.032	1.032	1.065	1.099	1.134	1.171	1.208	
09.-.	Channels & Canals	$0	$9,074,000	0	179,560	88,440	0	3,434,340	5,371,660	0	
	FULLY FUNDED			$0	$185,306	$94,189	$0	$3,894,542	$6,290,214	$0	$10,464,000
	Contingency	$0	$2,324,000	0	45,988	22,651	0	879,591	1,375,770	0	
	FULLY FUNDED			$0	$47,460	$24,123	$0	$997,456	$1,611,027	$0	$2,680,000
	OMB FACTOR			1.000	1.000	1.000	1.000	1.000	1.000	1.000	
22.-.	Feasibility Studies	$2,200,000	$2,200,000	0	0	0	0	0	0	0	
	FULLY FUNDED			$0	$0	$0	$0	$0	$0	$0	$2,200,000
	Contingency	$0	$0	0	0	0	0	0	0	0	
	FULLY FUNDED			$0	$0	$0	$0	$0	$0	$0	$0
	OMB FACTOR			1.044	1.039	1.081	1.128	1.177	1.228	1.281	
30.-.	Engineering & Design	$0	$1,750,000	262,500	297,500	297,500	297,500	297,500	297,500	0	
	FULLY FUNDED			$274,050	$309,103	$321,598	$335,580	$350,158	$365,330	$0	$1,956,000
	Contingency	$0	$175,000	26,250	29,750	29,750	29,750	29,750	29,750	0	
	FULLY FUNDED			$27,405	$30,910	$32,160	$33,558	$35,016	$36,533	$0	$196,000
	OMB FACTOR			1.044	1.039	1.081	1.128	1.177	1.228	1.281	
31.-.	Supervision & Administration	$0	$509,000	0	0	0	0	233,610	365,390	0	
	FULLY FUNDED			$0	$0	$0	$0	$274,959	$448,699	$0	$724,000
	Contingency	$0	$60,000	0	0	0	0	23,400	36,600	0	
	FULLY FUNDED			$0	$0	$0	$0	$27,542	$44,945	$0	$72,000
	TOTAL PROJECT COST	$ 2,200,000	$ 24,787,000	$ 301,455	$ 1,510,619	$ 2,972,296	$ 2,949,183	$ 8,397,640	$ 9,400,984	$ -	$ 27,732,177

Section E

FULLY FUNDED COSTS BY FY

Fully Funded Estimate
Island Creek LPP
Logan, WV



Section F

COST SUMMARIES – ALTERNATIVE CHANNELS

ISLAND CREEK LPP
LOGAN, WEST VIRGINIA
60-FOOT CHANNEL
SUMMARY SHEET WITH CONTINGENCIES

FEATURE ACCOUNT	BASE SCHEME	SUPER 8 WALL	BAISDEN WALL	UPSTREAM EXTENSION	COMPTON'S WALL	BODY SHOP WALL
01	$7,728,000	($1,636,000)	($1,411,000)	$1,472,000	($368,000)	$380,000
02	$768,000	$0	$0	$0	$0	$0
15	$6,871,000	$1,007,000	$750,000	$469,000	$345,000	($19,000)
22	$1,110,000	$0	$0	$0	$0	$0
30	$1,956,000	$255,000	$193,000	$108,000	$87,000	($4,000)
31	$696,000	$101,000	$77,000	$44,000	$34,000	($1,000)
TOTAL	**$19,129,000**	**($273,000)**	**($391,000)**	**$2,093,000**	**$98,000**	**$356,000**

ISLAND CREEK LPP
LOGAN, WEST VIRGINIA
60-FOOT CHANNEL
SUMMARY SHEET WITH CONTINGENCIES (SCHEMES A-E)

FEATURE ACCOUNT	A (BASE)	B	C	D	E
O1	$7,728,000	$6,092,000	$6,317,000	$4,681,000	$9,200,000
02	$768,000	$768,000	$768,000	$768,000	$768,000
15	$6,871,000	$7,878,000	$7,621,000	$8,628,000	$7,340,000
22	$1,110,000	$1,110,000	$1,110,000	$1,110,000	$1,110,000
30	$1,956,000	$2,211,000	$2,149,000	$2,404,000	$2,064,000
31	$696,000	$797,000	$773,000	$874,000	$740,000
TOTAL	**$19,129,000**	**$18,856,000**	**$18,738,000**	**$18,465,000**	**$21,222,000**

A: Post & Panel Wall from Sta 5+00 to 14+25; acquiring Super 8 Motel, Baisden Hardware, and kennel/pump house
B: (A) + Wall @ Super 8
C: (A) + Wall @ Baisden Hardware
D: (A) + Wall @ Super 8 Motel + Wall @ Baisden Hardware
E: (A) + Upstream Extension; acquiring Body Shop, Southern Public Utilities Bldg., and Compton's Chevron

ISLAND CREEK LPP
LOGAN, WEST VIRGINIA
60-FOOT CHANNEL
SUMMARY SHEET WITH CONTINGENCIES (SCHEMES F-J)

FEATURE ACCOUNT	F	G	H	I	J
01	$9,580,000	$8,832,000	$9,212,000	$7,564,000	$7,944,000
02	$768,000	$768,000	$768,000	$768,000	$768,000
15	$7,321,000	$7,685,000	$7,666,000	$8,347,000	$8,328,000
22	$1,110,000	$1,110,000	$1,110,000	$1,110,000	$1,110,000
30	$2,060,000	$2,151,000	$2,147,000	$2,319,000	$2,315,000
31	$739,000	$774,000	$773,000	$841,000	$840,000
TOTAL	**$21,578,000**	**$21,320,000**	**$21,676,000**	**$20,949,000**	**$21,305,000**

F: (A) + Upstream Extension + Wall @ Body Shop; acquiring Southern Public Utilities Bldg., and Compton's Chevron
G: (A) + Upstream Extension + Wall @ Compton's Chevron
H: (A) + Upstream Extension + Wall @ Body Shop + Wall @ Compton's Chevron + acquiring Southern Public Utilities Bldg.
I: (A) + Wall @ Super 8 Motel + Upstream Extension; acquiring Body Shop, Compton's Chevron and Southern Public Utilities Bldg.
J: (A) + Wall @ Super 8 Motel + Upstream Extension + Wall @ Body Shop; acquring Southern Public Utilities Bldg., and Compton's Chevron,

ISLAND CREEK LPP
LOGAN, WEST VIRGINIA
60-FOOT CHANNEL
SUMMARY SHEET WITH CONTINGENCIES (SCHEMES K-O)

FEATURE ACCOUNT	K	L	M	N	O
01	$7,196,000	$7,576,000	$7,789,000	$8,169,000	$7,421,000
02	$768,000	$768,000	$768,000	$768,000	$768,000
15	$8,692,000	$8,673,000	$8,090,000	$8,071,000	$8,435,000
22	$1,110,000	$1,110,000	$1,110,000	$1,110,000	$1,110,000
30	$2,406,000	$2,402,000	$2,257,000	$2,253,000	$2,344,000
31	$875,000	$874,000	$817,000	$816,000	$851,000
TOTAL	**$21,047,000**	**$21,403,000**	**$20,831,000**	**$21,187,000**	**$20,929,000**

K: (A) + Wall @ Super 8 Motel + Wall @ Compton's Chevron + Upstream Extension; acquiring Southern Public Utilities Bldg., and Body Shop;
L: (A) + Wall @ Super 8 Motel + Wall @ Body Shop + Wall @ Compton's Chevron + Upstream Extension; acquiring Southern Public Utilities Bldg.
M: (A) + Wall @ Baisden Hardware + Upstream Extension; acquiring Compton's Chevron, Southern Public Utilities Bldg., and Body Shop
N: (A) + Wall @ Baisden Hardware + Wall @ Body Shop + Upstream Extension; acquiring Southern Public Utilities Bldg., and Compton's Chevron
O: (A) + Wall @ Baisden Hardware + Wall @ Compton's Chevron + Upstream Extension; acquiring Body Shop, Southern Public Utilities Bldg., Super 8 Motel

ISLAND CREEK LPP
LOGAN, WEST VIRGINIA
60-FOOT CHANNEL
SUMMARY SHEET WITH CONTINGENCIES (SCHEMES P-T)

FEATURE ACCOUNT	P	Q	R	S	T
O1	$7,801,000	$6,153,000	$6,533,000	$5,785,000	$6,165,000
02	$768,000	$768,000	$768,000	$768,000	$768,000
15	$8,416,000	$9,097,000	$9,078,000	$9,442,000	$9,423,000
22	$1,110,000	$1,110,000	$1,110,000	$1,110,000	$1,110,000
30	$2,340,000	$2,512,000	$2,508,000	$2,599,000	$2,595,000
31	$850,000	$918,000	$917,000	$952,000	$951,000
TOTAL	**$21,285,000**	**$20,558,000**	**$20,914,000**	**$20,656,000**	**$21,012,000**

P: (A) + Wall @ Baisden Hardware + Wall @ Body Shop + Wall @ Compton's Chevron + Upstream Extension; acquiring Southern Public Utilities Bldg.
Q: (A) + Wall @ Super 8 Motel + Wall @ Baisden Hardware + Upstream Extension; acquiring Body Shop, Southern Public Utilities Bldg., and Compton's Chevron
R: (A) + Wall @ Super 8 Motel + Wall @ Baisden Hardware + Wall @ Body Shop + Upstream Extension; acquiring Southern Public Utilities Bldg., and Compton's Chevron
S: (A) + Wall @ Super 8 Motel + Wall @ Baisden Hardware + Wall @ Compton's Chevron + Upstream Extension; acquiring Body shop
T: (A) + Wall @ Super 8 Motel + Wall @ Baisden Hardware + Wall @ Body Shop + Wall @ Compton's Chevron + Upstream Extension; acquiring Southern Public Utilities Bldg.

ISLAND CREEK LPP
LOGAN, WEST VIRGINIA
80-FOOT CHANNEL
SUMMARY SHEET WITH CONTINGENCIES (SCHEMES A-F)

FEATURE ACCOUNT	A	B	C	D	E	F
01	$7,930,000	$6,519,000	$9,402,000	$9,021,000	$7,991,000	$7,611,000
02	$768,000	$768,000	$768,000	$768,000	$768,000	$768,000
15	$8,822,000	$9,702,000	$9,346,000	$9,708,000	$10,227,000	$10,588,000
22	$1,110,000	$1,110,000	$1,110,000	$1,110,000	$1,110,000	$1,110,000
30	$2,424,000	$2,648,000	$2,559,000	$2,648,000	$2,780,000	$2,872,000
31	$893,000	$981,000	$946,000	$982,000	$1,035,000	$1,071,000
TOTAL	**$21,947,000**	**$21,728,000**	**$24,131,000**	**$24,237,000**	**$23,911,000**	**$24,020,000**

A: Post & Panel Wall from Sta 5+00 to 14+25; acquiring Super 8 Motel, Baisden Hardware, and kennel/pump house
B: (A) + Wall @ Baisden Hardware
C: (A) + Upstream Extension; acquiring Body Shop, Southern Public Utilities Bldg., and Compton's Chevron
D: (A) + Wall @ Body Shop + Upstream Extension; acquiring Southern Public Utilities Bldg., and Compton's Chevron
E: (A) + Wall @ Baisden Hardware + Wall @ Body Shop + Upstream Extension; acquiring Compton's Chevron, Southern Public Utilities Bldg., and Body Shop
F: (A) + Wall @ Baisden Hardware + Wall @ Body Shop + Upstream Extension; acquiring Southern Public Utilities Bldg., and Compton's Chevron

ISLAND CREEK LPP
LOGAN, WEST VIRGINIA
100-FOOT CHANNEL
SCHEMES A and B WITH CONTINGENCIES

FEATURE ACCOUNT	BASE SCHEME	UPSTREAM EXTENSION	A (BASE)	B
01	$8,653,000	$1,472,000	$8,653,000	$10,125,000
02	$768,000	$0	$768,000	$768,000
15	$9,592,000	$541,000	$9,592,000	$10,133,000
22	$1,110,000	$0	$1,110,000	$1,110,000
30	$2,620,000	$137,000	$2,620,000	$2,757,000
31	$970,000	$54,000	$970,000	$1,024,000
TOTAL	**$23,713,000**	**$2,204,000**	**$23,713,000**	**$25,917,000**

A: Post & Panel Wall from Sta 5+00 to 12+50; acquiring Super 8 Motel, Baisden Hardware, Anderson Wholesale and kennel/pump house
B: (A) + Upstream extension; acquiring Body Shop, Southern Public Utilities Bldg., and Compton's Chevron

ISLAND CREEK

LOCAL PROTECTION PROJECT

ENGINEERING TECHNICAL APPENDIX

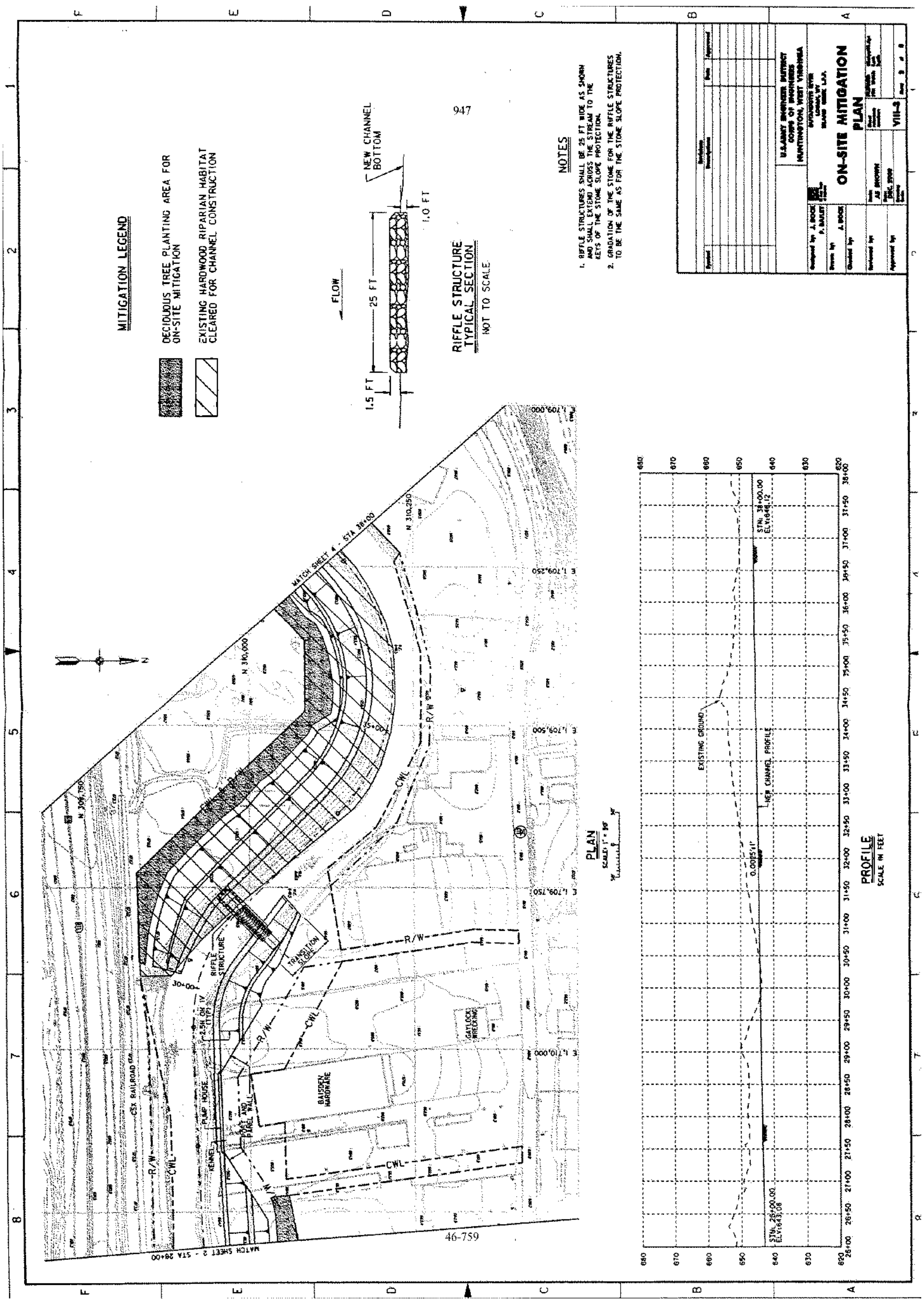
TO THE

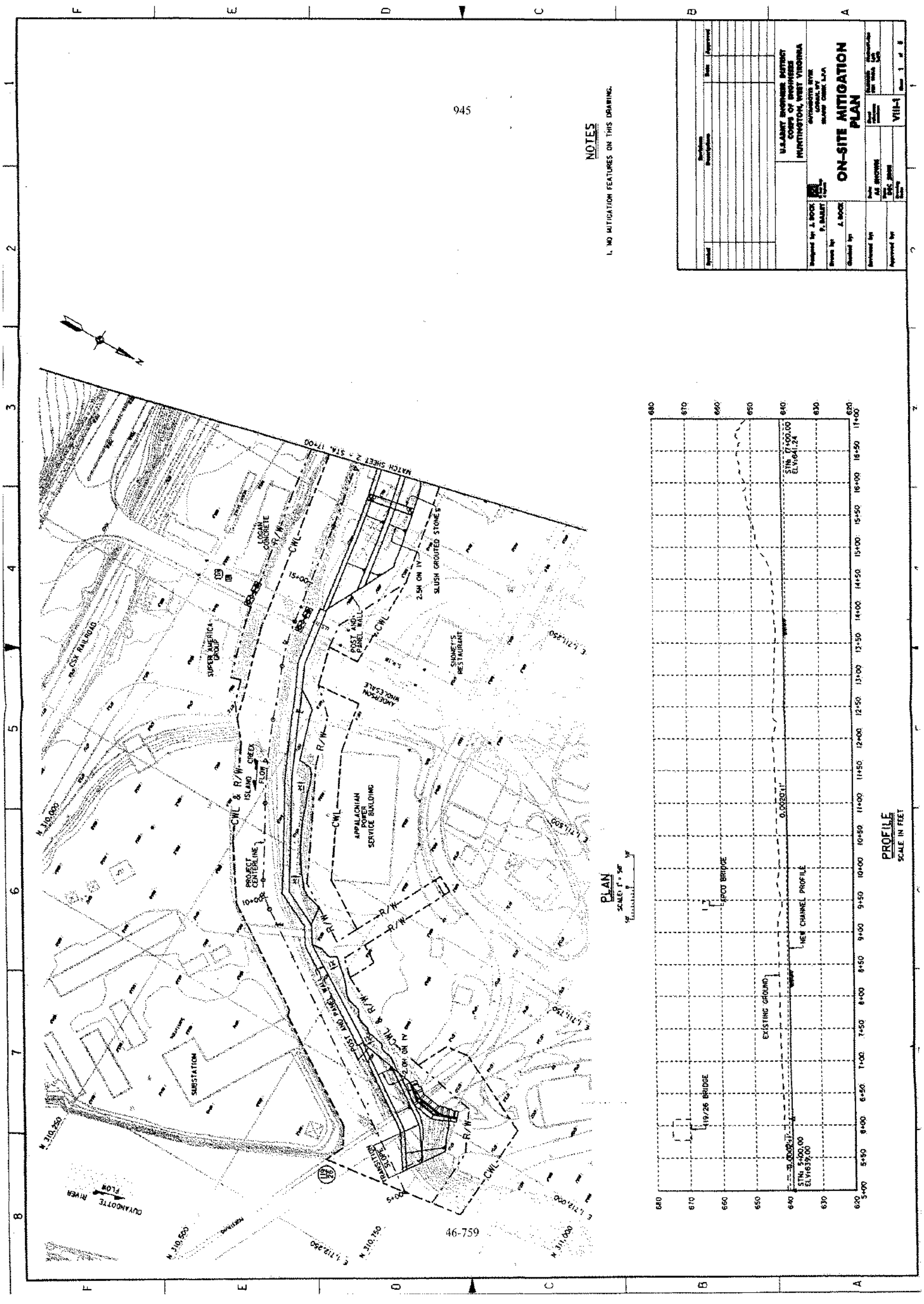
GENERAL REEVALUATION REPORT

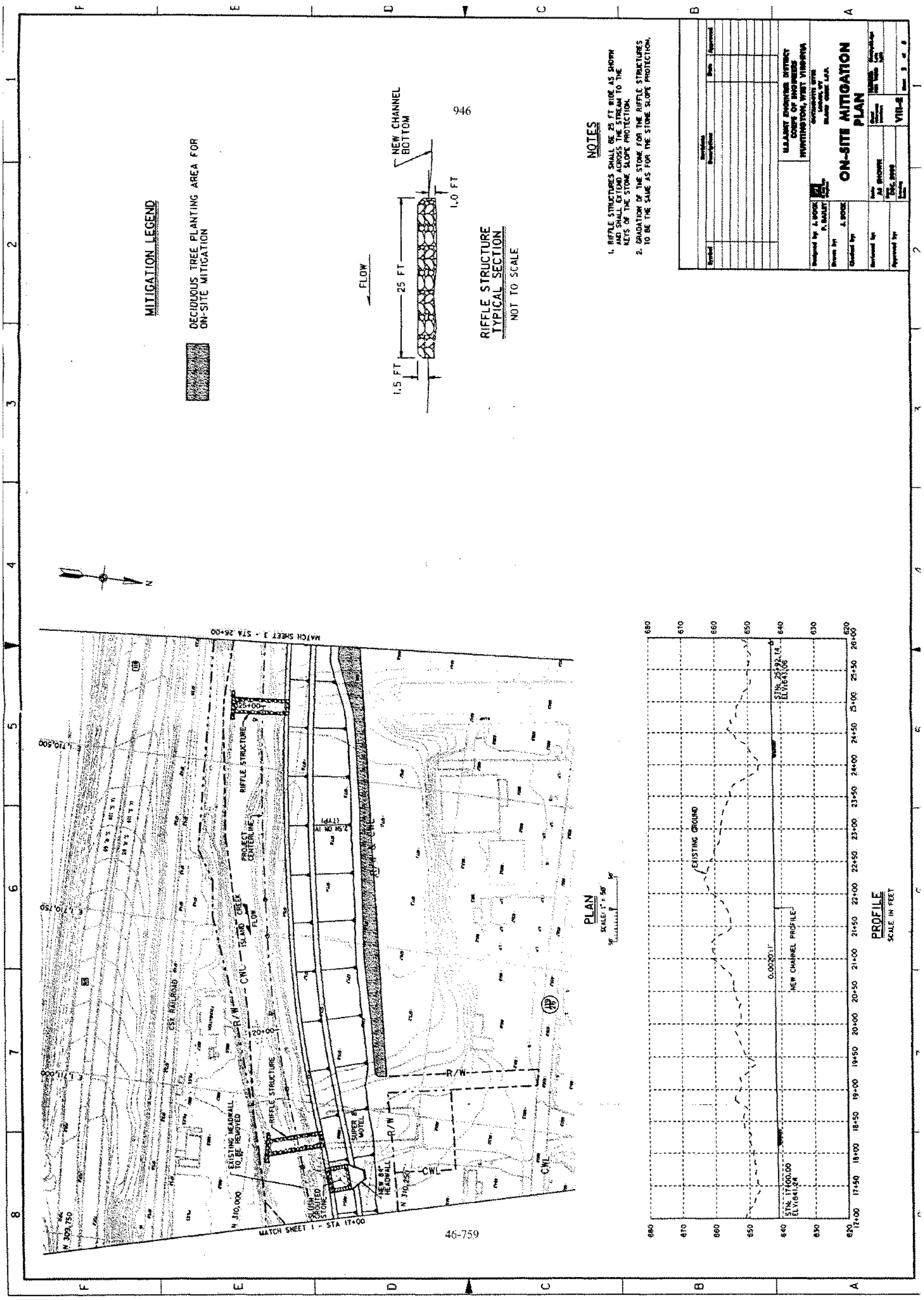
TAB VIII

ENVIRONMENTAL DESIGN MEASURES

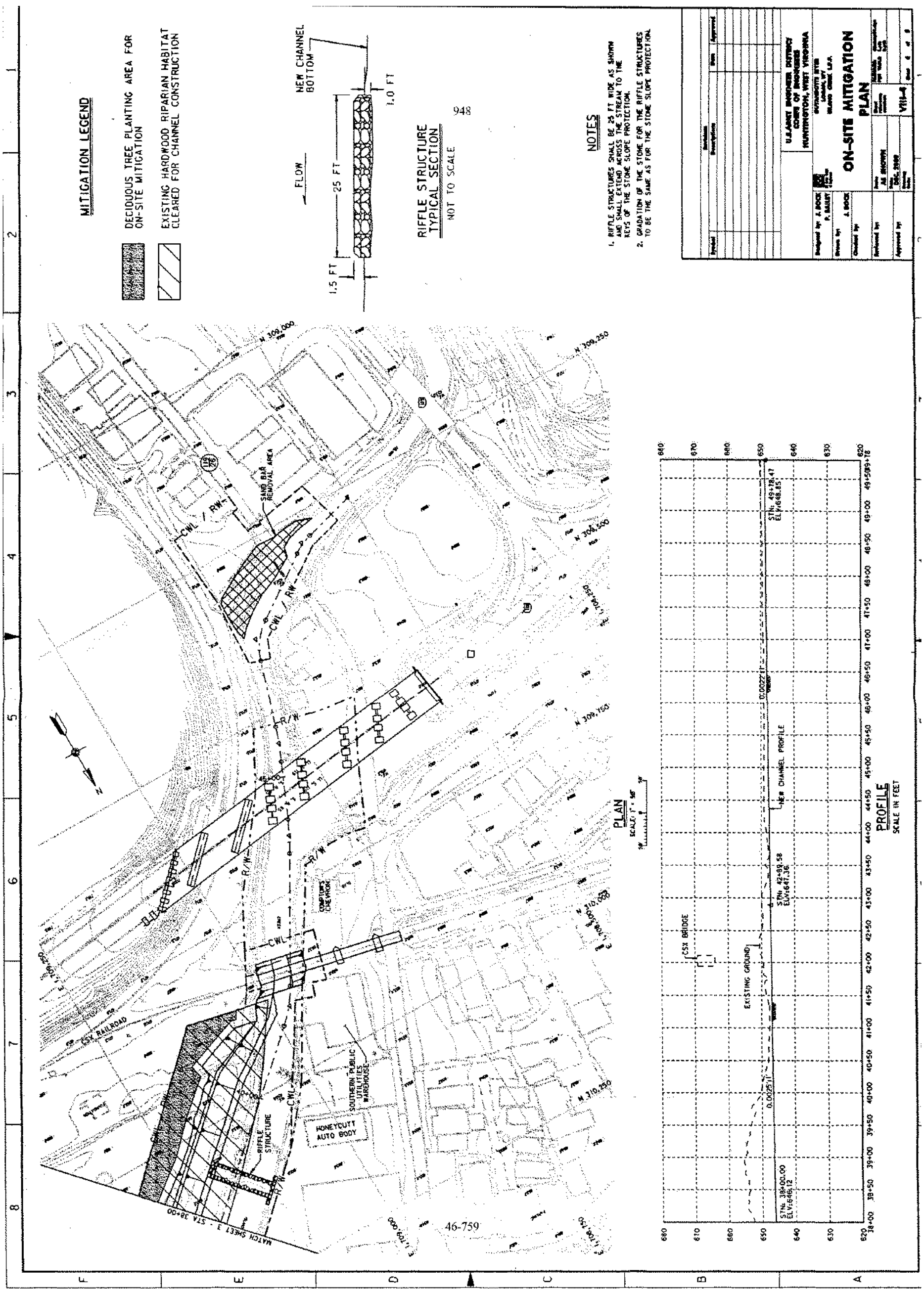
Department of the Army
Huntington District, Corps of Engineers
Huntington, West Virginia

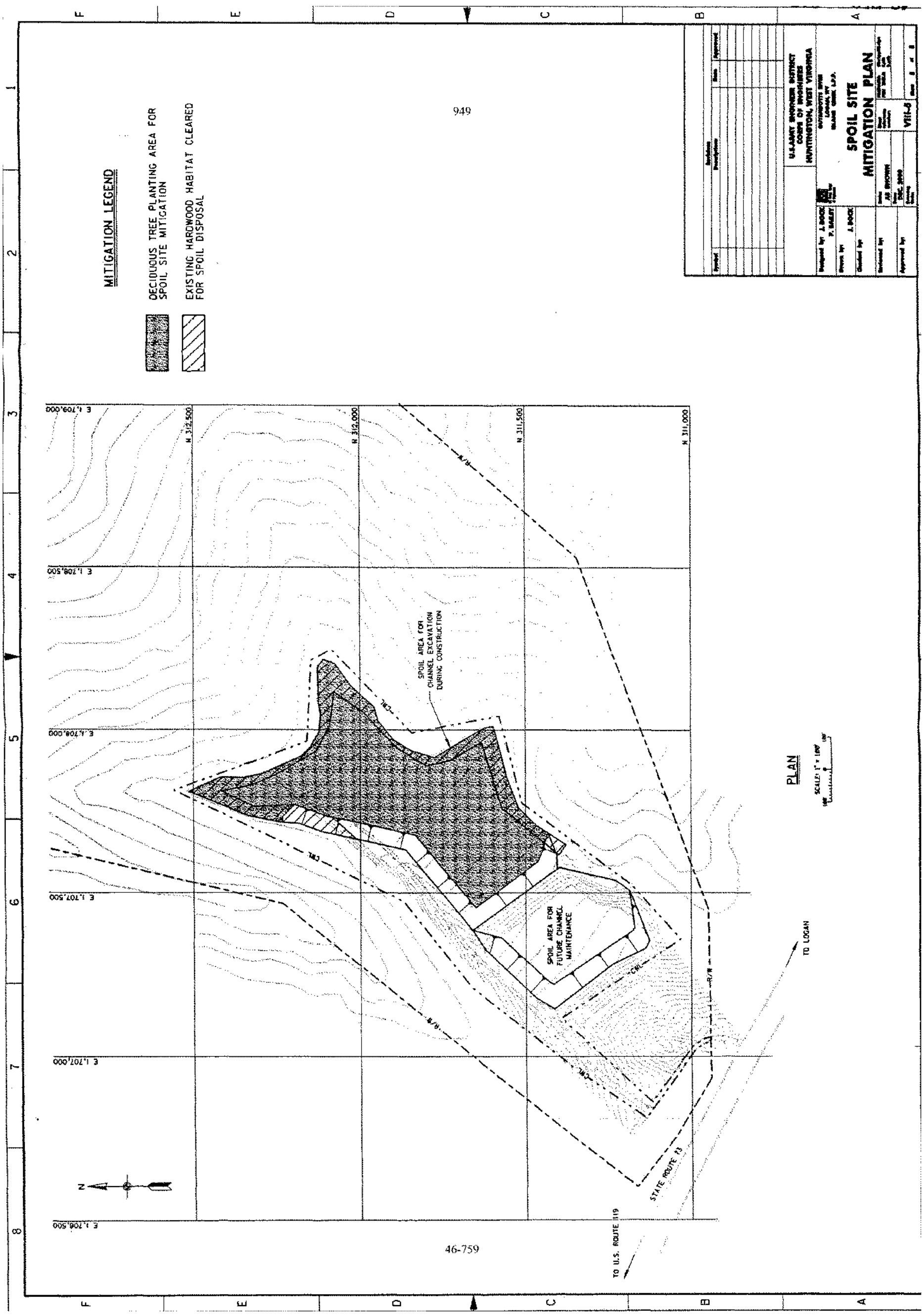

947
MITIGATION LEGEND
DECIDUOUS TREE PLANTING AREA FOR ON-SITE MITIGATION
EXISTING HARDWOOD RIPARIAN HABITAT CLEARED FOR CHANNEL CONSTRUCTION
NEW CHANNEL BOTTOM
FLOW
25 FT
1.5 FT
1.0 FT
RIFFLE STRUCTURE TYPICAL SECTION
NOT TO SCALE
NOTES
1. RIFFLE STRUCTURES SHALL BE 25 FT WIDE AS SHOWN AND SHALL EXTEND ACROSS THE STREAM TO THE KEYS OF THE STONE SLOPE PROTECTION.
2. GRADATION OF THE STONE FOR THE RIFFLE STRUCTURES TO BE THE SAME AS FOR THE STONE SLOPE PROTECTION.
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
ON-SITE MITIGATION PLAN
VIII-3
MATCH SHEET 4 - STA 38+00
MATCH SHEET 2 - STA 28+00
RIFFLE STRUCTURE
TRANSITION
CSX RAILROAD
PUMP HOUSE
KENNEL
BAISDEN HARDWARE
GAYLOCK WRECKING
R/W
CWL
PLAN
EXISTING GROUND
NEW CHANNEL PROFILE
STA. 38+00.00
STA. 28+00.00
PROFILE
SCALE IN FEET
46-759


945
NOTES
1. NO MITIGATION FEATURES ON THIS DRAWING.
ON-SITE MITIGATION PLAN
VIII-1
PLAN
PROFILE
SCALE IN FEET
CSX RAILROAD
SUPER AMERICA GROUP
LOGAN CONCRETE
APPALACHIAN POWER SERVICE BUILDING
ANDERSON WHOLESALE
SHONEY'S RESTAURANT
SUBSTATION
POST AND PANEL WALL
SLUSH GROUTED STONES
ISLAND CREEK FLOW
GUYANDOTTE RIVER FLOW
PROJECT CENTERLINE
EXISTING GROUND
NEW CHANNEL PROFILE
APCO BRIDGE
119/26 BRIDGE
46-759



MITIGATION LEGEND
DECIDUOUS TREE PLANTING AREA FOR ON-SITE MITIGATION
946
NEW CHANNEL BOTTOM
FLOW
25 FT
1.0 FT
1.5 FT
RIFFLE STRUCTURE TYPICAL SECTION
NOT TO SCALE
NOTES
1. RIFFLE STRUCTURES SHALL BE 25 FT WIDE AS SHOWN AND SHALL EXTEND ACROSS THE STREAM TO THE KEYS OF THE STONE SLOPE PROTECTION.
2. GRADATION OF THE STONE FOR THE RIFFLE STRUCTURES TO BE THE SAME AS FOR THE STONE SLOPE PROTECTION.
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
ON-SITE MITIGATION PLAN
VIII-8
MATCH SHEET 3 - STA 26+00
RIFFLE STRUCTURE
PROJECT CENTERLINE
ISLAND CREEK
FLOW
CWL
R/W
CSX RAILROAD
EXISTING HEADWALL TO BE REMOVED
SLUSH GROUTED STONE
SUPER 8 MOTEL
NEW 84" HEADWALL
MATCH SHEET 1 - STA 17+00
PLAN
EXISTING GROUND
NEW CHANNEL PROFILE
PROFILE
SCALE IN FEET
46-759


MITIGATION LEGEND
DECIDUOUS TREE PLANTING AREA FOR ON-SITE MITIGATION
EXISTING HARDWOOD RIPARIAN HABITAT CLEARED FOR CHANNEL CONSTRUCTION
NEW CHANNEL BOTTOM
FLOW
25 FT
1.5 FT
1.0 FT
RIFFLE STRUCTURE TYPICAL SECTION
NOT TO SCALE
948
NOTES
1. RIFFLE STRUCTURES SHALL BE 25 FT WIDE AS SHOWN AND SMALL EXTEND ACROSS THE STREAM TO THE KEYS OF THE STONE SLOPE PROTECTION.
2. GRADATION OF THE STONE FOR THE RIFFLE STRUCTURES TO BE THE SAME AS FOR THE STONE SLOPE PROTECTION.
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS HUNTINGTON, WEST VIRGINIA
ON-SITE MITIGATION PLAN
SAND BAR REMOVAL AREA
CSX RAILROAD
RIFFLE STRUCTURE
HONEYCUTT AUTO BODY
SOUTHERN PUBLIC UTILITIES WAREHOUSE
MATCH SHEET 3 - STA 38+00
PLAN
PROFILE
SCALE IN FEET
CSX BRIDGE
EXISTING GROUND
NEW CHANNEL PROFILE
46-759


949
MITIGATION LEGEND
DECIDUOUS TREE PLANTING AREA FOR SPOIL SITE MITIGATION
EXISTING HARDWOOD HABITAT CLEARED FOR SPOIL DISPOSAL
SPOIL AREA FOR CHANNEL EXCAVATION DURING CONSTRUCTION
SPOIL AREA FOR FUTURE CHANNEL MAINTENANCE
PLAN
TO LOGAN
STATE ROUTE 73
TO U.S. ROUTE 119
SPOIL SITE
MITIGATION PLAN
46-759

US Army Corps
of Engineers
Huntington District

ISLAND CREEK
LOCAL PROTECTION PROJECT
AT LOGAN, WEST VIRGINIA

GENERAL REEVALUATION REPORT

MAIN REPORT
ENVIRONMENTAL ASSESSMENT
ECONOMIC APPENDIX
ENGINEERING TECHNICAL APPENDIX

MARCH 2002

ISLAND CREEK LOCAL PROTECTION PROJECT AT LOGAN, WV
GENERAL REEVALUATION REPORT

EXECUTIVE SUMMARY

This report documents the results of studies and investigations conducted to reevaluate the Island Creek Local Protection Project that was authorized in the Section 401 of the Water Resources Development Act of 1986 (PL 99-662). The report recommends implementation of the structural component of the authorized project as a separable element. It also recommends implementation of a basin-wide flood warning system (FWS) that has been found to be incrementally justified. The report further recommends the deferral of the reevaluation of other non-structural measures until such time that a capable and willing non-Federal sponsor is identified.

For the purposes of this report the Island Creek project area includes the 500-year floodplain along Island Creek from its confluence with the Guyandotte River to a point approximately 9,000 feet upstream. This area has experienced numerous damaging floods during the past. Flood damages caused by the occurrence of a 100-year flood event of Island Creek under existing conditions would exceed $20 million (October 2001 price level).

The recommended plan (80-Foot Channel Plan) includes channel modification of Island Creek consisting of widening the channel to 80 feet beginning at its confluence with the Guyandotte River continuing 3,600 feet upstream. The channel modification also includes the construction of two retaining walls to minimize the acquisition of existing commercial structures. The plan also includes removal of an existing sand bar, appropriate environmental design features, and a basin-wide flood warning system,. This plan provides between a 10- and 20-year level of protection and has annual net benefits of $2.58 million. The benefit-to-cost ratio is 2.6 to 1.

The Logan County Commission will serve as the non-Federal sponsor for the project and the West Virginia Soil Conservation Agency has agreed to provide non-Federal financial support. The non-Federal sponsor will be responsible for all lands, easements, rights-of-way, relocations, and disposal areas (LERRD) necessary to construct and operate the project. The sponsor will also provide in cash 5% of the cost attributable to structural flood control measures and any additional costs as necessary to make its total contribution equal to 25% of the total project costs. The Logan County Commission will also satisfy the operation and maintenance (O&M) requirements of the project including the FWS.

The estimated total project cost for the recommended plan is $23.8 million (fully funded) which includes Preconstruction Engineering and Design (PED). The non-Federal share including the LERRD requirement is $8.8 million or about 37% of the total project cost. Operation and maintenance costs for the project including the FWS are currently estimated to be $67,700 annually.

An Environmental Assessment (EA) has been prepared and implementation of the project is considered to have insignificant environmental impacts. The EA has been circulated for public and agency review and was received favorably by all entities. The District Engineer has executed a Finding of No Significant Impact (FONSI).

ISLAND CREEK AT LOGAN, WEST VIRGINIA, LOCAL PROTECTION PROJECT

GENERAL REEVALUATION STUDY

MAIN REPORT/EA

LIST OF TABLES

LIST OF EXHIBITS

ISLAND CREEK AT LOGAN, WEST VIRGINIA, LOCAL PROTECTION PROJECT

GENERAL REEVALUATION STUDY

MAIN REPORT

I. PURPOSE AND SCOPE

The purpose of this report is to conduct a reevaluation of the Island Creek Local Protection Project that was authorized in the Water Resources Development Act of 1986. Further, this reevaluation is to confirm the economic feasibility of the project; to re-affirm the National Economic Development (NED) plan; and to ensure conformity with current criteria, policy, and guidelines. It is intended that this reevaluation report will provide sufficient detail to allow the District to proceed directly to plans and specifications.

II. AUTHORIZATION

The Island Creek local protection project for flood control was authorized in Section 401 of the Water Resources Development Act of 1986 (P.L. 99-662). Pertinent sections of that authorization are quoted below:

(a) Authorization of Construction. – The following works of improvement for the control of destructive floodwaters are adopted and authorized to be prosecuted by the Secretary substantially in accordance with the plans and subject to the conditions recommended in respective reports designated in this subsection, except as otherwise provided in this subsection:

ISLAND CREEK BASIN, WEST VIRGINA

The project for flood control, Island Creek Basin in and around Logan, West Virginia; Report of the Chief of Engineers dated April 25, 1986, at a total cost of $86,000,000 with an estimated first Federal cost of $62,200,000 and an estimated first non-Federal cost of $23 800,000.

III. STUDY AREA

The original project study area as defined in the feasibility report, Interim Report, Island Creek Basin, Guyandotte River Basin Study, dated March 1985, lies within the Island Creek sub-basin of the Guyandotte River Basin (see map on Exhibit 1). This sub-basin drains about 105 square miles of rugged, mountainous terrain and is composed of three major streams – Island Creek, Copperas Mine Fork and Mud Fork.

EXHIBIT 1 – LOGAN COUNTY, WEST VIRGINIA MAP

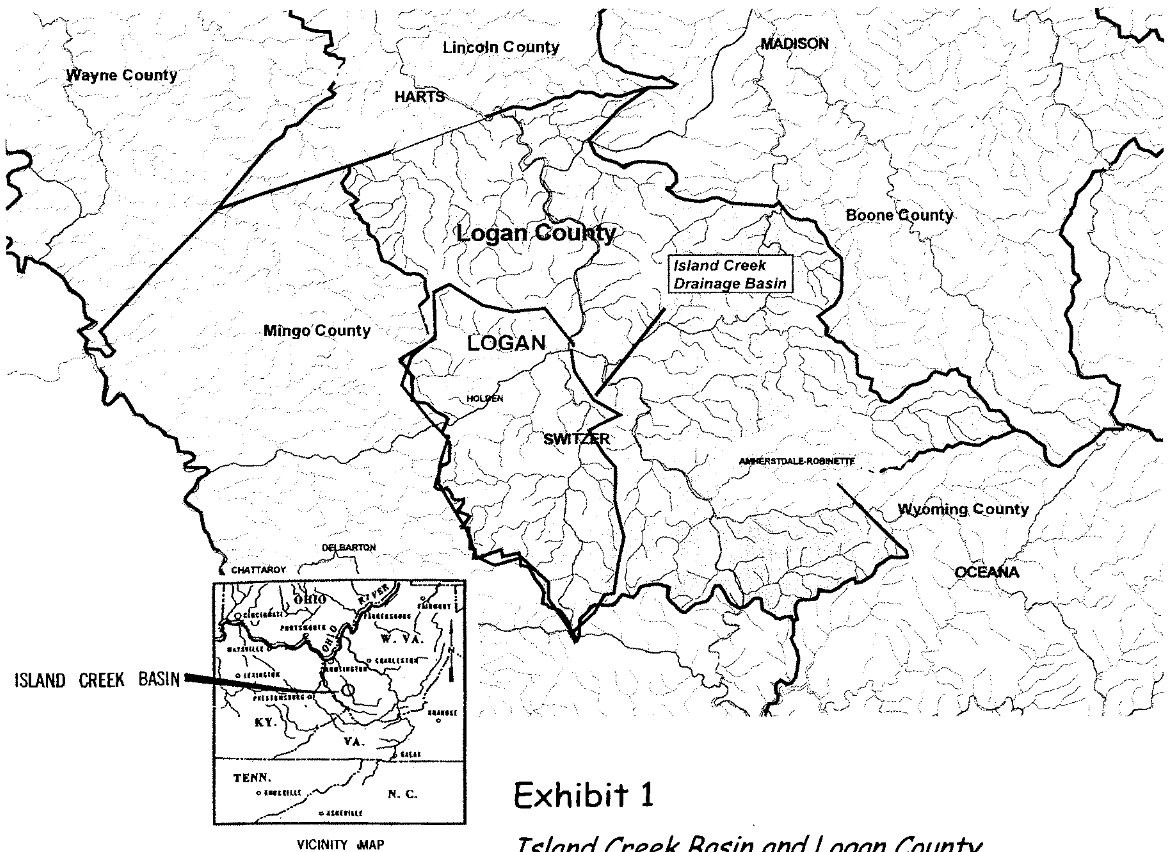


Exhibit 1

Island Creek Basin and Logan County

EXHIBIT 2 – ISLAND CREEK BASIN MAP

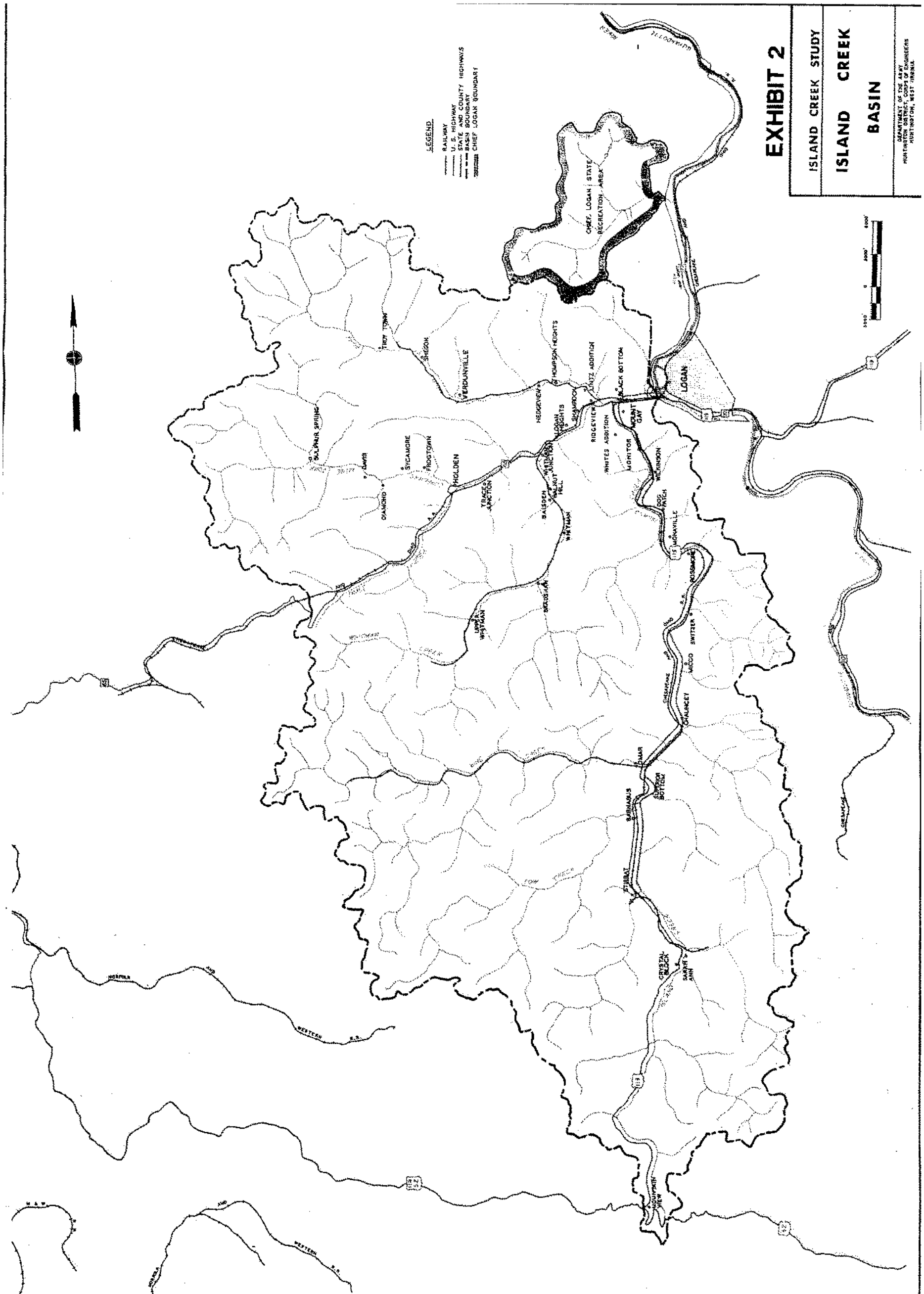


EXHIBIT 2
ISLAND CREEK STUDY
ISLAND CREEK BASIN
DEPARTMENT OF THE ARMY
HUNTINGTON DISTRICT, CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
LEGEND
RAILWAY
U.S. HIGHWAY
STATE AND COUNTY HIGHWAYS
BASIN BOUNDARY
CHIEF LOGAN BOUNDARY
CHIEF LOGAN STATE RECREATION AREA
LOGAN
HOLDEN
VERDUNVILLE
MOUNT GAY
BLACK BOTTOM
MONITOR
WHITES ADDITION
RIDGEVIEW
SHAMROCK
HEDGEVIEW
DIAMOND
SYCAMORE
FROGTOWN
SULPHUR SPRING
MONAVILLE
STIRRAT
BARNABUS
OMAR
CRYSTAL BLOCK
SARAH ANN
MOUNTAIN VIEW
NORFOLK AND WESTERN R.R.

This **original** study area was approximately 19 miles long and consisted of heavily developed areas within the 500-year floodplain along Island Creek from its mouth at Logan to a point upstream near Barnabus (about 10 miles); Copperas Mine Fork from its mouth to a point upstream near Davis (5.1 miles); and Mud Fork to a point upstream near Shegon (3.9 miles). (See map on Exhibit 2)

Subsequent reevaluation efforts narrowed the study area to just the 500-year floodplain along Island Creek. **This General Reevaluation Report focuses on the area impacted by the proposed alternatives. This area includes the 500-year floodplain along Island Creek from its confluence with the Guyandotte River to a point approximately 9,000 feet upstream and also a short distance upstream on Copperas Mine Fork that would be affected by backwater from Island Creek.**

IV. PRIOR STUDIES AND REPORTS

A. Feasibility

Interim Report, Island Creek Basin, Guyandotte River Basin Study, West Virginia," U.S. Army Corps of Engineers, Huntington District, dated March 1985. The preauthorization studies of the water and related land resources problems and needs of the Island Creek area of Logan County, West Virginia, were undertaken as a result of the Senate Public Works Committee Resolution dated 2 June 1976.

This report recommended a combination of channel and non-structural measures to alleviate the flooding problems experienced in the Island Creek Basin. As described in the feasibility report, the first 0.7 mile of Island creek would be structurally modified by widening the stream channel to 100 feet, with the lower 1,000 feet being a concrete-lined channel. Flood damages along the remainder of Island Creek, Copperas Mine Fork, and Mud Fork (a total length of 20 miles) would be reduced by non-structural measures. Over 1,200 residential structures would be raised in place and almost 80 non-residential structures would be floodproofed by raising in place or other means. As part of this project, a total of 146 residential and 116 non-residential structures would be relocated from the floodway and 149 mobile homes from the floodplain to flood-free housing and community development sites. Also it was recommended that a flood warning system must be established as part of the non-structural program to give flood plain occupants sufficient time to evacuate the affected area. The benefit-to-cost ratio for this project was 1.7 to 1 and resulted in the current authorization as cited above.

B. Preconstruction Engineering and Design (PED) Studies

1. PED

Following project authorization, funding for PED was received and studies were initiated in 1989. Preliminary analyses conducted during the early stages of PED identified the potential for substantial increases in the project costs due to an underestimate of costs used for the nonstructural portions of the project. Implementation of similar nonstructural projects in the neighboring region of Tug Fork Valley provided the experience of actual costs. The actual costs for raising in place in the Tug Fork basin showed a substantial increase above what was estimated for the Island Creek feasibility study. For example, in the Island Creek feasibility study, the cost to raise one residential structure in place was estimated at an average of $25,000 where actual costs being experienced in the Tug Fork basin were at an average of $89,600 (costs being experienced in 1989). The resulting increase in cost potentially made some elements of the project economically infeasible. Based on this information, it was concluded that a general reevaluation of the economic feasibility of the Island Creek Local Protection Project would be conducted as a part of PED.

2. Re-Analysis of Costs to Perform Non-Structural Floodproofing Measures, April 1991

This effort used the actual costs being experienced in the Tug Fork basin as described above and concluded that the non-federal share of the non-structural alternative was beyond the fiscal means of the local sponsor. Therefore the nonstructural component was removed from consideration as a cost-shared flood protection measure in the Island Creek basin. The data presented in the re-analysis demonstrated that costs for the nonstructural portion would make the authorized Island Creek project economically infeasible as currently formulated. With the concurrence of the Division office, further reevaluation of the non-structural component was deferred until a willing and capable non-Federal sponsor is identified. It is understood that any further reevaluation of the non-structural component will include the determination of whether a Post Authorization Change Report is required.

3. Draft General Reevaluation Report and Environmental Assessment, December 1993.

A draft report was prepared in December 1993 that presented findings and conclusions of a re-determination of Federal interest for the structural component of the authorized plan. This report concluded that the recommended plan (80-foot wide channel) was in the Federal interest and was economically feasible. However, at that time, the Logan County Commission did not have the financial ability to finance the non-Federal share of construction and asked that the project remain active while it explored other funding options. Therefore all reevaluation efforts were terminated and USACE notified.

4. General Reevaluation Report

In 1998, at the request of the Logan County Commission with financial support from the West Virginia Soil Conservation Agency PED activities were resumed. The WVSCA and the Logan County Commission requested that the PED efforts be directed towards the reevaluation of the structural component of the authorized plan and that reevaluation of all nonstructural measures continue to be deferred until additional funding sources could be identified. This General Reevaluation report presents the findings and conclusions based upon a review of plan formulation, an update of the project economics and project modifications that have occurred since the project was authorized.

V. NEEDS AND OPPORTUNITIES

A. General

Logan County, located in the southwestern portion of West Virginia, was formed in 1824 from parts of Giles, Tazewell, Cabell, and Kanawha Counties, in what was then Virginia. The county seat, Logan, is situated in the central portion of the county, at an elevation of 682 feet, m.s.l. (see map on Exhibit 1). The topography of the county, which measures 456 square miles, is steep and rugged, as streams have cut their channels deep through the surface rocks, making sharp V-shaped valleys. Surface elevations vary from 600 feet above sea level at Big Creek on the Guyandotte River at the Lincoln County line to 2,750 feet, m.s.l., at the corner where Logan, Boone, and Wyoming Counties meet.

The Guyandotte River largely drains the county. The Guyandotte, having a drainage area of 1,670 square miles, originates in Raleigh County and flows in a general northwesterly direction through Raleigh, Wyoming, Mingo, Logan, Lincoln, and Cabell counties to the Ohio River, near Huntington, West Virginia.

B. History of Flooding

Storm and flood of July 1875. The flood was caused by a series of summer-type storms beginning about 25 July and ending 6 August. A crest stage of 27.3 feet was reached at Logan, the seventh highest of record.

Storm and flood of January 1918. The storm, which caused this flood, was preceded by snow, sleet and freezing temperatures, all of which assisted in causing excessive runoff. The heavy precipitation together with melted snow produced a crest stage of 26.3 feet at Logan, the ninth highest of record.

Storm and flood of January 1957. Rainfall from 27 January to 1 February averaged 5.1 inches over the basin above Logan. The flood on the Guyandotte River reached a stage of 28.2 feet at Logan, the fifth highest of record. The historical crest stage at Logan was one foot higher than July 1875. The volume of runoff from the drainage area above Logan amounted to approximately 4.1 inches.

Storm and flood of March 1963. A succession of storms associated with low-pressure systems moved northeastward from northern Alabama to West Virginia and Ohio during the period 2-19 March 1963. On the 5th and 6th of March, two to three inches of rain fell over the Guyandotte River Basin. On the 11th and 12th of March, the second storm moved over the basin, producing rainfall amounts of three to three and a half inches in twenty-two hours. The rains that occurred on the fifth and sixth of March primed the basin for the second storm which produced the highest known flooding along the main stem of the Guyandotte River, and along most tributaries. This flood produced a crest stage of 34.90 feet at Logan, the highest of record.

Storm and flood of January 1974. On 3-5 January, the first storm moved over the Guyandotte Basin and released slightly more than 1.0 inch of rainfall. The second storm period, 9-12 January, produced about 3.5 inches in the upper portion of the basin and approximately 3.15 inches in the lower part of the basin. The Guyandotte River reached a crest stage of 31.1 feet at Logan, the third highest stage of record.

Storm and flood of April 1977. Precipitation began on the evening of 2 April. This set the stage for increased runoff when the rain began again Sunday evening, 3 April. A series of disturbances, with heavy rainfall, moved from the southern plains states into the Appalachians late Sunday, 3 April and Monday, 4 April. From 7 a.m. on 2 April to 7 a.m. on the 5th, a total of 3.14 inches of rainfall was recorded at Logan, WV. This flood produced the fourth highest stage of record.

Storm and flood of May 1984. Contrasting temperatures associated with this front produced an unstable atmospheric condition resulting in heavy precipitation that began on the 2nd of May and continued through the 9th of May. Most stations recorded flood waters cresting during the day of 8 May and returning to near normal stages by 20 May. Preliminary field investigation of flood marks in the Island Creek basin indicated normal water elevations were exceeded by as much as 16 feet. Lesser flooding occurred downstream on the Guyandotte River due to the impounding of floodwater behind the R.D. Bailey Dam and also due to the reduced amounts of rainfall over the lower Guyandotte River Basin. A crest stage of 23.3 feet was reached at the Guyandotte River at the Logan stream gaging station, the twelfth highest of record.

Storm and flood of May 1996. The flooding in Logan County on May 16, 1996 was a result of persistent frontal boundaries over the State of West Virginia. The frontal boundaries were persistent for the entire month. This weather produced the wettest conditions for the month in the history of several stations in West Virginia. The monthly averages for the Guyandotte Basin were 9-10 inches at the mouth of the Guyandotte River. A crest stage of 25.7 feet was reached at the Guyandotte River at Logan stream gaging station.

C. Summary

The Island Creek Basin (map on Exhibit 2) has experienced numerous damaging floods. The flood of record in the Basin occurred in March 1963. During the March 1963 flooding, the area's residences, and commercial and industrial establishments were flooded to a depth of up to 15 feet. Other major floods have occurred in January 1957, January 1974, April 1977, May 1984, and May 1996. Flooding along Island Creek and its tributaries is a continuing problem. Due to the steepness of terrain and the scarcity of land suitable for building, extensive development has occurred on the relatively flat floodplains of the basin. Residential and commercial structures, highways, and railroads occupy the flood plains along the major streams almost entirely. As a result, almost all development within the basin is susceptible to damage by even moderate flood events.

For the original authorized study area, the occurrence of a 100-year flood event on Island Creek (10.4 miles) under existing conditions would inundate approximately 950 residential structures and 225 commercial structures. Flood damages caused by this event would exceed $42 million (October 2001 price level). Approximately $20 million of these flood damages would occur within the current project area (9,000 feet of stream) that now includes approximately 174 residential and 102 non-residential structures. In addition to the financial burden caused by flooding, major floods result in hazards to health and even loss of life. The threat of flooding to floodplain land prevents economic development and increases the cost of land preparation and building construction.

VI. EXISTING CONDITIONS

A. General

There are no other flood protection systems currently in place in the Island Creek basin. However, since the completion in 1980 of the R. D. Bailey Lake on the Guyandotte River, about 35 miles upstream at Justice, backwater flooding problems from the Guyandotte River at the mouth of Island Creek have significantly been reduced; but that project does not eliminate the potential for headwater flooding in the Island Creek basin.

Since the Island Creek LPP project was authorized in 1986, some additional economic development has occurred in the lower 0.7 mile section of Island Creek. On the Guyandotte River, just below the mouth of Island Creek, there is a new fast-food restaurant. From that point upstream on Island Creek for a distance of over 600 feet, and interceptor sewer system has been installed. Just above the U.S. Rt. 119/St. Rt. 10 bridge over Island Creek, two new restaurants and a motel have been built on fill material. However, the impact from the declining coal industry and recurrent flooding is evident in the study area by the number of commercial structures standing vacant and in disrepair.

B. Population

During the 20th century, Logan County has experienced dramatic population changes, increasing from 6,955 in 1900 to 77,391 in 1950, decreasing to 46,269 in 1970, increasing again to 50,511 in 1980, decreasing to 43,032 in 1990 and again in 2000 to 37,710 people. The wide fluctuations of population in Logan County, as well as in the southern West Virginia region, over the last century can be attributed to the boom or bust economy of the coal industry.

While most of the inhabitants of the study area do not live in cities or towns, a high percentage do live in dense settlement clusters or ribbons along the three major streams. These clusters often approach urban density without urban service availability.

C. Commercial Development

The current study area is largely comprised of the major commercial district along Island Creek. Most of the establishments are located along Riverview Avenue, the main street through the study area. A variety of business types are represented including service, health services, pre-owned auto dealers, gas stations, eating and drinking establishments, special trade contractors, and hardware stores.

VII. FUTURE WITHOUT PROJECT CONDITIONS

In the absence of project implementation, the future land use and related conditions within the project area are forecast to remain comparable to conditions as they currently exist. The study area entered the flood insurance program in April 1972; flood insurance, therefore, continues to be available to residents of the area.

VIII. AUTHORIZED PROJECT

The authorized local protection project included channel modification of Island Creek from the mouth to a point 0.7 mile upstream. The channel would have been 100 feet wide, with the lower 1,000 feet being concrete-lined. Flood damages along the remainder of Island Creek, Copperas Mine Fork, and Mud Fork (a total length of 20 miles) would have been reduced by non-structural measures such as raising structures in place and other floodproofing measures. The first cost of the authorized project was estimated to be $86 million (October

1984 prices). The channel component of the authorized project plan is shown on Exhibit 3 and a detailed description of project features as presented in the March 1985 Final Feasibility Report is included as Exhibit 4.

EXHIBIT 3 – AUTHORIZED PROJECT PLAN

EXHIBIT 4 – ORIGINAL AUTHORIZED PLAN – PROJECT FEATURES

The Island Creek Local Protection Project authorized by the Water Resources Development Act of 1986 included a combination of structural and non-structural measures. The project plan is shown on Exhibit 3. The authorized plan is about nineteen miles in length: Island Creek – 10 miles, Copperas Mine Fork – 5.1 miles, and Mud Fork – 3.9 miles. The first 0.7 miles of Island Creek, from its confluence with the Guyandotte River upstream, would be structurally modified by widening the stream channel to a width of 100 feet. The lower 1,000 feet of this area would be concrete-lined. The remainder of Island Creek (9.3 miles) and both Copperas Mine Fork and Mud Fork would be treated with a variety of non-structural measures.

Because of the scarcity of available housing, a provision of a housing program would be an integral component of project construction to accommodate those who must be relocated. Project construction requires the relocation of 146 families and 116 non-residential structures. Three sites along the Guyandotte River above Logan will be developed to accommodate relocates. The structures to be raised in the fringe area amount to 1,226, and 77 would have floodproofing techniques applied to reduce damages. In addition, 149 mobile home owners would be required to evacuate the fringe area of the flood plain.

Day use recreation facilities will also be developed as an integral part of the plan. These facilities generally consist of play areas, trails and tot lots. There will be eight of these facilities located throughout the project area on evacuated flood plain land to satisfy the local need for day use facilities.

Environmental management and design considerations would be an integral part of the plan. The evacuated floodway will be graded and seeded, and stream banks will be stabilized as necessary. The evacuated floodway and stream will be maintained as a green belt area with land uses that are compatible with flooding.

Construction would occur in four phases requiring a total of 8 ½ years to complete. Phase 1 of the plan, channel work on Island Creek, will require 1 year to construct. Phase 2 Mud Fork non-structural; will require 1 year to complete. Phase 3, Copperas Mine Fork non-structural, will require 1 ½ years to complete; and the final phase, Phase 4, Island Creek non-structural, will require 5 years to complete.

Estimated first cost (October 1984 price level) for the Island Creek basin project is $86 million of which $66.4 million is the Federal share and $19.6 million is the non-Federal share. Average annual costs are $4.5 million compared to average annual benefits of $7.5 resulting in a benefit-cost ratio of 1.7 to 1.

IX. REEVALUATION EFFORTS

A. General

As discussed in Section III. B., reevaluation efforts were initiated in 1989 and a draft report was prepared in December 1993 that presented findings and conclusions of all studies completed at that time. The report concluded that the structural component of the authorized plan was in the Federal interest and was economically feasible. At that time, the Logan County Commission stated that it did not have the financial ability to finance the non-Federal share of construction. However, the Commission asked that the project remain active while it explored other funding options. All reevaluation efforts were terminated at that time.

In 1998, at the request of the Logan County Commission with financial support from the West Virginia Soil Conservation Agency PED activities were resumed. The WVSCA and the Logan County Commission requested that the PED efforts be directed towards the reevaluation of the structural component of the authorized plan and that reevaluation of all nonstructural measures continue to be deferred until additional funding sources could be identified.

This report presents the results of the reevaluation of the structural component documenting economic feasibility, optimization of project scope, NEPA compliance, and minor design changes. The report also reexamines the need for a basin-wide flood warning system (FWS) as recommended in the 1986 Feasibility Report. Field investigations were conducted to determine existing conditions in the project reach under current conditions and criteria, and additional channel alternatives were also formulated and evaluated. Flood damage surveys were updated and project benefits calculated for each of the new alternatives. Potential social and environmental impacts were also assessed. A channel optimization was conducted to ensure that the NED plan had been properly identified. An Environmental Assessment was prepared for the selected plan and is included in this report.

The report recommends that the deferral of the reevaluation of the non-structural component should continue and does not recommend any significant changes to the Island Creek Local Protection Project authorized in WRDA 1986.

B. Formulation

The major issue of concern at the onset of the 1993 reevaluation, as well as the current reevaluation was whether or not the authorized 100-foot wide channel remained a practicable and viable alternative. Since authorization of the project in 1986, land use changes along the 0.7 mile area have occurred. When considering channel width and alignment, a storm sewer and three new structures built on fill material on the left descending bank have been taken into account.

Recent reevaluation efforts were directed toward identification and evaluation of a viable channel project. Primary emphasis was placed on re-examining channel alignments alternative that would provide reductions in flooding, prevent acquisition of as many structures as possible, and reduce project costs. Several alternatives, consisting of combinations and modifications of a number of basic channel widths, were identified and evaluated during this phase. The alternatives included a variation of the authorized channel (100-foot wide). More detailed information about the plan selection process is included in the Plan Selection section of this report.

C. National Economic Development (NED) Evaluations

The reevaluation process identified the NED plan by determining the optimum channel for the 0.7 mile channel project at Island Creek. Details of this process are contained in Section X, Plan Formulation.

D. Project Economics Update

This section explains the history of economics analysis of the previous reports. The tables below reflect economics figures from previous evaluations updated to current price levels for historical comparison purposes. These figures do not however, reflect the damage estimates for the **current** study area. Refer to the Economics Appendix for damages related to this **current** study area.

The flood damage survey used in preparing the 1985 feasibility report was conducted in October 1978. The survey included a detailed inventory, mapping and assessment of all structures in the 20-mile study area located within the limits of the 500-year flood. Each structure included in the inventory was assigned a unique identification number and located on detailed maps; classified according to category of use (e.g., residential, commercial, industrial, and other properties); and surveyed to determine the first floor elevation. The damage survey was previously updated to incorporate the change in damageable improvements that occurred in the study area between 1978 and 1991. The price level was also updated to an October 1992 (FY 1993) level. The flood survey information was further updated to October 2001 (FY 2002) price levels through field verification and new commercial damage surveys where necessary. More details regarding project economics can be found in the Economic Appendix. Computation of project benefits was affected by several factors including change in price level, revised flood frequency profiles, and changes in the without-project condition. A description of the development of the new flood frequency profiles is presented in Appendix A - Engineering Technical Appendix Tab II.

Table 1 summarizes the 100-year frequency flood damages for Island Creek (10.4 miles) presented in the 1985 feasibility report and updates these figures to current price levels for historical comparison purposes.

TABLE 1 - COMPARISON OF FLOOD DAMAGES AT 100-YR. FREQUENCY FEASIBILITY REPORT AND REEVALUATION REPORT ISLAND CREEK (10.4 miles)

Category	**Feasibility Report** 1985 prices	**Reevaluation Report** Oct 2001 prices
Residential	$15,681,000	$13,477,000
Commercial-Industrial	20,010,000	24,645,000
Utilities	729,000	763,000
Transportation	1,208,000	1,223,000
Emergency Costs	1,471,000	2,207,000
TOTALS	**$39,164,000**	**$42,315,000**

The 100-year frequency flood damages in real dollar terms have increased only slightly in the 16 years since the feasibility report was published. The variables impacting this result include: low increase in residential structure values; decrease in number of residential structures; and changes in the composition and number of commercial structures and inflation.

Table 2 presents a comparison of average annual damages under existing conditions presented in the feasibility report for the Island Creek (10.4) with those computed during the reevaluation study. The updated average annual damages for the project area are estimated at $10.8 million. This represents an increase of approximately 20 percent of the average annual damages (real dollars) presented in the March 1985 feasibility report. This increase results from the same factors discussed above regarding Table 1.

The damages figures in column three of Table 2 do not reflect the Without Project damages computed for the **current** study area. Refer to the Economics Appendix for calculations of damages pertaining to the current analysis.

TABLE 2 - FEASIBILITY/REEVALUATION COMPARISON OF AVERAGE ANNUAL DAMAGES EXISTING CONDITIONS FOR ISLAND CREEK (10.4 miles)

Category	**Feasibility Report** 1985 prices	**Reevaluation Report** Oct 2001 prices
Residential	$3,157,000	$3,206,000
Commercial-Industrial	4,287,000	6,503,000
Utilities	64,000	70,000
Transportation	497,000	514,000
Emergency Costs	369,000	550,000
TOTALS	**$8,374,000**	**$10,843,000**

E. Environmental Impac t Reassessment

The National Environmental Policy Act (NEPA) compliance document for the 1985 Feasibility Report included a Final Environmental Impact Statement. For the 1993 reevaluation study, an Environmental Assessment (EA) and a Finding of No Significant Impact (FONSI) were completed but the FONSI not signed. These documents were reviewed during the preparation of the current reevaluation report to determine its applicability to the current project proposal. Coordination with the U. S. Fish and Wildlife Service (USFWS) was maintained throughout the study. All coordination documents may be found in Appendix C to the Final Environmental Assessment.

An EA and FONSI have been prepared to assess the plan recommended in this document. A Notice of Availability for the Draft Environmental Assessment and FONSI notified the public of the comment review period, which was held from January 5, 2001 through February 5, 2001. Comment resolutions were incorporated into the Final Environmental Assessment. Documentation of the public review period and comment resolutions may be found in Appendix C of the Final Environmental Assessment.

F. HTRW Investigations

A Phase I HTRW (Hazardous, Toxic, and Radioactive Waste) assessment of the study area was completed in May 1991. The assessment consisted of a physical investigation of the study area, a research of the historical land use and ownership, and a regulatory record review. From this investigation, four Areas of Concern (AOC) were identified. A Phase II investigation was conducted by personnel from the Nashville District Corps of Engineers.

The project was terminated due to lack of sponsor funds in December 1993. Because of the amount of time lapsed between the previous Phase II HTRW investigation and the present, the project site was revisited in November 1999 by personnel from the Huntington District (LRH) to visually observe any changes in site conditions since 1991. From this revisit, a decision was made to perform additional Phase II HTRW investigations on two of the previous sites to determine extents of potential contamination. The supplemental Phase II investigation revealed that one area does not require treatment and further defined the depth and extent of soil needing to be removed in the remaining site. The revisit also concluded that site conditions at the other two AOCs had not changed from the 1991 investigation.

The spoil site for the LPP was changed to an alternate location along State Route 73. A Phase I HTRW investigation was conducted in accordance with established ACOE HTRW policies. Based on the findings from the investigation, the spoil site was determined to contain no potential HTRW concerns, nor were any adjacent properties observed to contain any HTRW concerns that would impact the tract. Therefore, no further HTRW investigations on the spoil site are warranted.

Additional details can be found in the Engineering Technical Appendix, Section 11 and the HTRW reports on file in the Huntington District Office, Environmental & Remediation Section.

X. PLAN FORMULATION

During the reevaluation process a number of channel plans were analyzed in an effort to identify the plan that would maximize net benefits (NED plan).

A. Initial Assessment

As a first step, to determine whether the authorized 0.7 mile channel project was still feasible, it was analyzed together with five other channel plans – two plans using a 100-foot width, three plans using an 80-foot width, and one snagging and clearing plan. These are described in Table 3.

TABLE 3 - INITIAL PLAN ASSESSMENT

PLAN	DESCRIPTION
PLAN A	Authorized 100-foot wide channel plan. Concrete-lined channel from mouth to U.S. 119/S.R. 10 bridge. Then 100 feet wide channel with 2.5 to 1 slopes up to mouth of Copperas Mine Fork.
PLAN B	Concrete-lined 100-foot wide channel from mouth to CSX railroad bridge.
PLAN C	Concrete-lined, U-framed channel with 80-foot width from mouth to U.S. 119/S.R. 10 bridge. Then 80-foot wide channel from bridge upstream to end of project with 2.5 to 1 side slopes.
PLAN D	Snagging and clearing for entire 0.7 mile length.
PLAN E	Snagging and clearing from mouth to U.S. 119/S.R. 10 bridge. Remainder of project has 80-foot channel width with 2.5 to 1 side slopes.
PLAN F	Concrete-lined, U-framed channel with 80-foot wide channel from mouth up to U.S. 119/S.R. 10 bridge. Then 80-foot wide channel from bridge upstream to end of project with 2.5 to 1 side slopes.

A plan selection matrix was developed in which the plans were rated from best to worst (1 being best and 6 being worst). The plans were evaluated on reductions in water surface profiles, estimated costs, benefits, relocations requirements, environmental impacts, HTRW impacts and real estate impacts.

At this point in the study, a decision was made to alter the channel design. This change concerned the U-frame channel design. Studies revealed that in order to construct a U-frame channel for a 100- foot wide channel, properties on both sides of the stream would have to be acquired, the stability of the U.S. Rt. 100/St. Rt. 10 bridge piers would be undermined, and the CSX Railroad tracks on the right descending bank would have to be relocated. Therefore, post and panel wall configurations were substituted in subsequent plan analyses.

Plans C and D were selected to be carried forward for further evaluation as well as two variations of Plan C. The intermediate plans were redesignated as Alternatives 1 through 4. Descriptions of the four alternatives are provided in Table 4.

TABLE 4 - INTERMEDIATE PLAN ASSESSMENT VENTURE-LEVEL COSTS (Oct 92 prices)

PLAN	DESCRIPTION
Alternative 1	Channel width 80 feet with post and panel wall from mouth up to U.S. 119/S.R. 10 bridge. Remainder of project 2.5H to 1V side slopes. Estimated cost of project was $13.2 million.
Alternative 2	Snagging and clearing from mouth to U.S. 119/S.R. 10 bridge. Remainder of project to be 80 feet with 2.5H to 1V side slopes. Estimated cost of project was $9.9 million.
Alternative 3	Channel width 80 feet with post and panel wall from mouth to just past Super 8 motel. A second post and panel wall at Baisden Hardware, the third post and panel wall at Honeycutt body shop, and a fourth wall at the Chevron station. Estimated cost of project was $12.1 million.
Alternative 4	Channel width 80 feet with post and panel wall from mouth to behind Baisden Hardware, and a second at Honeycutt body shop, and a third at the Chevron station. Estimated cost of project was $15.3 million.

Venture-level cost estimates were provided and average annual costs were computed for the four plans described above. Table 5 displays the residual annual damages, the damages prevented, the average annual costs, the net benefits, and the benefit-cost ratio.

TABLE 5 - BENEFIT-COST COMPARISON OF INTERMEDIATE PLANS ($1,000's in Oct 92 prices)

	ALT 1	ALT 2	ALT 3	ALT 4
Existing Damages	$ 6,975.0	$ 6,975.0	$ 6,975.0	$ 6,975.0
Residual Avg Ann Damages	$ 4,669.0	$ 5,065.0	$ 4,674.0	$ 4,658.0
Damages Prevented (Avg Ann Benefits)	$ 2,306.0	$ 1,910.0	$ 2,301.0	$ 2,317.0
Avg Ann Costs	$ 1,253.0	$ 949.0	$ 1,153.0	$ 1,453.0
Net Benefits	$ 1,053.0	$ 961.0	$ 1,148.0	$ 864.0
Benefit-Cost Ratio	1.84	2.01	2.00	1.59

* This table displays previous economic analysis. These figures do not and should not match the current Economics Appendix.

The above analysis showed that Alternative 3 (80-foot side channel with four post and panel walls in the vicinity of the motel, the hardware, body shop, and the Chevron station) produced the most net benefits.

After venture level estimates were prepared for Alternatives 1 through 4, another alternative (Alt. 5) was considered which was a refinement of the best features of Alternatives 2 and 3. Alternative 5 consisted of snagging and clearing from the mouth of Island Creek to the U.S. Route 119/State Route 10 bridge, with a post and panel wall on the right descending bank at the Logan Concrete complex (opposite bank from all the plans presented thus far). This wall would allow the concrete business to remain in place and also prevent taking the motel on the opposite bank. Post and panel walls also would be constructed in the vicinity of the hardware store and the Chevron station.

At the Technical Review Conference (TRC) held in October 1992, all five alternatives were presented. During the presentation of the alternatives and their formulation, the question was raised of how and why the authorized 100-foot channel was changed to an 80-foot wide channel. It was felt by the CELRD personnel attending the TRC that the reasons for changing from a 100-foot wide channel as authorized by Congress to an 80-foot wide channel were not adequately addressed. Therefore, the decision was made and agreed upon to conduct a project optimization study to clearly identify the NED plan and therefore a new formulation of alternatives was created.

B. Channel Optimization

For the channel alternative optimization process, three channel widths were chosen – 60-feet, 80-feet, and 100-feet. All channel plans would begin at the confluence of the Guyandotte River and end 0.7 mile upstream. Generally, channel widening would occur only on one side of the channel in any area for all plans. In addition, each plan included removal of a sandbar located underneath the County Route 119-26 bridge. Channel excavation then continues along the same bank, with a side slope of 1 V to 2.5 H. Just past Baisden Hardware, the cut transitions to the right descending bank. The excavation continues on this side and ends just short of the CSX railroad bridge. Sandbar removal is a feature of all base designs.

Next retaining walls at various locations to minimize the acquisition of existing businesses and an upstream extension (from the railroad bridge to the mouth of Copperas Mine Fork) were added as features to all three of the channel width base designs making a total of 28 design variations to be analyzed. All variations are shown in matrix form in Tables 6, 7, 8 and 9.

TABLE 6 - PLAN MATRIX 60-Foot Channel Alt. A-J

Features	60-Foot Channel Alts. A-J									
	A	B	C	D	E	F	G	H	I	J
Base Design	X	X	X	X	X	X	X	X	X	X
Super 8 Motel Wall		X		X					X	X
Super 8 Motel Bldg Removed	X		X		X	X	X	X		
Baisden Hardware Wall			X	X						
Baisden Building Removed	X	X			X	X	X	X	X	X
Kennel/Pump House Removed	X	X	X	X	X	X	X	X	X	X
Upstream Extension					X	X	X	X	X	X
Honeycutt Auto Body Shop Wall						X		X		X
Honeycutt Building Removed					X		X		X	
S. Public Utilities Bldg Removed					X	X	X	X	X	X
Compton's Chevron Wall							X	X		
Compton's Building Removed					X	X			X	X

TABLE 7 - PLAN MATRIX 60-Foot Channel Alt. K-T

Features	60-Foot Channel Alts. K-T									
	K	L	M	N	O	P	Q	R	S	T
Base Design	X	X	X	X	X	X	X	X	X	X
Super 8 Motel Wall	X	X					X	X	X	X
Super 8 Motel Bldg Removed			X	X	X	X				
Baisden Hardware Wall			X	X	X	X	X	X	X	X
Baisden Building Removed	X	X								
Kennel/Pump House Removed	X	X	X	X	X	X	X	X	X	X
Upstream Extension	X	X	X	X	X	X	X	X	X	X
Honeycutt Auto Body Shop Wall		X		X		X		X		X
Honeycutt Building Removed	X		X		X		X		X	
S. Public Utilities Bldg Removed	X	X	X	X	X	X	X	X	X	X
Compton's Chevron Wall	X	X			X	X			X	X
Compton's Building Removed			X	X			X	X		

TABLE 8 - PLAN MATRIX 80-Foot Channel Alternatives

Features	80-Foot Channel Alts.					
	A	B	C	D	E	F
Base Design	X	X	X	X	X	X
Super 8 Motel Wall						
Super 8 Motel Bldg Removed	X	X	X	X	X	X
Baisden Hardware Wall		X			X	X
Baisden Building Removed	X		X	X		
Kennel/Pump House Removed	X	X	X	X	X	X
Upstream Extension			X	X	X	X
Honeycutt Auto Body Shop Wall				X		X
Honeycutt Building Removed			X		X	
S. Public Utilities Bldg Removed			X	X	X	X
Compton's Chevron Wall						
Compton's Building Removed			X	X	X	X

TABLE 9 - PLAN MATRIX 100-Foot Channel Alternatives

Features	100-Foot Channel Alts.	
	A	B
Base Design	X	X
Super 8 Motel Wall		
Super 8 Motel Bldg Removed	X	X
Baisden Hardware Wall		
Baisden Building Removed	X	X
Kennel/Pump House Removed	X	X
Upstream Extension		X
Honeycutt Auto Body Shop Wall		
Honeycutt Building Removed		X
S. Public Utilities Bldg Removed		X
Compton's Chevron Wall		
Compton's Building Removed		X

As an example, Plan 80A (shown in Table 8) consists of the base plan only. It has an 80-foot wide channel and the Super 8 Motel, Baisden Hardware, and the building behind the hardware store are removed. In Plan 60R, the channel is 60-feet wide. There are walls in the vicinity of the Super 8 Motel, and Baisden Hardware. The kennel/pump house building behind the hardware store is removed. Plan 60R also has an upstream extension and wall at the body shop of Honeycutt Pontiac. The Southern Public Service District building and the Chevron station are removed.

Since some features (i.e., wall behind Honeycutt body shop) did not make a difference in the water surface profiles, only 17 variations were analyzed using venture level estimates. As a part of the 1993 reevaluation study, venture level cost estimates were prepared for the channel optimization. Those estimates were updated during the 2001 reevaluation and can be found in Tab VII, Section F of the Engineering Technical Appendix. These 17 plans are shown in Table 10, which follows.

The plans highlighted in Table 10 were those with the best net benefits for each of the three channel widths. Using net benefits obtained from the channel width optimization analysis, the best 100-foot, 80-foot, and 60-foot side channels were chosen, namely: Plan 100A with net benefits of $2.8 million, Plan 80B with net benefits of $2.9 million, and Plan 60E with net benefits of $2.8 million. These net benefit figures do not reflect the current net benefits calculations displayed in the Economics Appendix.

Based on the results of this evaluation these three plans were selected as the final array of alternatives and are discussed in further detail in the section below. These three plans will be referred to as 60-, 80-, and 100-Foot channels throughout the remainder of this report.

A Flood Warning System (FWS) was recommended as part of the authorized project's non-structural component, the FWS is included as part of each plan in the final array. At a public meeting held on 9 February 2000, the Local Sponsor and the residents of Island Creek requested the inclusion of FWS as part of the Island Creek LPP General Reevaluation Report.

TABLE 10 - CHANNEL WIDTH OPTIMIZATION – PLAN ALTERNATIVE
Oct 2001 prices ($1,000)

Total Average Annual Damages - Existing Conditions:					$	6,866.0
Channel Plans	**Residual Avg. Ann. Damages**	**Damages Prevented (Avg. Ann. Benefits)**	**Total Project Cost**	**Average Annual Costs**	**Net Benefits**	**Benefit Cost Ratio**
PLAN 100A*	$2,567.6	$4,298.4	$23,713.0	$1,530.8	$2,767.7	2.81
PLAN 80A	$2,764.1	$4,101.9	$21,947.0	$1,416.8	$2,685.1	2.90
PLAN 80B*	$2,537.7	$4,328.3	$21,728.0	$1,402.6	$2,925.6	3.09
PLAN 80C	$2,473.7	$4,392.3	$24,131.0	$1,557.8	$2,834.6	2.82
PLAN 80E	$2,506.8	$4,359.2	$23,911.0	$1,543.6	$2,815.6	2.82
PLAN 60A	$2,995.0	$3,871.0	$19,129.0	$1,234.9	$2,636.2	3.13
PLAN 60B	$3,082.2	$3,783.8	$18,856.0	$1,217.2	$2,566.6	3.11
PLAN 60C	$3,004.9	$3,861.1	$18,738.0	$1,209.6	$2,651.5	3.19
PLAN 60D	$3,120.9	$3,745.1	$18,465.0	$1,192.0	$2,553.1	3.14
PLAN 60E*	$2,731.0	$4,135.0	$21,222.0	$1,370.0	$2,765.0	3.02
PLAN 60H	$2,788.4	$4,077.6	$21,676.0	$1,399.3	$2,678.3	2.91
PLAN 60I	$2,829.3	$4,036.7	$20,949.0	$1,352.3	$2,684.4	2.98
PLAN 60L	$2,904.4	$3,961.6	$21,403.0	$1,381.6	$2,579.9	2.87
PLAN 60M	$2,789.5	$4,076.5	$20,831.0	$1,344.7	$2,731.7	3.03
PLAN 60P	$2,829.3	$4,036.7	$21,285.0	$1,374.0	$2,662.7	2.94
PLAN 60Q	$2,881.2	$3,984.8	$20,558.0	$1,327.1	$2,657.7	3.00
PLAN 60T	$2,951.9	$3,914.1	$21,012.0	$1,356.4	$2,557.7	2.89

*These are the plans with the greatest Net Benefits for each of the three channel widths – 100 ft., 80 ft., and 60 ft. The net benefits figures above were used to select the plans to carry forward. However, after these plans were chosen detailed analysis resulted in different net benefits which are reflected in the Economics Appendix.

C. Final Array of Alternatives

This section describes features of each of the three plans included in the final array and shows a comparison of the benefits and costs associated for each. This analysis provides the basis for selection of the recommended plan.

1. <u>60-Foot Channel</u>

This channel plan consists of widening the channel to 60 feet beginning at the confluence of the Guyandotte River and Island Creek and continuing 3,800 feet upstream. The trapezoidal channel would have side slopes that would be laid back on a 2.5H to 1V slope. A post and panel wall would be constructed near the AEP facility. The plan also includes a Flood Warning System and sandbar removal.

This plan requires the acquisition and demolition of six commercial structures including the Super 8 Motel, Baisden Hardware, Baisden Hardware's outbuilding, Southern Public Utilities Warehouse, Honeycutt Auto Body, and Compton's Chevron. Generic drawings for the 60-Foot plans and their associated features can be found in the Engineering Technical Appendix as drawing numbers 80/11-14.

2. <u>80-Foot Channel</u>

This channel plan is similar to the 60-foot design except for the channel width. This plan consists of widening the channel to 80 feet beginning at the confluence of the Guyandotte River and Island Creek and continuing 3,600 feet upstream. The trapezoidal channel would have side slopes that would be laid back on a 2.5H to 1V slope. Post and panel walls would be constructed at AEP facility and at Baisden Hardware. The plan also includes a Flood Warning System and sandbar removal.

This plan requires acquisition and demolition of Super 8 Motel and Baisden Hardware's outbuilding. Generic drawings for the 80-Foot plans and their associated features can be found in the Engineering Technical Appendix as drawing numbers 80/11-14.

3. <u>100-Foot Channel</u>

This channel plan consists of widening the channel to 100 foot beginning at the confluence of the Guyandotte River and Island Creek and continuing 3,600 feet upstream. The trapezoidal channel would have side slopes that would be laid back on a 2.5H to 1V slope. A post and panel wall would be located at the AEP facility. The plan also included a Flood Warning System and sandbar removal.

This plan requires acquisition and demolition of four commercial structures including Super 8 Motel, Anderson Wholesale, Baisden Hardware's outbuilding and Baisden Hardware. Generic drawings for the 100-Foot plans and their associated features can be found in the Engineering Technical Appendix as drawing numbers 80/11-14.

4. No Action Alternative.

A consideration for any Federal project is the No Action alternative. For this alternative, there would be no project implemented by the Federal government. Without intervention by another local or state agency, flooding would continue to occur as described in the without-project conditions. These conditions result in continued threat to life and property, loss of income to businesses and employees, and little incentive for economic development.

5. Project Benefits

Project benefits were calculated for each plan in the final array based on only those structures within the project impact area. The project impact area begins at the mouth of Island Creek and continues approximately 9,000 feet upstream. Detailed information regarding project economics can be found in the Economic Appendix.

Total (structures & contents and FWS) expected annual benefits for the 60-, 80-, and 100-Foot Channel Plans are $3.9, $4.1, and $4.4 million, respectively. These total benefits are allocated as follows in Table 11.

TABLE 11 – TOTAL EXPECTED AVERAGE ANNUAL BENEFITS FOR ALTERNATIVES

(in $1,000s) Oct 2001 prices

Category	60-Foot Channel	80-Foot Channel	100-Foot Channel
Structure & Contents	$3,716.3	$3,951.7	$4,234.4
FWS Residual Damage Reduction	$142.0	$131.0	$118.0
Total	$3,858.3	$4,082.7	$4,352.4

6. Project Costs

Baseline cost estimates were prepared for the final array of alternatives and can be found in the Engineering Technical Appendix Tab VII.

The total first project cost for the 60-, 80-, and 100-Foot Channel plans are $22.8, $21.5, and $24.8 million (October 2001 price level) respectively. After subtracting the Post Feasibility Studies costs ($2.2 million), total economic first costs for the three alternatives are $20.6, $19.3, and $22.6 million, respectively. Average annual costs for each of these alternatives are calculated based on a

50-year economic life and using a 6 1/8 percent interest rate (October 2001), and includes interest during construction and the annual operations and maintenance (O&M) cost of $67,700 (O&M is discussed in more detail in Section X. E.). The expected annual costs for the 60-, 80-, 100-Foot plans are $1.6, $1.5, and $1.7 million, respectively. Total project costs along with the expected average annual cost for each plan are shown in Table 12, Island Creek Project Costs.

TABLE 12 – ISLAND CREEK PROJECT COSTS
(in $1,000s) Oct 2001 prices

Item	**60-Foot Channel**	**80-Foot Channel**	**100-Foot Channel**
01-Lands & Damages	$6,804.0	$4,974.0	$6,125.0
Contingency	$1,626.0	$1,146.0	$1,448.0
02-Relocations	$710.0	$710.0	$$710.0
Contingency	$322.0	$322.0	$322.0
09-Channels & Canals	$7,025.0	$7,772.0	$9,074.0
Contingency	$1,721.0	$1,908.0	$2,324.0
22-Post Feas. Studies	$2,200.0	$2,200.0	$2,200.0
Contingency	$0	$0	$0
30-PED	$1,750.0	$1,750.0	$1,750.0
Contingency	$175.0	$175.0	$175.0
31-S & A	$464.0	$514.0	$599.0
Contingency	$46.0	$51.0	$60.0
Total First Cost	**$22,843.0**	**$21,522.0**	**$24,787.0**
Less Sunk Cost	$2,200.0	$2,200.0	$2,200.0
Economic First Cost	**$20,643.0**	**$19,322.0**	**$22,587.0**
Annualized (6 1/85, 50yrs)	$1,378.7	$1,290.5	$1,508.6
Ann. Int. During Const.	$169.6	$142.5	$170.3
O & M	$67.7	$67.7	$67.7
Total Annual Cost	**$1,616.0**	**$1,500.7**	**$1,746.6**

7. Comparison of Project Economics

The plans' benefits and costs are compared in Table 13. By the slightest of margins ($23,900 or less than 1% of either net benefits amounts), the 100-Foot Channel has the highest net benefits of $2.6 million and is the NED plan. Considering the risk and uncertainty incorporated in the calculation of damages, it should be noted that statistically the 80-Foot channel project provides equal net benefits, has the highest benefit to cost ratio (2.6), and has the lowest total project cost of $21.5 million.

TABLE 13 – FINAL ARRAY OF ALTERNATIVES COMPARISON OF ECONOMICS
(in $1,000s) Oct 2001 prices

	60-Foot Channel	80-Foot Channel	100-Foot Channel
Expected Annual Benefits	$3,858.3	$4,082.7	$4,352.4
Expected Annual Costs	$1,616.0	$1,500.7	$1,746.6
Net Benefits	$2,242.3	$2,581.9	$2,605.8
Benefit/Cost Ratio	2.39	2.63	2.42

D. Plan Selection

Although the 100-Foot Channel produces slightly higher net benefits and is the NED plan, the 80-Foot and 100-Foot plans produce essentially the same amount of net benefits, approximately $2.60 million. Therefore, further analysis was conducted to confirm whether the 100-Foot Channel should be considered the recommended plan. To assist in this comparison, a matrix was prepared that includes information on the No Action Alternative and the 60-Foot, 80-Foot, and 100-Foot Channels. This matrix compares all the plans in several major categories including project features, economics, project effectiveness, social considerations, environmental considerations, and real estate requirements. The categories listed were then evaluated to determine which plan had either the least impact or the greatest benefit. The matrix is included as Table 14.

This analysis reveals a number of categories where the 80-Foot Channel is superior to the 100-Foot Channel. These categories are highlighted in yellow in Table 14. As can be seen in the matrix, this plan has the lowest project cost; least impact to existing commercial development; causes less environmental damage, requires less real estate acquisition and has the lowest overall real estate cost.

As documented above, the 80-Foot Channel Plan is clearly superior to the 100-Foot Plan for a number of social, economic and environmental considerations. The 80-Foot Channel Plan is also the preferred plan of the non-Federal sponsor. Although it is not technically the NED plan, the difference in net benefits between the 80-Foot and 100-Foot plans is less than one percent of the total. Therefore, the 80-Foot Channel Plan is considered to "reasonably" maximize NED benefits. For those same reasons the 80-Foot Channel Plan is selected as the recommended plan.

TABLE 14 – PLAN SELECTION MATRIX

TABLE 14 - PLAN SELECTION MATRIX

MAJOR CATEGORY	SUB-CATEGORY	NO ACTION ALTERNATIVE	60 FOOT CHANNEL	80 FOOT CHANNEL	100 FOOT CHANNEL
PROJECT DESCRIPTION					
		NA	Trapezoidal channel 3,600 ft in length	Trapezoidal channel 3,600 ft in length	Trapezoidal channel 3,600 ft in length
		NA	134,700 cubic yards of excavation (10,000 cy HTRW)	215,700 cubic yards of excavation (11,000 cy HTRW)	270,500 cubic yards of excavation (13,600 cy HTRW)
		NA	924 linear feet of post-and-panel tied-back retaining wall	1,290 linear feet of post-and-panel tied-back retaining wall	750 linear feet of post-and-panel tied-back retaining wall
		NA	1,400 cubic yard of sand-bar removal	1,400 cubic yard of sand-bar removal	1,400 cubic yard of sand-bar removal
		NA	Demolition of Super 8 Motel, Baisden Hardware's outbuilding, Baisden Hardware, Southern Public Utilities Warehouse, Honeycutt Auto Body Shop and Compton's Chevron	Demolition of Super 8 Motel and Baisden Hardware's outbuilding	Demolition of Super 8 Motel, Anderson Wholesale, Baisden Hardware's outbuilding, and Baisden Hardware
		NA	UST Removal at Baisden Hardware & Compton's Chevron	UST removal at Baisden Hardware	UST removal at Baisden Hardware
		NA	Aquatic and terrestrial environmental design measures	Aquatic and terrestrial environmental design measures	Aquatic and terrestrial environmental design measures
		NA	Flood Warning System (9 new stations max)	Flood Warning System (9 new stations max)	Flood Warning System (9 new stations max)
		NA	Spoil Site at School House Hollow (State Route 73)	Spoil Site at School House Hollow (State Route 73)	Spoil Site at School House Hollow (State Route 73)
		NA			Replacement of AEP service bridge
ECONOMIC CONSIDERATIONS					
	Total Project Cost	NA	$25.4M	$23.8M	$27.7 M
	Federal	NA	$13.8M	$15.0M	$16.9M
	Non-Federal	NA	$11.6M	$8.8M	$10.8M
	Expected Annual Cost	NA	$1.6M	$1.5M	$1.7M
	Expected Annual Benefit	NA	$3.9M	$4.1M	$4.4M
	Net Benefit	NA	$2.2M	$2.6M	$2.6M
	BCR	NA	2.39	2.63	2.42
	Annual O&M	NA	$67,700	$67,700	$67,700
PROJECT EFFECTIVENESS					
	Expected Annual Flood Damages w/in project impact area (6,000 ft)	$6.9M	$3.2M	$2.9M	$2.6M
	Max Feet Reduction 100 yr frequency	0	3 feet	7 feet	9 feet
SOCIAL CONSIDERATIONS					
	Public Safety	Continued threat to life and property	Reduces threat to loss of life and property damages	Reduces threat to loss of life and property damages	Reduces threat to loss of life and property damages
	Business Activities	Business activites are constrained by repeated flooding causing loss of income to both the business and its employees. Many vacant structures and little incentive for new business to locate there.	Improved Condition for effective operation and greater portential for development.	Improved Condition for effective operation and greater portential for development.	Improved Condition for effective operation and greater portential for development.
	Community Cohesion	Typical Appalachian coal mining community. Close family relationships tied to coal industry and local business employment. Due to severe topography primary business community concentrated in floodplain.	Loss of six commercial structures due to project construction will reduce employment opportunities thereby impacting family structure in project area.	Loss of two commercial structures due to project construction will reduce employment opportunities thereby impacting family structure in project area.	Loss of three commercial structures due to project construction will reduce employment opportunities thereby impacting family structure in project area.
	Property Values	Future flooding will continue to decrease property values in the project area	Provides reduction of maximum of 3 ft for 100-yr and 8 ft for the 1-yr.thus increasing property values.	Provides reduction of maximum of 7 Ft for the 100-yr and 8.5 Ft for the 1-yr thus increasing property values.	Provides reduction of maximum of 9 Ft for the 100-yr and 10 Ft for the 1-yr thus increasing property values.
	Tax Base	Business may choose to relocate if subject to recurrent flooding, reducing tax base	Six commercial structures will be removed.	Two commercial structures will be removed.	Three commercial structures will be removed.
	Socio-Economic Factors	Living conditions and employment below national averages.	Decreased flooding will have beneficial impact, however channel will require acquisition of six businesses thereby reducing tax revenues and employment opportunities.	Same as 60 Foot Channel except only two businesses acquired thus minimizing impacts.	Same as 60 Foot Channel except only three businesses acquired thus reducing impacts.
ENVIRONMENTAL					
	Rare and Endangered Species	None present in project area	NA	NA	NA
	Wetlands	0.2 Acre wetland in area	No impact	No impact	Possible encroachment into the wetland and/or buffer area resulting in loss of habitat and/or lower habitat quality.
	Air Quality	Average	Temporary impacts during construction	Temporary impacts during construction	Temporary impacts during construction
	Water Quality	Fair to poor throughout basin	Minor impacts during construction. Disolved oxygen expected to increase due to environmental design measures.	Minor impacts during construction. Disolved oxygen expected to increase due to environmental design measures.	Minor impacts during construction. Disolved oxygen expected to increase due to environmental design measures.
	HTRW	Phase I HTRW revealed one area	Petochemical & UST removal.	Petochemical & UST removal.	Petochemical & UST removal.
	Cultural Resources	None found in project area	None found in project area	None found in project area	None found in project area
	Noise	Current noise sources: commercial and residential traffic & CSX rail.	Temporary increase due to construcion	Temporary increase due to construcion	Temporary increase due to construcion
	Fishery Resources	Fair to good throughout basin, however poor in project area	Temporary impacts during construction. Environmental design measures would provide improved aquatic habitat.	Temporary impacts during construction. Environmental design measures would provide improved aquatic habitat.	Temporary impacts during construction. Environmental design measures would provide improved aquatic habitat.
	Wildlife Resources	Habitat generally good throughout basin. Populations below carrying capacity, riparian habitat sparse in project area	Extensive riparian losses, however lost habitat will be replaced with native vegetation.	Some riparian losses, however lost habitat will be replaced with native vegetation.	Some riparian losses, however lost habitat will be replaced with native vegetation. Additional habitat may be impacted beyond riparian zone.
ENGINEERING					
	Major Design Features	NA	924 linear feet of post-and-panel tied-back retaining wall	1,290 linear feet of post-and-panel tied-back retaining wall	750 linear feet of post-and-panel tied-back retaining wall
		NA			Single lane AEP service bridge, 165 ft in length
REAL ESTATE					
	Acres Acquired	NA	17.5	16.6	18.98
	Costs	NA	$8.4M	$6.1M	$7.5M
	Number of Structures Removed	NA	5 Businesses & outbuilding	1 Business & outbuilding	3 Businesses & outbuilding
	Other Impacts	NA	NA	NA	Adverse impacts to Taco Bell and Shoney's

XI. RECOMMENDED PLAN

A. Project Components

The purpose of the Island Creek Local Protection Project is to reduce flooding in the vicinity of Logan, West Virginia, and to provide reliable warnings of local flooding situations to the residents and businesses situated along Island Creek. The recommended project consists of approximately 3,600 feet of channel modification and installation of a flood warning system. These components are described below.

1. Channel Modification

The method of flood reduction chosen was to widen the existing streambed to a trapezoidal channel with an 80-foot bottom width and 2.5H:1V side slopes, where feasible. Special features of the project include retaining walls, structure removal, removal of a sand bar, permanent channel access for maintenance purposes, and environmental design features such as riffle structures. The project begins at the confluence of the Guyadotte River and Island Creek and terminates with the sandbar removal located approximately 400 feet upstream of the confluence of Island Creek and Copperas Mine Fork. The project's total length is approximately 4500 feet. The project plan is shown on Exhibit 5. A detailed description of all project features and project drawings is included in the Engineering Technical Appendix.

2. Spoil Site

The proposed spoil disposal site is located in Logan, WV at School House Hollow, an area adjacent to and to the east of Milkhouse Hollow. The site is on the north side of State Route 73, approximately 0.35 miles from its intersection with Old U.S. Route 119 and State Route 44. A 12-foot wide paved road provides access to the site from State Route 73. This site is identified on Exhibit 5.

The spoil site is a valley containing approximately 105 acres of moderate to steep hillside with upland hardwood vegetation. Approximately 12 acres of the valley portion of the site has previously been used as a spoil disposal site during the construction of U.S. Route 119 and State Route 73 in the mid-1990's. The previous fill material consists of rock and soil and is configured in two flat benches with fill slopes of approximately 2.5 to 1. These 12 acres are vegetated with tall grasses and low growing brush. Within the valley, a dirt haul road provides access along the west side of the fill. A shallow ditch around the perimeter of the existing fill collects storm water surface runoff from the hillsides and carries it to the base of the fill where it flows under the access road and State Route 73 via concrete culverts.

Material excavated from the Island Creek channel will be placed over the 6.5 acres of existing fill. The spoil site will also be used by the local sponsor for future disposal of channel sediment.

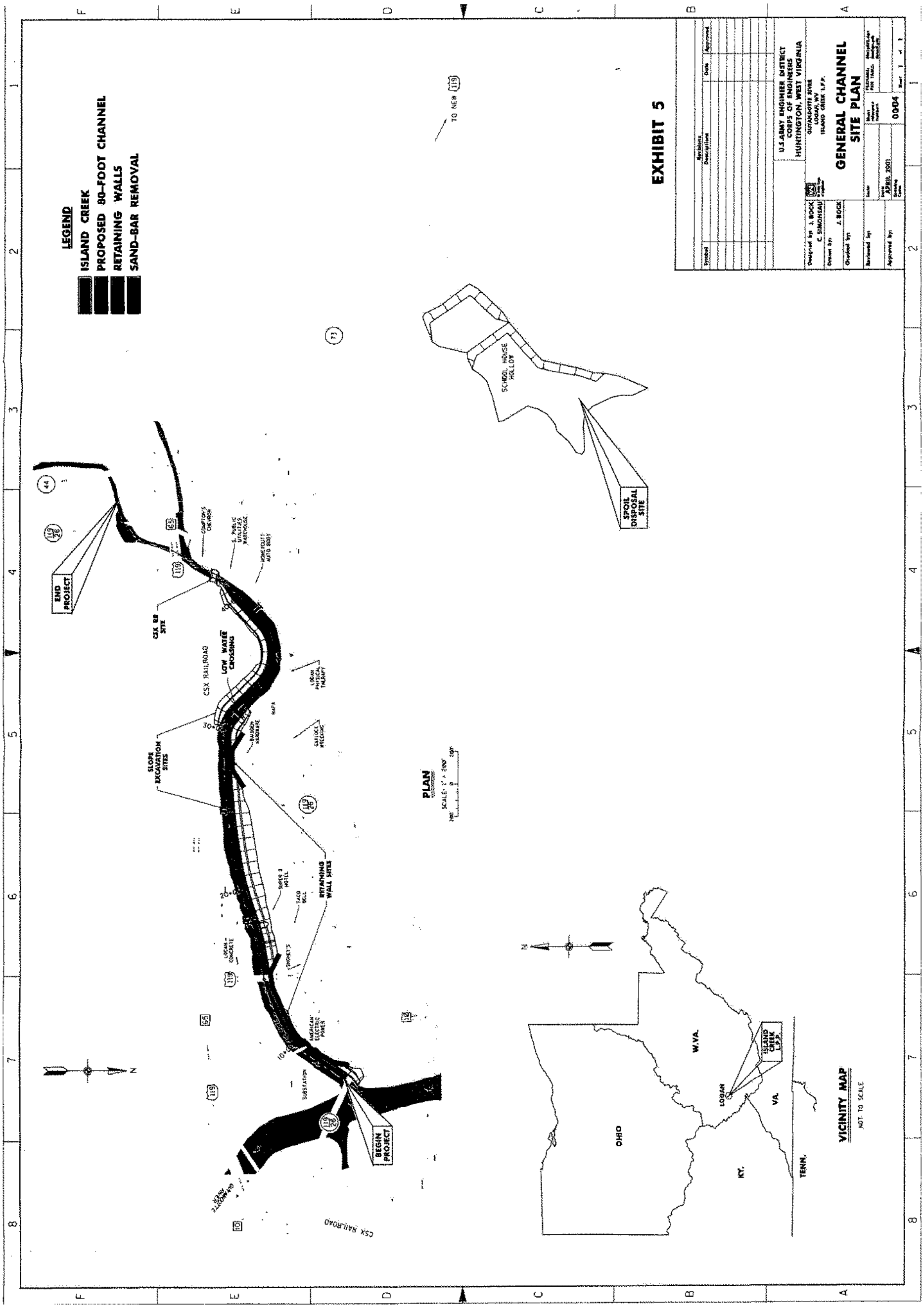
3. Flood Warning System

A Flood Warning System (FWS) is recommended for the Island Creek Basin allowing continual direct access to flood/storm data. Community access to this data would significantly improve response time of the communities in the event of a flooding situation. The recommended system would be a state-of-the-art integration of new stream and precipitation gages, radio repeater sites and dedicated computer workstations running software with forecast capability. The system would provide additional warning time for the small communities upstream of Logan. The system would also be beneficial for communities located downstream on the Guyandotte River. The recommended FWS would expand the existing Integrated Flood Observing and Warning System (IFLOWS) to meet the basin-wide requirement of providing flood warning to the Office of Emergency Service (OES), officials of Logan County, and possibly some of the surrounding counties. By including stream gauge data into the forecast model, the reliability of flood height predictions and warning times would improve current capability considerably.

A maximum of nine (9) new river gages would be installed to forecast flooding upstream of Logan. The location of the stations was determined during field investigations and took into account recommendations of the Logan County Office of Emergency Services. Equipment to be installed would provide all the functions including satellite communications, data collection, telephone, and IFLOWS transmission capabilities.

Addition details about the FWS and a location map are contained in the Engineering Technical Appendix, Tab II, Section B. The economic analysis of the FWS is contained in the Economic Appendix.

EXHIBIT 5 – RECOMMENDED PROJECT MAP


LEGEND
ISLAND CREEK
PROPOSED 80-FOOT CHANNEL
RETAINING WALLS
SAND-BAR REMOVAL
EXHIBIT 5
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
GUYANDOTTE RIVER
LOGAN, WV
ISLAND CREEK L.P.P.
GENERAL CHANNEL
SITE PLAN
APRIL 2001
0004
END PROJECT
BEGIN PROJECT
CSX RAILROAD
LOW WATER CROSSING
SLOPE EXCAVATION SITES
RETAINING WALL SITES
SCHOOL HOUSE HOLLOW
SPOIL DISPOSAL SITE
TO NEW 119
PLAN
SUBSTATION
AMERICAN ELECTRIC POWER
LOGAN CONCRETE
VICINITY MAP
NOT TO SCALE
OHIO
W.VA.
KY.
VA.
TENN.
LOGAN
ISLAND CREEK L.P.P.

B. Real Estate Acquisition

Acquisition of lands, easements, rights-of-ways, relocations and disposal lands (LERRD) is the responsibility of the non-Federal sponsor. For this project, the proposed sponsor is the Logan County Commission. A determination of the Commission's land acquisition experience and ability has been made. It is assumed that the sponsor will request the Corps to accomplish acquisitions/relocations of all necessary interests in lands on their behalf due to their limitations. Following execution of the Project Cooperation Agreement (PCA), a Memorandum of Agreement (MOA) will be entered into between the Corps and the Commission that will specify the details of this service. Generally, all project lands will be acquired in the name of the Commission.

The proposed acquisition limits conform to currently identified construction and operation and maintenance requirements. The required area is comprised of 93 tracts, containing approximately 125 acres. No residences are to be acquired. There is two commercial acquisitions (Super 8 Motel & Baisden Hardware's outbuilding). These structures will be acquired and demolished. The proposed Flood Warning System has minimal real estate requirements. See the Engineering Technical Appendix Tab V for the Real Estate Plan for a more complete discussion of real estate requirements.

The estimated cost to acquire the real estate required for this project is approximately $5.9 million. Acquisition of real estate is estimated to require a period of 42 months. Real estate acquisitions would be initiated after execution of the PCA and entering into an MOA for acquisition services.

C. Relocations

Construction of the proposed channel improvement will affect facilities owned by Pure Water Company of Logan, Allegheny Power Company, City of Logan, American Electric Power Company CSX Railroad, West Virginia Department of Highways, and Verizon. The estimated cost to complete the relocations is approximately $1.0 million. The Logan County Commission, as the proposed sponsor, will be responsible for all relocations and adjustments to the facilities. The Engineering Technical Appendix, Section 8 contains a description of affected facilities. Drawings showing the facilities are shown in Engineering Technical Appendix, Tab III.

D. Environmental Impacts

The potential impacts of the recommended plan have changed since the 1993 review of the project. Commercial development dominates the project-affected area. Land use patterns in the project area virtually preclude natural areas. Therefore, where disturbed, the upper slopes of the stream bank will be reseeded with deep rooting grasses and non-woody annuals and perennials. Aquatic environmental design measures include in-stream riffle/pool complexes. These structures would be constructed intermittently along the 0.7-mile of Island Creek to be widened. The riffle structures, consisting of stone similar in size to the stone slope protection, would be approximately 25 feet wide and extend across the width of the channel. The riffle structures would be anchored approximately 1 foot into the streambed and rise approximately 1.5 foot above the streambed. The new disposal site at Schoolhouse Hollow significantly decreases the amount of upland hardwood trees and shrubs to be disturbed. The 6.5 acres of new fill would be seeded with native grass, annual and perennial mix and planted with upland deciduous trees and shrubs. The planting would be maintained as a successional plant community requiring no maintenance such as mowing or herbicide use. The spoil disposal site would be acquired in fee to insure control and management of environmental design measures. Refer to the Environmental Assessment for further details of project environmental design measures.

E. Cul tural Resources

No National Register sites will be directly impacted and the design of the project will be coordinated with the West Virginia Division of Culture and History. Implementation of the recommended plan would not have an effect on cultural resources of the area. If significant archeological or historical resources are encountered during construction, appropriate measures will be incorporated.

F. O&M Considerations

The non-Federal sponsor will be responsible for the operation and maintenance of the project and all associated costs thereof after the completion and acceptance of the project as well as the operation and maintenance of the project and all associated costs thereof after the completion and acceptance of the project. The operation and maintenance of the project will be in accordance with Federal regulations and the Project Cooperation Agreement. The sponsor will be required to do the following: keep the right-of-way free of all unauthorized encroachments; inspect the post and panel walls on a prescribed basis and make any necessary repair; mow (both with trimmer and by mower) the grass on a predetermined average per season; inspect the stone slope protection; make repairs to the project when required; and submit annual reports to the District Engineer. An operation and maintenance manual will be prepared by the Corps and provided to the Sponsor and will contain detailed requirements and information regarding all project mitigation, including an erosion control plan for all construction work. The Corps of Engineers will, annually, inspect the condition of the project including all mitigation features, both along Island Creek and at the School House Hollow spoil sites. The average annual estimated cost (labor, equipment and materials) to perform operation and maintenance for the channel portion of the recommended project is $19,100. Additional details about operation and maintenance are found in the Engineering Technical Appendix, Tab VI.

Operation and maintenance must also be performed on the FWS on a regular basis as detailed in the Engineering Technical Appendix, Tab II, Section B. The total annual operations and maintenance cost for the FWS is estimated at $5,400 per gage. Based on 9 gages, this would amount to $48,600 per year. Therefore, the total operations and maintenance cost for the Island Creek project is currently estimated to be $67,700 annually.

G. Project Cost

All costs associated with construction of the Island Creek Local Protection Project have been estimated and amount to $21.5 million at October 2001 price level. This estimate includes the design and construction of a channel, 80-foot wide; two retaining walls; other appurtenance items; and required relocation and real estate. A detailed breakdown of all project costs is provided in the Engineering Technical Appendix, Tab VII. The fully funded cost of the project including inflation during the period of construction is currently estimated to be $23.8 million. A summary of the cost estimate for the recommended plan (80-Foot Channel) is shown in Table 15.

TABLE 15 – COST ESTIMATE
(in $1,000s)

ACC NO	ITEM DESCRIPTION	OCT 2001 COST	FULLY FUNDED
01	**Lands & Damages**	$4,974.0	$5,251.0
	Contingency	$1,146.0	$1,210.0
02	**Relocations**	$710.0	$793.0
	Contingency	$322.0	$360.0
09	**Channel & Canals**	$7,772.0	$8,958.0
	Contingency	$1,908.0	$2,199.0
22	**Post Feasibility Studies**	$2,200.0	$2,200.0
	Contingency	$0	$0
30	**Planning, Engineering & Design**	$1,750.0	$1,956.0
	Contingency	$175.0	$196.0
31	**Supervision & Administration**	$514.0	$621.0
	Contingency	$51.0	$62.0
	TOTAL PROJECT COST	**$21,522.0**	**$23,806.0**

H. NED Plan and Project Economics

The 100-Foot Channel Plan has been designated as the NED plan. However, the 80-Foot Channel Plan has been selected as the recommended plan for the following reasons:

1) statistically the same net benefits as the NED plan,
2) less impact to existing commercial development,
3) less social and environmental impacts than the NED plan, and
4) the 80-Foot Channel is the locally preferred plan.

The 80-Foot channel plan has expected annual benefits of $3.9 million, expected annual costs of $1.5 million, net benefits of $2.6 million and a benefit cost ratio of 2.63 to 1.

I. Cost Sharing

The non-Federal sponsor will be responsible for all lands, easements, rights-of-way, relocations, and disposal areas (LERRD). The sponsor must also provide a minimum of five percent of the project cost in cash. The total non-Federal share must be at least 25 percent and not more than 50 percent of the total project cost. If the non-Federal share including the items above should be less than 25 percent, the sponsor must pay any additional amounts necessary for the non-Federal share to equal 25 percent. The cost share requirements reflect the requirement, which existed at the time of original project authorization. The details regarding cost share and sponsor responsibilities can be found in Section XIV., B. Division of Plan Responsibilities.

Table 16 shows the break out of the project cost and the Federal and non-Federal share. Total project cost is $23.8 million with $15.0 million being the Federal responsibility and $8.8 million as the non-Federal share. This non-Federal share represents approximately 37 percent of total project cost. These figures are based on costs contained in the fully funded baseline cost estimate.

TABLE 16 – COST SHARE REQUIREMENTS (FULLY FUNDED)
(in $1,000s)

Total Project Cost		**$23,805.5**
Federal Share		**$15,018.7**
Non Federal Share		**$8,786.9**
Non-Federal Share break down		
01 Lands & Damages	$6,461.0	
02 Relocations	$1,153.0	
5% of Structural Project in Cash	$1,172.9	
Non-Federal Share	$8,786.9	

XII. PLAN ACCOMPLISHMENTS

The implementation of the recommended plan (80-Foot Channel Plan) would result in a project that would provide reductions in flooding depths along the lower portion of Island Creek. Specifically for a 100-yr flood the flooding depths would be reduced 4.4 ft., 6.6 ft., and 6.3 ft. at 1,000 ft., 2,000 ft., and 3,000 ft. upstream of the mouth respectively. For more detailed information on the flood reductions at other frequencies and locations, see Exhibit A-II-10 in Tab II, Hydrology and Hydraulics Section of the Engineering Technical Appendix. The project would prevent $3.9 million or about 58% of the Without Project expected annual damages estimated to occur under existing conditions. The plan has net benefits of $2.58 million and has a benefit-to-cost ratio of 2.6 to 1. The project avoids detrimental social, environmental, and economic impacts and provides a betterment of public safety through reduced flooding and warning.

XIII. PLAN IMPLEMENTATION

A. Institutional Requirements

Prior to initiation of construction, Congress must appropriate funds for the Federal share of project costs. Requirements for non-Federal participation must also be met prior to initiation of construction. This includes the execution of a Project Cooperation Agreement (PCA) between the local sponsor and the Federal government and the provision of all funds and/or work necessary to satisfy the cost sharing requirements in effect at the time of PCA execution. Upon completion of construction, the project will be turned over to the local sponsor for operation and maintenance.

B. Division of Plan Responsibilities

The implementation of the recommended plan of development is the joint responsibility of the Corps of Engineers (representing the Federal government) and the Logan County Commission, West Virginia (the local sponsor) with financial support from the West Virginia Soil Conservation Agency (WVSCA). The Corps of Engineers will complete the plans and specifications, provide funds for project construction, construct the project, and make an annual inspection of the conditions of the project. The following is a list of the non-Federal sponsor's required responsibilities for the project (Logan County Commission along with WVSCA):

a. Provide a minimum of 25 percent, but not to exceed 50 percent of total project costs as further specified below:

(1) Enter into an agreement which provides, prior to execution of the project cooperation agreement, 25 percent of design costs;

(2) Provide, during construction, any additional funds needed to cover the non-federal share of design costs;

(3) Provide, during construction, a cash contribution equal to 5 percent of total project costs assigned to structural flood control;

(4) Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations determined by the Government to be necessary for the construction, operation, and maintenance of the project;

(5) Provide or pay to the Government the cost of providing all retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring features and stilling basins, that may be required at any dredged or excavated material disposal areas required for the construction, operation, and maintenance of the project; and

(6) Provide, during construction, any additional costs as necessary to make its total contribution equal to at least 25 percent of total project costs.

b. Give the Government a right to enter, at reasonable times and in a reasonable manner, upon land which the local sponsor owns or controls for access to the project for the purpose of inspection, and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the project.

c. Assume responsibility for operating, maintaining, replacing, repairing, and rehabilitating (OMRR&R) the project or completed functional portions of the project, including mitigation features without cost to the Government, in a manner compatible with the project's authorized purpose and in accordance with applicable Federal and State laws and specific directions prescribed by the Government in the OMRR&R manual and any subsequent amendments thereto.

d. 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 non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element.

e. Hold and save the Government free from all damages arising for the construction, operation, maintenance, repair, replacement, and rehabilitation of the project and any project-related betterments, except for damages due to the fault or negligence of the Government or the Government's contractors.

f. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project to the extent and in such detail as will properly reflect total project costs.

g. Perform, or cause to be performed, 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 USC 9601-9675, that may exist in, on, or under lands, easements or rights-of-way necessary for the construction, operation, and maintenance of the project; except that the non-Federal sponsor shall not perform such investigations on lands, easements, or rights-of-way that the Government determines to be subject to the navigation servitude without prior specific written direction by the Government.

h. Assume complete financial responsibility 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 Government determines necessary for the construction, operation, or maintenance of the project.

i. Agree that, as between the Federal Government and the non-Federal sponsor, the non-Federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and, to the maximum extent practicable, operate, maintain, repair, replace, and rehabilitate the project in a manner that will not cause liability to arise under CERCLA.

j. Prescribe and enforce regulations to prevent obstruction of or encroachment on the Project that would reduce the level of protection it affords or that would hinder operation or maintenance of the Project.

k. 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 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR part 24, in acquiring lands, easements, and rights-of-way, and performing relocations for construction, operation, and maintenance of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act.

l. Comply with all applicable Federal and State laws and regulations, including Section 601 of the Civil Rights Act of 1964, Public Law 88-352, 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 Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), requiring non-Federal participation and implementation of floodplain management plans;

m. 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, in accordance with the cost sharing provisions of the agreement;

n. Participate in and comply with applicable Federal floodplain management and flood insurance programs;

o. Do not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is authorized.

p. Inform affected interests, at least annually, regarding the limitations of the projection afforded by the project.

Preliminary discussions were held with the Logan County Commission concerning their legal capability to sponsor, ability to acquire real estate and PL 91-646 requirements as well as documentation of LERRD costs. The PCA specifying the responsibilities of the two parties must be consummated prior to the initiation of construction. The estimated Federal cost of construction is $15.0 million. The estimated non-Federal first cost is $8.8 million and the estimated cost of operation and maintenance is $67,700 annually.

C. Views of the Non-Federal Sponsor

During the course of the study, the Logan County Commission has demonstrated an interest and support in the development and implementation of a project that would reduce flood damages in the Island Creek area. However, at a meeting attended by the three Logan County Commissioners on 13 October 1993, the Commission President explained that Logan County was in no position to finance their share of construction costs. While they were unable to financially commit to the project at that time, the Commission did want to continue to seek potential sources of funding for the non-Federal share of the project.

Subsequent to the events above, in 1998 the West Virginia Soil Conservation Agency (WVSCA) agreed to provide funding to assist the Logan County Commission with sponsoring the project. In a resolution passed 9 January 1998, the Logan County Commission agreed to request the Corps to proceed with the study efforts. WVSCA fully supports this project and will work with the Logan County Commission to provide non-Federal financial support. The Letter of Intent and other letters of support are included as Exhibit 6.

XIV. SUMMARY OF COORDINATION

During the Reevaluation study effort, coordination was maintained with Federal, State, and local government agencies and other interested parties. Specific coordination was conducted with the U.S. Fish and Wildlife Service, the West Virginia Department of Natural Resources, the Logan County Commission and West Virginia Soil Conservation Agency.

EXHIBIT 6 - LETTERS OF SUPPORT

COUNTY OF LOGAN

COMMISSIONERS:
ARTHUR E. KIRKENDOLL
PRESIDENT

DANNY R. GODBY

WILLIE D. AKERS, JR.

COUNTY ADMINISTRATOR
PAUL HARDESTY

OFFICE OF THE COUNTY COMMISSION

ROOM 103 • LOGAN COUNTY COURTHOUSE
LOGAN, WV 25601
(304) 792-8626 FAX (304) 792-8511

August 17, 2001

Col. John D. Rivenburgh, District Engineer
Huntington District
U. S. Army Corps of Engineers
502 Eighth St
Huntington, WV 25701-2070

Dear Col. Rivenburgh:

The Logan County Commission has completed its review of the model Project Cooperation Agreement and the draft General Reevaluation Report, dated May, 2001, for the Island Creek Local Protection Project. The recommended project includes widening the existing Island Creek channel to 80 feet beginning at the confluence of the Guyandotte River and continuing 3,600 feet upstream. The plan also includes two post-and-panel retaining walls constructed in locations to protect specific commercial structures, removal of an existing sandbar, installation of a flood warning system and aquatic and terrestrial mitigation features. The Logan County Commission understands that the proposed project provides between a 10 and 20 year level of flood protection. Furthermore, the Logan County Commission understands its responsibility to provide all necessary project lands, easements, rights-of-way, utility relocations and disposal sites (LERRDs) and agrees to comply with the floodplain management and insurance requirements stated in Section 402 of the Water Resources Development Act of 1986 as amended.

The estimated fully funded total project cost is $23.4 million (October, 2000 price level), which includes all post feasibility studies, pre-construction engineering and design, project construction and LERRDs costs. The Logan County Commission's share as the non-Federal sponsor is estimated at $8.8 million (38 percent of total project cost), which includes a 5 percent cash requirement ($1.2 million) and LERRDs requirement ($7.6 million). The Logan County Commission anticipates receiving financial support for its share of project costs through the West Virginia Soil Conservation Agency.

EXHIBIT 6

Col. John D. Rivenburgh
Page 2
August 17, 2001

The Logan County Commission has determined that the model Project Cooperation Agreement contains terms that are acceptable. The Logan County Commission has the ability, capability and full legal authority to fulfill all of its obligations contained in the model agreement. The Logan County Commission intends to enter into an agreement with the Department of the Army for implementation of the project and for its subsequent operation and maintenance.

It is understood that the purpose of this letter is to establish the Logan County Commission's intent and ability to serve as the non-Federal sponsor of the project, and does not financially or legally obligate the Logan County Commission or the Federal Government.

Very truly yours,

Arthur E. Kirkendoll
President, Logan County Commission

AEK/zw

EXHIBIT 6

Bob Wise
Governor

West Virginia
Soil Conservation Agency
1900 Kanawha Boulevard, East
Charleston, WV 25305-0193
Phone: (304) 558-2204
Fax: (304) 340-4839

Gus R. Douglass
Chairman

Lance Tabor
Executive Director

June 29, 2001

Colonel John D. Rivenburgh
District Engineer, Huntington District
U.S. Corps of Engineers
502 8th Street
Huntington, West Virginia 25701-2070

Dear Colonel Rivenburgh:

The West Virginia Soil Conservation Agency has completed its review of the General Reevaluation Report, dated May 2001, for the Island Creek Local Protection Project. This agency understands that the proposed project includes widening the lower 0.7 mile of Island Creek to a bottom channel width of 80 feet; construction of two post-and-panel tie-back retaining walls; removal of a sandbar; and installation of a flood warning system and various aquatic and terrestrial environmental mitigation features. The Logan County Commission would be the non-federal sponsor for this project with financial assistance being provided from the State of West Virginia being co-administered by this agency and the Guyan Soil Conservation District.

The estimated fully funded total project cost is $23.4 million, which includes all post feasibility studies, pre-construction engineering and design, project construction and LERRDs costs. The Logan County Commission's share as the non-federal sponsor is estimated at $8.8 million, which includes a 5 percent cash requirement ($1.2 million) and LERRDs requirement ($7.6 million).

It is understood that the purpose of this letter is to establish the West Virginia Soil Conservation Agency's intent and ability (dependent on appropriated state funding) to serve as a financial supporter to the Logan County Commission (non-federal sponsor) for this project, and does not financially or legally obligate this agency or the Federal Government.

Sincerely,

Lance E. Tabor
Executive Director

LT/rah

CC: Douglass, Campbell, Wolfe, Guyan SCD
Filing 390-30-118

EXHIBIT 6

Guyan Soil Conservation District
2631-5th Street Road - Huntington, WV 25701

July 23, 2001

Colonel John D. Rivenburgh
District Engineer, Huntington District
US Corps of Engineers
502 8th Street
Huntington, WV 25701-2070

Dear Colonel Rivenburgh,

The Guyan Soil Conservation District has completed its review of the Project Cooperation Agreement for the Island Creek Local Protection Project. The Guyan Soil Conservation District understands that the proposed project includes widening the lower 0.7 mile of Island Creek to a bottom channel width of 80 feet; construction of two post-and-panel tie-back retaining walls; removal of sandbar; installation of a flood warning system; and various aquatic and terrestrial environmental mitigation features. The Logan County Commission would be the non-federal sponsor for this project with financial assistance being provided from the State of West Virginia through the WV Soil Conservation Agency being administered by us, the Guyan Soil Conservation District.

The estimated fully funded total project cost is $23.4 million, which includes all post feasibility studies, pre-construction engineering and design, project construction and LERRDs costs. The Logan County Commission's share as the non-federal sponsor is estimated at $8.8 million, which includes a 5 percent cash requirement ($1.2 million) and LERRDs requirement ($7.6 million).

It is understood that the purpose of this letter is to establish the Guyan Soil Conservation District's intent and ability (dependent on appropriated state funding) to serve as a financial administrator between the WV Soil Conservation Agency (financial supporter) and the Logan County Commission (non-federal sponsor) for this project, and does not financially or legally obligate this District or the Federal Government.

Sincerely,

Jan Barry Hatfield

Jan Barry Hatfield
GSCD Sec./Treasurer

JBH/mm

Cc: Tabor, Campbell, Layman

EXHIBIT 6

XV. CONCLUSIONS

The reevaluation studies contained herein have concluded that the recommended plan (80-Foot Channel Plan) a 0.7 mile long channel modification project to reduce flood damages is in the federal interest and is economically feasible with a benefit-to-cost ratio of 2.63 to 1. The recommended channel plan provides protection for approximately a 10-year event for most structures in the project area and produces expected annual net benefits of $2.6 million. The recommended plan also includes a basin-wide flood warning system that has been found to be incrementally justified. Although the recommended plan is not the NED plan, it produces statistically the same amount of net benefits and because of environmental and social considerations documented in this report is clearly the superior plan. The 80-Foot Channel Plan is also the non-Federal sponsor's preferred plan. For these reasons, the 80-Foot Channel Plan is the recommended plan for water resources development in the Island Creek area.

The Logan County Commission has stated that it is financially unable at this time to meet the cost sharing requirements for the additional nonstructural components of the authorized plan. Therefore, it is further concluded that reevaluation of the nonstructural component of the authorized plan should be deferred until such time as a willing and capable nonfederal sponsor expresses interest in the implementation of such measures.

XVI. RECOMMENDATION

Based upon findings contained herein and the Environmental Assessment, I recommend that the 80-Foot Channel Plan be implemented as a separable element pursuant to the authorization contained in the 1986 Water Resources Development Act (P.L. 99-662). I further recommend that the nonstructural component of the authorized plan be deferred at this time.

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 state, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

JOHN D. RIVENBURGH
COLONEL, Corp of Engineers
Commanding

XV. CONCLUSIONS

The reevaluation studies contained herein have concluded that the recommended plan (80-Foot Channel Plan) a 0.7 mile long channel modification project to reduce flood damages is in the federal interest and is economically feasible with a benefit-to-cost ratio of 2.63 to 1. The recommended channel plan provides protection for approximately a 10-year event for most structures in the project area and produces expected annual net benefits of $2.6 million. The recommended plan also includes a basin-wide flood warning system that has been found to be incrementally justified. Although the recommended plan is not the NED plan, it produces statistically the same amount of net benefits and because of environmental and social considerations documented in this report is clearly the superior plan. The 80-Foot Channel Plan is also the non-Federal sponsor's preferred plan. For these reasons, the 80-Foot Channel Plan is the recommended plan for water resources development in the Island Creek area.

The Logan County Commission has stated that it is financially unable at this time to meet the cost sharing requirements for the additional nonstructural components of the authorized plan. Therefore, it is further concluded that reevaluation of the nonstructural component of the authorized plan should be deferred until such time as a willing and capable nonfederal sponsor expresses interest in the implementation of such measures.

XVI. RECOMMENDATION

Based upon findings contained herein and the Environmental Assessment, I recommend that the 80-Foot Channel Plan be implemented as a separable element pursuant to the authorization contained in the 1986 Water Resources Development Act (P.L. 99-662). I further recommend that the nonstructural component of the authorized plan be deferred at this time.

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 state, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

JOHN D. RIVENBURGH
COLONEL, Corp of Engineers
Commanding

EA/EIS CERTIFICATION SHEET
FINAL ENVIRONMENTAL ASSESSMENT
ISLAND CREEK LOCAL PROTECTION PROJECT
LOGAN COUNTY, WEST VIRGINIA

Authorization for the project is provided under The Water Resources Development Act (WRDA) of 1986, Public Law (PL 99-662), dated November 17, 1986.

The project has been designed to reduce flooding damages within the Island Creek Basin and to improve response time of the community in the event of a flood situation.

All comments received as a result of the 30-day agency and public review period have been considered in the Final Environmental Assessment (FEA). The comments and subsequent District responses are included in Appendix E of the FEA. There are no unresolved issues regarding the proposed action.

The following Staff/ Team Members have reviewed the FEA and Findings of No Significant Impact (FONSI) and have determined they are in compliance with all existing Project Management Plans (PMP) and National Environmental Policy Act (NEPA) guidance.

Wallace E. Dean 10 January 08
WALLACE E. DEAN, CWB
Ecologist, Environmental Analysis Section
Planning Branch

TERRY L. CLARKE, Esq.
NEPA REVIEW
Office of Counsel

14 JAN 08
PETER K. DODGION
Chief, Environmental Analysis Section
Planning Branch

for S. MICHAEL WORLEY, P.E.
Chief, Planning Branch

SHERRY L. ADAMS
Project Manager
Project Management

COY W. MILLER, P.E.
Deputy District Engineer
For Project Management

QUALITY CONTR AN

ISLAND CREEK LOCAL PROTECTION PROJECT, LOGAN COUNTY, WEST VIRGINIA

Volume: Environmental Assessment
Technical Specialist: Wallace E. Dean
Organization: Planning Division, Environmental Analysis Branch

Activity ID	Activity Description	Technical Reviewer	Certification Signature	Certification Date	Certification Man Hours
880	Draft EA and FONSI	Terry Clarke	Terry Clarke	11/28/2007	
880	Draft EA and FONSI	Gus Drum			

QUALITY CONTI PLAN

ISLAND CREEK LOCAL PROTECTION PROJECT, LOGAN COUNTY, WEST VIRGINIA

Volume: Environmental Assessment
Technical Specialist: Wallace E. Dean
Organization: Planning Division, Environmental Analysis Branch

Activity ID	Activity Description	Technical Reviewer	Certification Signature	Certification Date	Certification Man Hours
880	Draft EA and FONSI	Terry Clarke			
880	Draft EA and FONSI	Gus Drum	[illegible]	11/14/07	2.0 Hrs.

Finding of No Significant Impact
Island Creek Basin
Local Protection Project
Logan, West Virginia

1. I have conducted an environmental assessment in the overall public interest concerning implementation of the Island Creek Local Protection Plan. The purpose of this project is to reduce flooding damages with the Island Creek Basin and to improve response time of the community in the event of a flood situation as authorized in Section 202 of PL 96-367.

2. The possible consequences of the project have been studied for environmental, cultural and social impacts. Another factor bearing on my assessment was the capability of the project to meet the public needs for which it was proposed. The following references the assessment:

a. Environmental Considerations. The Huntington District has taken reasonable measures to assemble and present the known or foreseeable environmental impacts of the project in the environmental assessment. These impacts involve biological and human resources. All adverse effects of project implementation are considered insignificant or will be avoided through best management techniques.

b. Social Well-Being Considerations. The proposed project will provide reduced flooding damages with the Island Creek Basin and improve response time of the community in the event of a flood situation. No significant economic or social well-being impacts are forseen as a result of the proposed project. No archeological resources are recorded in the project area. There would be temporary visual and noise impacts associated with construction; however these are considered minor and will cease once project is constructed.

c. Coordination with Resource Agencies. Pursuant to the Fish and Wildlife Coordination Act (FWCA) of 1958, coordination with the U.S. Fish and Wildlife Service and the West Virginia Department of Natural Resources has been maintained throughout the study. Appropriate measures and best management practices have been identified and incorporated into the plan. Also, in accordance with the Endangered Species Act, as amended, the recommended plan would not impact listed species.

d. Other Pertinent Compliance. No prime or unique farmland under the Farmland Protection Policy Act will be involved. The proposed action is also in compliance with the National Historic Preservation Act, (Section 106 32 CFR 300), Executive (EO) 11988 (Floodplain Management) and EO 11990 (Protection of Wetlands).

Finding of No Significant Impact
Island Creek Basin
Local Protection Project
Logan, West Virginia

e. Other Public Interest Considerations. There has been no significant opposition to the proposed action by State or local Governments, or organized environmental groups. Comments received during the public review period have been included in the Final Environmental Assessment. There are no unresolved issues regarding the implementation of the project.

f. Section 176(c) Clean Air Act. The proposed action has been analyzed for conformity applicability pursuant to regulations implementing Section 176 (c) of the Clean Air Act. It has been determined that the proposed action will not exceed *de minimis* levels or direct emissions of criteria pollutant or its precursors and is exempted by 40 CFR Part 93.153. Any later direct emissions are generally not within the Districts' continuing program responsibility and generally cannot be practicably controlled by the District. For these reasons a conformity determination is not required for this action.

3. I find the Island Creek Local Protection Project has been planned in accordance with the current authorization as described in the Environmental Assessment. The project is consistent with National policy, statutes, and administrative directives. This determination is based on a thorough analysis and evaluation of the project and alternative courses of action. In conclusion, I find the proposed Island Creek Local Protection Plan will have no significant adverse effect on the quality of the human and/or natural environment.

22 JAN, 2008
DATE

Dana R Hurst
DANA R. HURST
Colonel, Corps of Engineers
District Engineer

US Army Corps
of Engineers
Huntington District

FINAL ENVIRONMENTAL ASSESSMENT

ISLAND CREEK LOCAL PROTECTION PROJECT
LOGAN COUNTY, WEST VIRGINIA

US ARMY CORPS OF ENGINEERS
HUNTINGTON DISTRICT
HUNTINGTON, WEST VIRGINIA

January 2008

U.S. Army Corps of Engineers
Huntington District

FINAL ENVIRONMENTAL ASSESSMENT
ISLAND CREEK LOCAL PROTECTION PROJECT
LOGAN, LOGAN COUNTY, WEST VIRGINIA

Abstract: The proposed project area is located in southern West Virginia, in Logan County, and is a part of the Island Creek Local Protection Project. The proposed actions consist of widening Island Creek to approximately 80 ft. along a reach from its confluence with the Guyandotte River to approximately 3,600 ft upstream. The material excavated during the channel widening will be spoiled in School House Hollow, located off U.S. Route 119 and State Route 73. Approximately 203,000 cubic yards of material will be placed on an existing 12-acre fill to a depth of 19 ft. This Draft Environmental Assessment (DEA) was undertaken to provide updated information concerning the proposed project. Huntington District's analysis for the human and natural environment and socio-economics determined the proposed action produced insignificant impacts. The proposed action was selected because it provides benefits, is environmentally sound, is socially acceptable and is responsive to the request of the local residents and Logan County.

For Additional Information Contact:

Mr. Peter K. Dodgion
U.S. Army Corps of Engineers
Huntington District
502 Eighth Street
Huntington, West Virginia 25701-2070
Telephone: (304) 399-5873

EXECUTIVE SUMMARY

Introduction: This report was authorized by the Water Resources Development Act of 1986 (Public Law 99-662, dated 17 November 1986). The proposed actions consist of widening Island Creek to approximately 80 ft from its confluence with the Guyandotte River to approximately 3,600 ft upstream. As reported in the Island Creek Reevaluation Report (2002), this plan provides between a 10- and 20-year level of protection and has annual net benefits of $2.58 million. The benefit-to-cost ratio is 2.6 to 1. The material excavated during the channel widening will be spoiled in School House Hollow, located off U.S. Route 119 and State Route 73. Approximately 203,000 cubic yards of material will be placed on an existing 12-acre fill to a depth of 19 ft.

Appendix A of this document includes the Final Environmental Assessment (FEA) and signed Finding of No Significant Impact (FONSI) for the Island Creek Local protection Project (ICLPP) dated March 2002. Huntington District Policy is to update and resubmit for Public Review and Comment all Environmental Assessments (EA's) five or more years old which have not been implemented. This DEA contains updated Flood Warning System (FWS), fishery, HTRW and water quality data current to the proposed ICLPP.

The project economics for the proposed plan were updated in Fiscal Year 2007. The estimated total project cost is $32.3 million. Based on a 4.875 discount rate and a 50 year period of analysis, the annual benefits are $4.3 million with $2.5 million in net benefits. The resulting benefit cost ratio is 2.3 to 1.

Permit Coordination Procedures: The resident contractor will be responsible for obtaining all permits necessary for completion of the proposed action.

Alternatives Considered: A number of alternatives with potential for meeting the needs of the proposed action amendments were considered. As a result of previous evaluations, alternatives considered in this document include widening the Island Creek Channel to 60, 80 and 100 feet, along with a flood warning system and No Action. The selected alternative adequately meets the cost and minimal impact requirement as well as the desires of the local residents and citizens of Logan County.

Environmental Effects of the Action: The proposed action will not have any significant long-term or short-term impacts on the human and/or natural environment.

Impact Mitigation: Compensation for habitat impacts will be implemented at the project site with bottomland hardwoods and riparian plantings and at the School House Hollow spoil site with upland plantings. In addition a riffle pool complex will be implemented intermittently along the 3,600 feet of Island Creek to be widened. The channel modification also includes the construction of two retaining walls to minimize the acquisition of existing commercial structures.

SUMMARY

(X) Final Environmental Assessment

Responsible Office:

Environmental Analysis Section
Planning Branch
Planning, Programs, and
Project Management Division
U.S. Army Corps of Engineers
Huntington District
502 Eighth Street
Huntington, West Virginia 25701-2070

Telephone: (304) 529-5712

1. Name of Action: Island Creek Local Protection Project, Logan, Logan County, West Virginia.

2. Description of Action: The proposed actions consist of widening Island Creek to approximately 80 ft from its confluence with the Guyandotte River to approximately 3,600 ft upstream. The material excavated during the channel widening will be spoiled in School House Hollow, located off U.S. Route 119 and State Route 73. Approximately 203,000 cubic yards of material will be placed on an existing 12-acre fill to a depth of 19 ft.

3. Environmental Impacts: Impacts on flora and fauna, aquatic and terrestrial, as the result of the proposed action implementation, would result in no significant adverse long-term impacts to the resources within the action area. Endangered/Threatened species, archeological and/or historical sites and wetlands will not be adversely impacted. Hazardous Toxic and Radiological Waste (HTRW) is not a concern at the action or spoil sites.

In summation, implementation of the proposed widening of Island Creek at Logan, Logan County, will not adversely affect the long-term quality of the human or natural environmental within the identified action area.

LOCAL PROTECTION PLAN
ISLAND CREEK, LOGAN COUNTY, WV
DRAFT ENVIRONMENTAL ASSESSMENT

TABLE OF CONTENTS

APPENDIX E	COMMMENTS AND RESOLUTIONS TO COMMENTS ON NOVEMBER 2007 DEA
MAILING LIST	

1.0 INTRODUCTION

Island Creek is located in Logan County in southwestern West Virginia. It is a tributary of the Guyandotte River at Logan, WV. The watershed drains about 105 square miles of mountainous terrain and is composed of three major streams – Island Creek, Copperas Mine Fork and Mud Fork. The study area is approximately 19 miles long, and consists of heavily developed areas within the 500 year floodplain.

1.1 Purpose, Needs and Authorization.

The Island Creek Basin has experienced numerous damaging floods. Due to the steepness of terrain and the scarcity of land suitable for building, extensive development has occurred on the relatively flat floodplains of the basin. As a result, almost all development within the basin is susceptible to damage by even moderate flood events. The flood of record in the basin occurred in March 1963. During this event, the area's residences and commercial and industrial establishments were flooded to a depth of up to 15 feet. Other major floods have occurred in January 1957, January 1974, April 1977, May 1984 and May 1996. The Island Creek Reevaluation Report (2002) determined that occurrence of a 100 year flood event on Island Creek under existing conditions would result in approximately $20 million in damages in the current project area.

The purpose of the Island Creek Local Protection Project (ICLPP) at Logan, West Virginia is to reduce flooding damages within the Island Creek Basin and to improve response time of the community in the event of a flood situation. The reevaluation study of the authorized ICLPP has been conducted to affirm the economic feasibility of the project, to identify the National Economic Development (NED) plan and to ensure conformity with current criteria, policy, and guidelines. The Corps seeks to achieve flood damage reduction benefits efficiently (or lowest dollar cost), lowest impact to economic and environmental resources (i.e., commercial development, minimum footprint), and least real estate acquisition.

Preauthorization studies of the water and related land resources problems and needs of the Island Creek area of Logan County, West Virginia, were undertaken as a result of the Senate Public Works Committee Resolution dated 2 June 1976.

The Water Resources Development Act of 1986 (PL 99-662) authorized the Island Creek Local Protection Project for flood control at a total first cost of $86,000,000, with an estimated first Federal cost of $66,400,00 and an estimated first non-Federal cost of $19,600,00 (October 1984 prices and conditions). The benefit-to-cost ratio for this project was 1.7 to 1.

1.2 Changes in Project Conditions.

Since completion of the authorized local protection plan at Logan in 1986, several changes have occurred for which an environmental evaluation is required. First, there have been significant reductions in scope and cost for a Federal project at Logan. In the 1993 General Reevaluation Study, several changes were made to improve the economic feasibility of the alternatives. The project length was shortened from 19 miles to 3,600 ft. Proposed work along Mud and Copperas Mine Fork was eliminated, as has all non-structural work within the basin. The Reevaluation Study determined that the recommended project would widen the lower 3,600 ft of Island Creek to 100 ft, with the lower 1000 ft to be concrete-lined. However, the 1993 General Reevaluation study of the ICLPP would minimize disturbance to the stream bed by eliminating the use of concrete and reducing the channel width to 80 ft (see Figure 1).

Secondly, the project area has experienced some additional economic development since the project was authorized in 1986. On the Guyandotte River, just downstream from the mouth of Island Creek, there is a new McDonald's restaurant. From that point upstream on Island Creek for a distance of over 600 feet, an interceptor sewer system has been installed. Just above the U.S. Route 119 bridge over Island Creek, a Shoney's restaurant, a Taco Bell restaurant, and a Super 8 have all been constructed on fill material. Near the upper end of the channel, the former K-City Discount store was remodeled to become the Honeycutt Pontiac dealership and since the 1996 flood has reverted to a discount store.

Thirdly, the amount of unauthorized dumping along the lower 3,600 ft of Island Creek has increased since 1986. The streambanks contain more rubble and automobile bodies at present, suggesting no improvement in environmental awareness regarding stream corridors in the project area.

Additionally, it should be noted that all economic figures in this Environmental Assessment reflect the calculations from the Island Creek Local Protection Project at Logan, West Virginia, General Reevaluation Report dated March 2002. Updated economic information for the selected alternative can be found in the attached executive summary.

2.0 ALTERNATIVES

A plan matrix was developed during the 1993 Reevaluation Study in which the plans were evaluated on reductions in water surface profiles, estimated costs, benefits, relocations requirements, environmental impacts, HTRW impacts and real estate impacts. It was determined that the feasible projects included an array of 80 ft channel width alternatives. Venture-level cost estimates were provided and average annual costs were computed for four 80 ft plan combinations. The 80-foot side channel with four post and panel walls near certain businesses produced the most net benefits. Snagging and clearing from the mouth of Island Creek to the U.S. Route 119/State Route 10 bridge was added during alternative refinements to increase benefits.

At the Technical Review Conference (TRC) held in October 1992, the Corps decided to optimize the channel work in order to clearly identify the National Economic Development (NED) plan. Based on the results of this evaluation, three plans were selected as the final array of alternatives and are discussed in further detail in the section below. These three plans will be referred to as 60, 80, and 100-Foot channels throughout the remainder of this report. The full details of the economics and alternative screening is available in the Island Creek LPP, General Reevaluation Report, March 2002.

The U.S. Fish and Wildlife Service (USFWS) provided the Huntington District with a Planning Aid Letter (PAL) in 1993. The USFWS, PAL suggested to the District to eliminate the concrete lined channel and utilized an irregular shaped stream bottom. The District agreed that this variation would increase the physical habitat in Island Creek. A copy of the Planning Aid Letter may be found in Appendix D.

2.1 Alternative Plans.

The original Island Creek Local Protection Project authorized by the Water Resources Development Act of 1986 included a combination of structural and non-structural measures. The authorized plan was about nineteen miles in length: Island Creek – 10 miles, Copperas Mine Fork – 5.1 miles, and Mud Fork – 3.9 miles. The first 0.7 miles of Island Creek, from its confluence with the Guyandotte River upstream, would be structurally modified by widening the stream channel to a width of 100 feet. The lower 1,000 feet of this area would be concrete-lined. The remainder of Island Creek (9.3 miles) and both Copperas Mine Fork and Mud Fork would be treated with a variety of non-structural measures.

The major issue of concern at the onset of the 1993 reevaluation, as well as the current reevaluation, was whether or not the authorized 100-foot wide channel remained a practicable and viable alternative. Since authorization of the project in 1986, land use changes along the 0.7 mile area have occurred. Changes include a storm sewer, as well as three new structures built on fill material on the left descending bank.

Recent reevaluation efforts were directed toward identification and evaluation of a viable channel project. Primary emphasis was placed on identifying a channel alignment alternative that would provide reductions in flooding damages, minimize structure acquisition, and reduce project costs. Several alternatives, consisting of combinations and modifications of a number of basic channel widths, were identified and evaluated during this phase, along with a variation of the authorized channel (100-foot wide). More detailed information about the plan selection process is included in the Plan Selection section of this report.

2.1.1 60-Foot Channel
This channel plan would consist of widening the channel to 60 feet beginning at the confluence of the Guyandotte River and Island Creek and continuing 3,800 feet upstream. The trapezoidal channel would have sides that would be a 2.5 horizontal to 1 vertical slope. A post and panel wall would be constructed near the AEP facility. The plan also includes a Flood Warning System and sandbar removal.

This plan would require the acquisition and demolition of six commercial structures including the Super 8 Motel, Baisden Hardware, Baisden Hardware's outbuilding, Southern Public Utilities Warehouse, Honeycutt Auto Body, and Compton's Chevron.

2.1.2 80-Foot Channel
This channel plan would be similar to the 60-foot design except for the channel width. This plan would consist of widening the channel to 80 feet beginning at the confluence of the Guyandotte River and Island Creek and continuing 3,600 feet upstream. The trapezoidal channel would have sides that would be a 2.5 horizontal to 1 vertical slope. Post and panel walls would be constructed at AEP facility and at Baisden Hardware. The plan also includes a Flood Warning System and sandbar removal. This plan would require acquisition and demolition of Super 8 Motel and Baisden Hardware's outbuilding.

2.1.3 100-Foot Channel
This channel plan would consist of widening the channel to 100 feet beginning at the confluence of the Guyandotte River and Island Creek and continuing 3,600 feet upstream. The trapezoidal channel would have sides that would be a 2.5 horizontal to 1 vertical slope. A post and panel wall would be located at the AEP facility. The plan would also include a Flood Warning System

and sandbar removal. This plan would require acquisition and demolition of four commercial structures including Super 8 Motel, Anderson Wholesale, Baisden Hardware's outbuilding and Baisden Hardware.

2.1.4 Flood Warning System

A Flood Warning System (FWS) is recommended for the Island Creek Basin allowing continual direct access for local officials and the public to flood/storm data. Community access to this data would significantly improve response time of the communities in the event of a flooding situation. The recommended system would be an integration of new and upgraded stream and precipitation gages, radio repeater sites and dedicated computer workstations running software with forecast capability and the data would be transmitted to the Logan County Office of Emergency Service (OES). The system would provide additional warning time for the small communities upstream of Logan. The system would also be beneficial for communities located downstream on the Guyandotte River. The recommended FWS would expand the existing Integrated Flood Observing and Warning System (IFLOWS) to meet the basin-wide requirement of providing flood warning to the OES, Directors of Logan County, and possibly some of the surrounding counties. By including stream gage data into the forecast model, the reliability of flood height predictions and warning times would considerably improve current capability.

One of the three existing stream gage sites on the Guyandotte River that use data loggers/transmitters would be up-graded using modern equipment. A maximum of five (5) new stream gages would be installed to forecast flooding upstream of Logan. The locations of the stations were determined during field investigations and took into account recommendations of the Logan County OES. Equipment to be installed would provide all the FWS functions including satellite communications, data collection, telephone, and IFLOWS transmission capabilities.

Normally, Flood Warning Systems are designed and implemented within a short period from the time of authorization. The recommended system would be a state-of-the-art integration of new and upgraded river and precipitation gages, radio repeater sites and dedicated computer workstations running software with forecast capability. Advanced warning times would be enhanced significantly with the installation of a FWS. Operation and Maintenance (O&M) of the completed system will be the responsibility of the West Virginia Division of Homeland Security and Emergency Managment as the local sponsor.

2.1.5 Without Condition (No Federal Action)

A consideration for any Federal project is the No Action alternative. For this alternative, there would be no project implemented by the Federal government. Local residents would be dependent on local radio, television and floodplain managers, 911 centers, county emergency management services and the Logan County Division of Homeland Security for evacuation notification, clean-up and reestablishment.

In the absence of the proposed project, the future land use and related conditions within the project area are forecast to remain comparable to conditions as they currently exist. The study area entered the flood insurance program in April 1972; flood insurance, therefore, continues to be available to residents of the area. The "No Action" alternative will be fully evaluated and serve as baseline for comparison.

2.2 Plan Selection

The above plans were evaluated in an initial screening for economic costs and benefits, effectiveness to meet project objectives; potential environmental and social impacts, and real estate requirements. A nonstructural floodproofing and structural flood protection along upper Island Creek, Copperas Mine Fork and Mud Fork was previously evaluated and determined to be economically infeasible. Of the structural alternatives, the 100-Foot Channel produces slightly higher net benefits and has been designated as the NED plan. However, the difference in net benefits between the 80-Foot and 100-Foot plans is less than one percent of the total. Additionally, the 80-ft channel has lower project cots, least impact to existing commercial development, has a smaller footprint which would most likely result in less environmental damage, and requires less real estate acquisition. The 60 foot channel would have fewer net benefits of both the 100 and 80 foot channels, at $2.4 million, and higher costs than the 80 foot channel. Environmental impacts from the three channels would be similar. The Economic and Environmental Principles and Guidelines allow the Corps to select other than the NED plan where non-economic issues are important decision factors. Therefore, the 80-Foot Channel Plan is considered to "reasonably" maximize NED benefits and is the recommended plan. With approximately $2.60 million in net benefits, the 80-ft channel is the recommended alternative. The 80-Foot Channel Plan is also the preferred plan of the non-Federal sponsor. Appendix B provides plan assessment documentation. Additionally, a Flood Warning System is recommended to improve community response time in the event of a flood event.

2.3 Selected Plan Description

For the selected plan, Island Creek would be widened to create a trapezoidal channel 80 feet wide, using 2.5 horizontal to 1 vertical side slopes. Channel widening would begin at the confluence of Island Creek and the Guyandotte River and continue for approximately 3,600 ft. Post and panel walls would be constructed in certain locations to avoid the impacts associated with the acquisition of certain structures along the channel.

In addition to elimination of the originally planned concrete lined channel, riffle/pool complexes would be constructed intermittently along the 3,600 ft of Island Creek to be widened. The riffle structures, consisting of stone similar in size to the stone slope protection, would be approximately 25 feet wide and extend across the width of the channel. The riffle structures would be anchored approximately 1 foot into the streambed and rise approximately 1.5 feet above the streambed.

Generally, widening would only be accomplished on one side of the channel in any area. Clearing and grubbing of vegetation would be accomplished only in those areas where walls are constructed or where earthwork cuts would be made. All other areas would remain undisturbed as much as possible. Stone slope protection would be placed along the base of the wall and at the toe of the newly excavated slope to reduce the effects of erosion in the lower level flood frequencies. The remaining area between the stone slope protection and the contractors working limits (CWL) would be seeded with a riparian buffer mix that establishes in 2 to 3 years a biologically diverse cover of native vegetation. The material removed during channel widening would be spoiled at a nearby site at School House Hollow. The material would be placed as upland fill over approximately 6.5 acres of the 12 acres of existing fill material that was spoiled at the site during the construction of U.S. Route 119 and State Route 73 in the mid-1990s. The material would be placed at an approximate depth of 19 feet. The final graded slopes would be properly drained and seeded and blended into the surrounding terrain. An additional 2.5 acres of the 12 acre site would be utilized by the local sponsor for future disposal of channel sediment from maintenance dredging. See Appendix B for additional information.

Additionally, a Flood Warning System (FWS) would be implemented to improve community response time in the event of a flood. The recommended Flood Warning System (FWS) would meet the basin-wide requirement of providing flood warning to Logan County. The Integrated Flood Observing and Warning System (IFLOWS) is a wide-area computer network of river and rain gages with enhanced, full, two-way radio, microwave, and satellite and telephone line communications. The primary responsibility for flood forecasting would remain with the National Weather Service (NWS). Real-time data will be transmitted from each gage to Cincinnati, Ohio, where it would be processed by existing software to develop flood forecasts. The reliability of flood height predictions and warning times would be considerably improved over the current capability, based on the inclusion of stream, gage data into the forecast model. Under this plan, the Office of Emergency Services (OES) Directors of Logan County, (located in local communities) would be equipped with new personal computers and software capable of assessing NWS flood models. The local OES representatives would have access to the NWS Flood Analysis and River Emulator (FLARE) flood-forecasting model through these IFLOWS computer workstations. This software collects, disseminates and displays weather data, facilitates data using standard definition, rating tables and equations, defines basins and tracks rainfall rates and accumulations status, forecasts and provides flash flood guidance. The IFLOWS computer workstations can also function as stand-alone ALERT (Automatic Local Evaluation in Real Time) base stations in the event of problems with the network.

In planning for the FWS, a maximum of ten (10) sites were investigated for installing new stream gages. All gages would be installed to forecast flooding upstream of Logan. TABLE 1 lists all the selected sites, which would comprise the IFLOWS stream gage locations for Island Creek in the Guyandotte River Basin. The equipment will handle all functions including satellite, data collection, telephone, and IFLOWS transmission capabilities that the Corps of Engineers, USGS, NWS, and local county OES offices need.

TABLE 1
IFLOWS STREAM GAGE INSTALLATION LOCATIONS

LOCATION	LATITUDE	LONGITUDE	NOTES/COMMENTS
Guyandotte River @ Logan, WV*	37° 50' 32"	81° 58' 37"	Add Alert**
Guyandotte River @ Man, WV	37° 48' 12"	81° 58' 58"	Add Alert**
Spruce Fork @ Sharples, WV	37° 55' 27"	81° 49' 42"	Add Gage Equipment
Copperas Mine Fork @ Whitman, WV	37° 49' 41"	82° 02' 52"	Add Gage with Alert**
Island Creek @ Switzer, WV	37° 47' 34"	81° 59' 15"	Add Gage with Alert**

New sites are located at highway bridges and maintained by the State of West Virginia Department of Highways
*It is anticipated that the existing Guyandotte Stream gage will be automated.

The typical rain gage/stream gage consists of a 16-foot, 12-inch diameter pipe on which a small antenna, solar panel, and rain-measuring device are mounted. The entire unit, including the mounting pipe weighs 80 pounds. It is installed by setting the pipe in a 2-foot by 2-foot concrete base. In some cases, the equipment is mounted on existing towers and not on the standard 16-foot pipe. The equipment is easily installed and removed as it is simply bolted onto the existing structures or towers. The new gages will be located on existing State of West Virginia property (West Virginia Department of Highways (WVDOH) road right-of-way) and constructed by the Corps under a standard WVDOH permit.

3.0 AFFECTED ENVIRONMENT AND CONSEQUENCES OF ALTERNATIVES

3.1 General.

Island Creek, a tributary of the middle reach of the Guyandotte River, drains approximately 105 square miles of rugged mountainous terrain. Island Creek basin is part of the extensively dissected Appalachian Plateau physiographic province and is comprised largely of steep-sided mountains and narrow stream valleys. Ninety percent of all slopes in Logan County, in which the basin lies, are in excess of 25 percent. Industrial, transportation, and residential land uses and community facilities occupy much of the rather limited level or gently sloping land which is adjacent to the streams and rivers of the region.

The quality of the environment has been affected in the densely populated study area. The quality of fish and wildlife habitats in the impact area ranges from fair to very poor. Most of this results from the fact that almost all development occurs in the bottomland along the stream due to the steep topography

3.2 Aquatic Resources

Except for the upper reaches of Island Creek, some small relatively undisturbed tributaries, and the Guyandotte River mainstream, the project area has poor water quality that is generally incapable of supporting aquatic life. Cumulative effects regarding the aquatic resources of the area are related to problems in the area including but not limited to acid mine drainage, siltation from logging and mining, untreated domestic sewage, trash, dredging and filling, and general stream bank disturbances such as riprap, cribwalls, gas and sewer pipes and bridges. Most of the stream reach has some snag cover and instream structure. Solid substrate is in short supply however, since much of the bottom is unconsolidated sediment. Overhanging riparian vegetation from the steep banks shade much of the stream, but the canopy rarely completely closes over the stream.

The proposed project no longer involves a concrete lined channel. In addition, riffle/pool complexes would be constructed intermittently along the 3,600 ft of Island Creek to be widened. The riffle structures, consisting of stone similar in size to the stone slope protection, would be approximately 25 feet wide and extend across the width of the channel. The riffle structures would be anchored approximately 1 foot into the streambed and rise approximately 1.5 feet above the streambed.

The Corps of Engineers has coordinated with the State of West Virginia to obtain a Section 401 Water Quality Certification for the authorized project at Logan. A 404 (b) (1) Analysis was completed for the project which, incorporates the fill activities occurring at the School House Hollow disposal site. The Water Quality Certification and the 404 (b) (1) Analysis was coordinated again with the WVDEP in October 2007 and may be found in Appendix C.

No significant impacts to aquatic resources would be expected from the channel widening alternatives despite the fact that all current habitats would be removed temporarily. No quality aquatic resources are found at the site. The Corps is aware of many negative effects resulting from actions throughout the basin. These have degraded the aquatic conditions in the Island Creek. The Corps would install of riffle pool complexes as it implements the recommended plan. This and the long-term set-back of urban activities would result in long-term improvement to habitats and water quality in the degraded stream. There would be no effects to aquatic resources from the No Action alternative.

3.3 Terrestrial Resources

Most of the bottomlands along Island Creek are limited to a narrow band of riparian vegetation and small stands of hardwoods. Disturbed areas have grown up in old fields adjacent to the nearly continuous string of commercial and industrial development in the project area. Major wildlife species found in the bottom lands of the study area are resident and migrant songbirds, small mammals, amphibians, and reptiles.

The bottomland and upland habitats are interspersed with small businesses, road, railroads, and some industry throughout the project area. The quality of this habitat type ranges from good to poor. Availability of food items for birds, amphibians, reptiles and small mammals is fair except for the absence of some major food producers, i.e., oaks and dogwoods. Sycamore and river birch are dominant. The stands are of uneven age with most being young. There is a general lack of mast producing species and den sites. Downed logs and detritus, rock and lush vegetation offer adequate small mammal, amphibian, and reptile habitat. High human disturbance (negative interspersion) makes the area undesirable for most game species. Food, cover, and reproduction value to wildlife generally declines downstream due to the increased human population downstream.

In agreement with the USFWS, the District would replace impacted riparian habitat with deep rooting native grasses and non-woody annuals and perennials. Approximately 1.0 acre of native bottomland hardwood tree and shrub species would be planted along the stream leaving a 12-foot wide access road for maintenance vehicles. The native bottomland plant community would be maintained as a successional plant community requiring no maintenance such as mowing or herbicide use.

The proposed School House Hollow disposal area consists of a valley; approximately 105 acres of moderate to steep hillside. The site is vegetated with upland hardwood vegetation. Approximately 12 acres of the valley portion of the site has previously been used as a spoil disposal site during the construction of U.S. Route 119 and State Route 73 in the mid-1990s. The previous fill material consists of rock and soil and is configured in two benches with fill slopes of approximately 2.5 to 1. The existing fill is vegetated with tall grasses and low growing brush. Within the valley, a dirt haul road provides access along the west side of the fill. A shallow ditch around the perimeter of the existing fill collects storm water from the hillsides and carries it to the base of the fill where it flows under the access road and State Route 73 via concrete culverts. The placement of channel excavated material over 6.5 acres of the spoil site would require the removal of approximately 1.5 acres of upland and bottomland hardwood trees located on the hillside around the perimeter of the existing fill. The 6.5 acres of new fill would be seeded with native grass, annual and perennial mix and planted with upland deciduous trees and shrubs. The planting would be maintained as a successional plant community requiring no maintenance such as mowing or herbicide use. The spoil disposal site would be acquired in fee in the name of the sponsor (Logan County Commission) to insure control and management.

Due to the disturbed urbanized nature of the terrestrial resources, and the measures to replant the riparian area after construction, no significant impacts to terrestrial resources would be expected from the channel alternatives. The No Action alternative would not disturb the current conditions, therefore there would be no impacts from this alternative.

3.4 Hazardous, Toxic, and Radioactive Waste

Channel Widening Activities

GRW Engineers Inc. of Lexington, KY conducted a Phase I Hazardous, Toxic, and Radioactive Waste investigation on the site, (HTRW report dated May, 1991). From this investigation, four Areas of Concern (AOC) were identified as AOC-1 Appalachian Power, AOC-4 Fill Material Area, AOC-5 Baisden Brothers Hardware, and AOC-6 Gaylock Wrecker Service. A Phase II investigation was conducted by personnel from the Huntington and Nashville District Corps of Engineers. Results of the Phase II investigation indicated the following: Polychlorinated biphenyl's (PCBs) contamination was detected at AOC-1, petroleum products and metals contamination was detected in AOC-4, potential leaking of a kerosene underground storage tank (UST) is suspected in AOC-5 and petroleum contamination was detected in AOC-6.

In May 1993, International Consultants Incorporated (ICI) conducted a further Phase II HTRW Investigation for AOC 4. Fill material encountered during this investigation was consistent with mining operations. The recommendation of this study was for disposal of the soils at AOC 4 as special waste.

In September 2000, WasteTron, Inc. (WTI) completed another Phase II HTRW Investigation of Areas of Concern I and 4. Based on review of the analytical data and the comparison levels to the WV Voluntary Remediation Program De Minimus Levels and U.S. Environment Protection Agency (USEPA) Toxicity Risk Based Concentrations Table for residential soil, there is no contaminated soil at AOC-1 which would require treatment, however, there is some contamination within AOC-4. The contamination identified in AOC-4 consists of TPH-DRO and lead.

The recommended method of treatment is that the approximately 11,000 cubic yards (cy) of contaminated soil be taken from AOC-4, AOC-5 and AOC-6 to an appropriate landfill for disposal. The TPH (AOC-4), kerosene (AOC-5), and petroleum (AOC-6) can be disposed in a solid waste facility that accepts petroleum-impacted soil. The lead-impacted soil would require disposal at a properly permitted facility as a special (non-hazardous, contaminated) waste at a certified facility at Ashland, Kentucky with the cost being born by the Sponsor.

Spoil Disposal Location
In accordance with established Corps of Engineers (COE) Hazardous, Toxic, and Radioactive Waste (HTRW) policies, a Limited Phase I HTRW Investigation has been conducted for the Island Creek Basin Local Protection Project's proposed spoil site. The spoil site would be used for the disposal of excess soil and rock excavated from the Island Creek channel during construction of the Local Protection Project and would also be used by the local sponsor for future disposal of channel sediment.

A site inspection was performed on the tract within the project's CWL. The site is on the north side of State Route 73, approximately 0.35 miles from its intersection with Old U.S. Route 119 and State Route 44. During the site inspection, it was observed that approximately 12 acres of the valley portion of the site had previously been used as a spoil disposal site during the construction of U.S. Route 119 and State Route 73 in the mid-1990. During the site inspection, no HTRW concerns were found, including the absence of staining or stressed vegetation on the former spoil area or in the surrounding area.

A search of available environmental records for the proposed spoil site was conducted using Environmental Data Resources, Inc. (EDR). This search met the government records search requirements of ASTM Standards Practice for Environmental Site Assessments, E1527-00. Search distances were also as per ASTM standards.

Based on the findings from the above activities, the proposed spoil site was determined to be free of HTRW concerns, and none were identified in adjacent properties that would have the potential to impact this tract. Therefore, no further HTRW investigations are warranted at this time.

Channel Sediment
Analysis of stream sediment will be conducted prior to channel excavation to insure that no significant impacts to human health or the environment from HTRW would result. A Phase I investigation will be conducted to determine the potential for contamination in stream sediment. Any further testing required to determine the presence and/or extent of contaminants will be completed before the start of construction. Any contaminated material would be disposed of in a properly licensed facility, thereby avoiding any significant impacts.

All contaminated soils would be taken to an appropriate landfill for disposal; therefore, there would be no impacts from HTRW to human health or the environment resulting from any of the channel widening alternatives. As the No Action alternative would not involve construction activities that would disturb the site, no impacts would be expected from this alternative.

3.5 Geology and Soils
Most bedrock in the Island Creek watershed is from the Kanawha Formation, which is part of the Pottsville Group. High ridges are capped by bedrock from the Allegheny Formation. These rocks are of sedimentary origin. The Pennsylvanian age geology consists of dominantly massive sandstone interbedded with numerous coal seams, impure fire clays, sandy and argillaceous shales, and a few thin impure lenticular limestones. Coal is the most important economic commodity and is economically attractive because of its low sulfur content. The largest reserves have been mined from the No. 5 Block, Coalburg, Peerless, No. 2 Gas, (locally know as Upper and Lower Cedar Grove), and Powellton seams (locally known as Alma seams).

Soils that weather from this sandy geology include the Matewan, Highsplint, and Guyandotte soils on the steep mountain ridges, sideslopes, and cove areas; and the Yeager, Craigsville, and Chavies soils in the narrow floodplains. Most floodplain soils are impacted by residential, industrial and other commercial development, as is the case along this project reach. Natural soils have been disturbed by addition of spoil material and earth moving activities. These disturbed and mostly filled areas consist of land covered by houses, buildings, streets, parking lots, railroad tracks, and other urban components. Natural soil is almost non-existent along this project reach. Coordination with the USDA Natural Resources Conservation Service determined that there is no Prime Farmland, Statewide Important Farmland, Locally Important Farmland, or Hydric soils along this project reach. The action alternatives propose to remove and dispose of various quantities of soil/sediment at an off-site location. The No Action alternative would allow current erosion, rework and transport of sediments within the Island Creek system. Limited actions by local landowners to place and remove fill would likely continue. None of the disturbed geologic or soils resources are locally or nationally important. Neither the proposed action nor the alternatives (including the No Action) impact significant resources.

3.6 Fish and Wildlife.

Island Creek does not sustain a sport fishery in the project area. The fishery resources of the Guyandotte River in the vicinity of Logan, West Virginia were surveyed in August 2007 by the West Virginia Department of Natural Resources. Small mouth bass and channel catfish were the dominant species in the Guyandotte River at Logan. Gizzard shad were the dominant nongame species. Thirteen species were collected during the survey. The Guyandotte River is presently affected by both domestic and industrial pollution. Silt and sediments and associated high turbidities are presently limiting factors of game fish species reproduction. In spite of this, game fish populations in the Guyandotte are good and overall standing crop is comparable to other West Virginia streams.

Wildlife habitat is good in most areas of the basin except where impacted by mining operations, residential areas, and roads. Forest game habitat predominates and offers the most potential for wildlife. Farm game habitat is scarce, but good songbird and cottontail rabbit habitat exists in valleys having adequate streambank cover and brushy areas. Good riparian habitat exists in areas where not disturbed or destroyed by urbanization and channelization. In spite of the generally adequate habitat in the basin, wildlife populations are well below the carrying capacity of the land as the result of free running dogs and illegal hunting. Game species inhabiting the basin include whitetail deer, turkey, gray squirrel, cottontail rabbit, raccoon, ruffed grouse, bobwhite, and gray fox, mink, muskrats, mallards, and wood ducks breeding along the streams.

The No Action alternative would not change the current situation for fish and wildlife resources. Human encroachment on the narrow channel of Island Creek would continue. Poor habitat quality found at the site is expected to continue for this urban condition. Typical riparian cycles of succession along with periodic habitat damage from flooding are expected for this constricted system.

There would be no significant effects to fish and wildlife resources as a result of any of the channel alternatives, due to the poor quality and urban nature of the habitat. Implementation of the action alternatives would be expected to have similar effects upon the fish and wildlife resources of the area. The entire riparian corridor of Island Creek would be temporarily removed for the 60-ft, 80-ft and 100-ft options due to the narrow extent of the existing stream. Downstream siltation during construction would be very similar among the three action alternatives. The limited urban wildlife resources found in the project area would be temporarily disrupted or dislocated. Similarly, the extent of upland disturbance (approximately 6-12 acres) at the disposal site is expected to be comparable among the action alternatives.

The direct effects of the action alternatives to riparian and in-stream habitats are not significant. However, riparian disturbances would involve total and temporary removal. Restoration of deep rooting grasses and non-woody annuals and perennials beneficial to wildlife would be planned to compensate for these losses. In-stream environmental design measures would include construction of riffle/pool complexes along the 3,600 ft channel-widening reach to enhance water quality and provide aquatic habitat.

Re-vegetation of the spoil area would restore upland habitat for the project area. Short-term and temporary siltation effects are expected during construction and during the periodic maintenance of the channel. The fishery of lower Island Creek is of poor quality and dominated by pollution tolerant species. A temporary increase in turbidity of the Guyandotte River would have a short term affect on aquatic resources of the Guyandotte below the mouth of Island Creek. Erosion control practices would minimize these effects to the extent feasible and are addressed in the 404(b)(1) analysis. A cumulative effects assessment was not conducted for this project, however Corps has adopted environmental design features within the CWL of the project to partially off-set poor habitat conditions within the watershed following construction.

3.7 Water Quality

The aquatic environment of the study area may be characterized as severely degraded through natural resource exploitation and man's encroachment and pollution. Coal mining pollution is undoubtedly the major cause of the poor water quality in the study area. Abandoned deep mines are a major source of acid mine drainage. Siltation can be attributed to both the surface mine industry and the timbering operations. Untreated domestic sewage is a serious problem over most of the watershed and is extremely critical during low flow periods.

Island Creek proper receives acid mine drainage, siltation from surface mine and logging activities, and untreated domestic sewage. Tributary streams of Island Creek have similar impacts, plus physical degradation from channelization by landholding companies and residents. Such practices periodically destroy certain segments of aquatic habitats.

Water Quality data provided by the West Virginia Department of Environmental Protection (WVDEP, 2007) revealed that the water quality of the major streams in the Island Creek Basin was fair to poor. Most Basin streams had poor water quality low pH values, measurable dissolved iron, low numbers of benthic organisms, and high fecal counts up to 250,000. Most of Copperas Mine Fork, Mud Fork, and main Island Creek below Miller Branch had poor water quality. Upstream from Miller Branch, Island Creek is considered fair-to-good water quality.

The No Action alternative would not change the current situation for water quality resources. Human encroachment on the narrow channel of Island Creek would continue. Periodic disturbance from intense flow and erosive events are expected for this constricted system. Local actions to "feed" the system with additional fill following such events is expected to continue.

Implementation of the action alternatives would be expected to have common effects. The entire riparian corridor of Island Creek would be temporarily removed for the 60-ft, 80-ft and 100-ft options due to the narrow extent of the existing stream. Similarly, the extent of upland disturbance (6-12 acres) at the disposal site is expected to be comparable among the action alternatives.

The effects of the action alternatives to water quality conditions would not be significant. The removal of automobile bodies and other solid waste materials along the stream channel would contribute to the overall improvement of the stream environment. The lower 3,600 ft of Island Creek would experience measurable temporary degradation through to the Guyandotte River near the mouth of Island Creek due to siltation and turbidity during construction. Beyond the mouth of the Guyandotte River, the effects of the Island Creek construction are not expected. Periodic maintenance of the channel in the future would involve siltation and sediment effects largely within the Island Creek system itself as the extent of disturbance would be small.

An erosion control plan has been developed to feasibly minimize sedimentation effects during construction. The 404(b)(1) analysis details these plans and may be found in Appendix B. Restoration of deep rooting grasses and non-woody annuals and perennials would be used to stabilize the site. In-stream environmental design measures are expected to improve overall water quality conditions. The extent of vegetation development, shading and filtration of run-off depends upon the largest set-back of the stream from urban land uses. Therefore the 100-ft channel would provide the best long-term conditions for water quality improvements within a modified channel.

Re-vegetation of the spoil area following construction along with implementation of sediment and erosion controls would be sufficient to minimize off-site water quality effects.

3.8 Wetlands

One jurisdictional wetland was identified in the project area in the early 1980s during field studies and literature search. It consisted of a one quarter acre Palustrine Emergent and Scrub-Shrub wetland habitat within an old field and bottomland hardwood area not far from the mouth of Island Creek. Intense human disturbance along the Island Creek corridor have continued since those early studies. No wetlands are currently found within the CWL of the 60-ft, 80-ft or 100-ft projects. No impacts to wetland resources would be expected with the action or No Action alternatives.

3.9 Endangered Species

In accordance with the Endangered Species Act (ESA) of 1973 and ESA Amendments of 1978, the District requested the views of the USFWS concerning the potential presence of species listed or proposed for listing as endangered. USFWS indicated a federally listed species that could occur within the proposed project area is the endangered Indiana bat, Myotis sodalis. This species may use the project area for foraging and roosting between April 1 and November 14. . Indiana bat summer foraging habitats are generally defined as riparian, bottomland, or upland forest, and old fields or pastures with scattered trees. Roosting/maternity habitat consists primarily of live or dead hardwood tree species, which have exfoliating bark that provides space for bats to roost between the bark and the bole of the tree. Tree cavities, crevices, splits, or hollow portions of tree boles and limbs also provide roost sites. There are no known Indiana bat hibernacula located within the Guyandotte River Basin. However, the Corps does not expect impacts to the Indiana Bat to occur based on the quality and quantity of habitats involved.

The USFWS concurs with the Corps position. The USFWS considers more than 17 acres of suitable foraging and roosting habitat on the West Virginia landscape necessary for each Indiana bat. On that basis, small West Virginia projects affecting 17 acres or less of suitable foraging and roosting habitat, would are considered unlikely (at the 98% confidence level) of resulting in direct or indirect take. If less than 17 acres of suitable habitat would be disturbed, the USFWS finds the action unlikely to adversely affect the endangered Indiana bat at any season of the year. (This determination was developed by the Elkins, West Virginia Field Office staff based on the number of acres of bat habitat (foraging and rooting), estimated bat populations and number of hibernacula for West Virginia is only valid for proposed actions located in West Virginia.)

The No Federal Action alternative would have no impact on the Indiana bat's foraging and roosting habitat. The three action alternatives similarly impact riparian and upland habitats within the channel of Island Creek and at the disposal area. None of these areas are expected to sustain populations of Indiana Bat due to limited extent of natural habitat and poor habitat quality. Please refer to the USFWS coordination documents dated December 2, 1993, June 19, 2000, and February 6, 2001.

3.10 Socio-economic Factors

Economic conditions throughout the project area have, for many years, been far below the average for the United States. In general, the economy of the basin is dependent upon the coal industry, either directly or indirectly. Industrial and housing development are restricted by the rugged topography of the region and the flooding potential. Income, living conditions, employment, and necessary facilities have been behind national averages although they have grown closer to these averages during the past 10-15 years.

The future land use and related conditions within the project area are forecast to remain comparable to conditions as they currently exist should no action be taken for the Island Creek project. This would result in a continuation of adverse social and economic conditions in the area as well as periodic acute impacts from flooding and recovery. Property values would remain depressed and development limited by the expectation of landowners and buyers for future flood impacts. The study area entered the flood insurance program in April 1972; flood insurance, therefore, continues to be available to residents of the area.

Implementation of the action alternatives for flood damage reduction and saving lives along lower Island Creek would make a positive contribution to economic health and social well being. The extent of direct impacts to existing structures varies among the alternatives. None of these impacts are considered significant. However, the Corps recommends the 80-ft channel option largely because this option presents the best balance of flood damage reduction benefits for the community and property/business impacts.

Generally, channel widening would occur only on one side of the channel in any area for all plans. The Corps proposes retaining walls at various locations to minimize the acquisition of existing businesses. The preferred plan (80-ft channel) would remove one commercial structure, the Super 8 Motel, during construction. The preferred results in $2.6 million in net benefits through reduced flood damage. The alternative 100-ft channel impacts four commercial structures and delivers $2.6 million in net benefits. The alternative 60-ft channel impacts six commercial structures and delivers $2.2 million. The 80-ft channel plan has the lowest project cost; least impact to existing commercial development; requires less real estate acquisition and has the lowest overall real estate cost.

3.11 Education

In 2000, the median number of school years completed for Logan County residents 25 years of age and older was 8.9. This compared unfavorably with both West Virginia and the nation, which reported median levels of education of 10.6 years and 12.1 years, respectively. Bureau of Census data in 2000 indicated that 34.8 percent of the county residents have completed high school compared with 66 percent for the state.

The Preferred plan and its alternatives would have no impact to education or education resources in the area.

3.12 Recreation

The study area has no major recreational facilities within its boundaries. However, there are a number of facilities within a one hour drive. Chief Logan State Park is located five miles north of Logan on U.S. Route 10. Laurel Creek Public Hunting Area is located 15 miles west of Logan in Mingo County. About 30 miles further north, the Cabwaylingo State Forest is located in Wayne, Cabell, Lincoln and Mingo Counties. The City of Logan has a park located on Hatfield Island in the Guyandotte River. Many acres of land owned by coal and timber companies is available as hunting lands throughout the county. Fishing resources are poor throughout the county because of degraded streams and the lack of nearby reservoirs on lakes. R.D. Bailey Lake, on the Guyandotte River in adjoining Wyoming County, is approximately 35 miles south of Logan. East Lynn Lake, 50 miles north from Logan, also is in operation and available to the study area inhabitants.

Since no recreational developments or resources occur in the project area and impacts would not be expected to extend far from the project, no impacts to recreation would result from any of the alternatives.

3.13 Aesthetics

Aesthetics in the project area range from fair to poor. Indiscriminate dumping of refuse along the road network and streambank in the study area is a common practice, making aesthetics generally less than appealing. Stream banks in the study area are frequently observed to be littered with refuse as well as automobile bodies. A portion of Island Creek above the confluence with the Guyandotte River contains many such discarded automobile bodies. Under the no action scenario, these conditions would continue.

The three action alternatives require the removal of all fill and discarded materials from the streambank. However, the action alternative would not significantly change the appearance of Island Creek as a conduit or waterway. Viewers would observe a largely vegetated channel after establishment. The widening of the channel would make the Island Creek a more prominent feature in the community. The presence of retaining walls along channel borders and the likely washing in of refuse materials from upstream of the project would prevent the stream from ever having a natural aesthetic. Overall impacts to aesthetics would not be expected to be significant for any of the alternatives.

3.14 Cultural Resources

Section 106 of the National Historic Preservation Act (NHPA) of 1966 requires the Corps to identify historic properties affected by the proposed action and to evaluate the eligibility of those properties for the National Register of Historic Places (NRHP). An archeological literature survey of the Island Creek Basin was conducted in 1983. As part of the EA, a request was submitted to the West Virginia State Historic Preservation Office (SHPO) for comments regarding any adverse impacts that the proposed project may have on cultural resources. Information received from the West Virginia SHPO indicated that the project site has the potential to contain archeological sites.

A Corps of Engineers' archeologist performed a site reconnaissance and prepared a report stating the project area appeared disturbed and that two historic structures would not be impacted by the project. The WVSHPO responded to the report with a concurrence letter dated April 27, 2001, that the proposed activities will have no adverse effect on the two historic structures that are eligible for listing in the NRHP (Appalachian Power Company building and CSX railroad bridge). Two other structures that will be affected by the project are not eligible for NRHP listing. The WVSHPO mistakenly wrote that archeological testing had been conducted. Please refer to Appendix C to review the consultation effort.

A Phase I archeological survey will be conducted in the project area before construction to determine if significant archeological sites are present. If any significant archeological sites that are eligible for NRHP listing are found, the Corps of Engineers will consult with the WVSHPO on measures to avoid, reduce or mitigate any adverse effect on these historic properties.

The No Action and action alternatives would have no effect on cultural resources of the area.

3.15 Air Quality

U.S. Environmental Protection Agency (USEPA) and West Virginia Department of Environmental Protection (WVDEP) data indicates that Logan County, West Virginia, is included in the category of "attainment/unclassifiable." This means that it is presumed to meet all applicable air quality standards for critical pollutants according to Title 40 of the Code of Federal Regulations (40CFR) Part 81.336. Major contributing pollutants to the air in the project area/site are from indiscriminate burning of household refuge, grasslands and woodlands, as well as from transportation/commercial vehicles exhaust. In general, they reduce atmospheric visibility and may adversely affect the respiratory system. The only potential effect on air quality created by this project would be during the construction phase.

Channel widening options would have minor impacts on air quality. Vehicular emissions from construction equipment would be limited and temporary. Heavy truck traffic associated with the hauling of material to the disposal site would not be expected to cause major impacts on air quality.

3.16 Noise

Commercial and residential traffic, CSX traffic and local business noise are the current sources of noise in the project vicinity. The project area is bordered on the right descending bank (RDB) by U.S. Rt. 119 and State Rt. 10. The majority of the area on the left descending bank is commercial and creates considerable noise at the present time. Construction activities associated with the proposed are expected to involve similar noise sources to other construction projects: excavators; roller compactors; front-end loaders; bulldozers; graders; backhoes; dump trucks; water trucks; concrete trucks; pump trucks; utility trucks; cranes; sheet pile drivers; man lifts; forklifts; and lube, oil, and fuel trucks. The expected noise levels are in the range that is typically annoying to residents. However, local attitudes have been shown to influence the extent of annoyance that residents experience. The timeframes of the exposure and the generally positive attitude of residents toward the project point toward no significant effects expected.

Heavy construction equipment (dozers, endloaders and graders), material handling, and truck traffic would temporarily generate noise in the construction area. Upon completion of the channel widening, the construction noise would cease.

Noise is measured as Day Night average noise levels (DNL) in "A-weighted" decibels that the human ear is most sensitive to (dBA). While there is no federal standard for allowable noise levels, several agencies have developed guidelines for acceptable noise levels. The Department of Housing and Urban Development Guidelines denote DNLs below 65 dBA as normally acceptable levels of exterior noise in residential areas. While the FAA denotes a DNL of 65 dBA as the level of significant noise impact. Several other agencies, including the Federal Energy Regulatory Commission, use a DNL criterion of 55 dBA as the threshold for defining noise impacts in sparse suburban and rural residential areas (Schomer et al 2001). According to Dr. Paul Schomer in his 2001 Whitepaper, while there are numerous thresholds for acceptable noise in residential areas, research suggests that an area's current noise environment, which has experienced noise in the past may reasonably expect to tolerate a level of noise about 5 dBA higher than the general guidelines. The USACE Safety and Health Requirements Manual, provides criteria for temporary permissible noise exposure levels, for consideration of hearing protection or the need to administer sound reduction controls.

Permissible Non-Department of Defense Noise Exposures

Duration/day (hours)	Noise level (dBA)
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105

Construction noise would be similar to that of farm equipment and other small machinery used in the local area. A backhoe, end loader, road grader and/or vibratory roller is equipment to be used, that each emit noise levels around 85 dBA at 45 feet. Construction machinery would be operated for approximately 8 hours, generating noise during the daytime (7am-6pm) when many residents are at work. Therefore, a reasonable exposure time of 2 hours would be expected during times which residents may be home during the day. As construction equipment approaches residences at a distance of 300-125 feet noise levels would range from approximately 68-78 dBA. Peak outdoor noise levels ranging from 78-90 dbA would occur during the time in which equipment is directly in front of or in close proximity to homes (within 25-100 feet). A maximum noise exposure of approximately 98 dBA, for one hour could occur if equipment were within 10 feet of homes. The noise projections do not account for screening objects, such as trees, outbuildings or other objects that muffle and reduce the noise emitted. The outdoor construction noise would be further muffled inside the home. While the construction noise generated would be considered unacceptable according to HUD and FAA standards, these limited exposures and time intervals are still within allowable Corps safety levels (USACE 2003). Further, they are similar to typical neighborhood noise generated by gaspowered lawnmowers in the local area, which could range from 90-95 dBA at 3 feet and 70-75 dbA at 100 feet. Residents' exposure to these noise levels would occur if/when residents are home and outdoors. Elevated noise levels proximate to homes should be limited to the duration of construction, and human exposure to such noises would likely be limited to a few hours. Due to daytime construction, impacts from noise to local residences should be minor and temporary.

Actual peak noise levels and associated vibration would vary at a given location based on line of sight, topography, vegetation, and atmospheric conditions. Relatively high peak noise levels in the range of 93-108 dBA may occur on the active construction sites and would decrease with distance from the construction areas. Construction workers who would be subjected to the highest noise levels would follow standard USACE and Federal Occupational Safety and Health Administration (OSHA) requirements to prevent hearing damage.

3.17 Environmental Justice

Executive Order 12898 "Federal Action to Address Environmental Justice in Minority Populations," required the responsible party to identify, address and avoid disproportionately high and adverse human health or environmental effects on minority and low income populations. The 2000 census indicates the Logan/Island Creek area is 92.5% white and has a median per capita income of $15,193 compared with $14,102 for Logan County and $16,477 for the state of West Virginia, with 18.2% of individuals below the poverty level. Construction of the Island Creek Local Protection Project will not negatively impact any minority or low income groups of individuals within or downstream of the project area. Implementation of the project would help improve the environment of the immediate project area.

3.18 Health and Safety

Flooding from Island Creek poses risks to human health and safety. Besides direct injury from flooding, high stream flows carries water contaminated with high levels of fecal coliform, which pose a risk of containing water born pathogens which can cause ear infections, dysentery, typhoid fever, viral and bacterial gastroenteritis, and hepatitis A.

The proposed action alternative would have a positive effect on the health and safety as the result of reducing flood waters along the lower 3,600 feet of the Island Creek Project area. For the No Action alternative, health and safety risks associated with flooding would continue. Without intervention by another local or state agency, flooding would continue to occur and without warnings sufficient to protect life and property, loss of income to businesses and employees.

4.0 PUBLIC AND AGENCY COORDINATION

4.1 Required Coordination.

Coordination with Federal, state and local resource agencies has been conducted throughout the preparation of the National Environmental Protection Agency (NEPA) Draft Environmental Assessment (DEA) for the proposed Island Creek Local Protection Project, Logan, Logan County, West Virginia. Recommendations concerning the proposed project have been considered from the Huntington District, USACE, U.S. Fish and Wildlife Service (Service), U.S. Natural Resources and Conservation Service (NRCS), West Virginia Department of Environmental Protection (WVDEP), West Virginia Division of Highways (WVDOH), West Virginia Division of Natural Resources (WVDNR) and West Virginia State Historic Preservation Office (WVSHPO). Appendix D provides a record of consultation activities completed during the original planning of this project.

4.2 Public Involvement.

Public meetings, workshops, public announcements, literature and close cooperation with local government and citizens have been and will continue to be important to the implementation of a recommended alternative. The following summarizes public involvement since the reevaluation study update began in October 1999:

January 13, 2000	Project Briefing for Logan County Commission (LCC)
February 7, 2000	Project Briefing for LCC (Open to Public)
February 9, 2000	Public Meeting Logan County Collect Project Impact Data
May 31, 2001	Project Briefing West Virginia Soil Conservation Agency (WVSCA) and LCC
December 11, 2002	Project Briefing WVSCA and LCC
January 23, 2003	Project Briefing LCC (Open to Public)
June 29, 2004	Assistant Secretary of Army Project Tour and Public Meeting
October 25, 2005	Project Briefing for LCC (Open to Public)
December 7, 2006	Project Briefing for LCC (Open to Public)
September 10, 2007	Project Briefing for LCC (Open to Public)

The Island Creek Local Protection Project DEA was made available to the natural resource agencies both Federal and state, local government, the general public and other interested agencies, groups or individuals for a thirty (30) day review period as required by NEPA.

A Notice of Availability (NOA) was prepared and published in the Logan Banner with information regarding the DEA, beginning on or about November 28, 2007. All comments received during the thirty (30) day public review period will be considered in the Final Environmental Assessment (FEA).

5.0 CONCLUSIONS

Major points derived from review of the anticipated environmental impacts are as follows: (1) The project would be beneficial as a result of a reduction of flooding along the lower 3,600 feet of Island Creek; (2) As there are no wetlands involved with the project, none will be affected; (3) Species listed on the Federal List of Endangered and Threatened Species would not be impacted; (4) The project would not adversely impact any known archeological, cultural or historic sites in the area; (5) Water quality would not be significantly or permanently affected; (6) The spoil site was determined to be free of HTRW concerns. Therefore, no further HTRW investigations are warranted at this time; (7) A 404 (b)(1) analysis was conducted and water certification was issued by WVDEP; (8) Significant natural resource mitigation would not be required; and (9) Coordination with Federal, state and local agencies has not resulted in any unresolved issues.

Although the 100-Foot Channel produces slightly higher net benefits and has been designated as the NED plan. However, the difference in net benefits between the 80-Foot and 100-Foot plans is less than one percent of the total. Additionally, the 80-ft channel has lower project cots, least impact to existing commercial development, and causes less environmental damage, requires less real estate acquisition and has the lowest overall real estate cost. Therefore, with approximately $2.60 million in net benefits and fewer environmental costs, the 80-ft channel is the recommended alternative.

6.0 List of Preparers

Sherry L. Adams	CELRH-PM-P	Project Manager
Peter K. Dodgion	CELRH-PM-PD-R (CHIEF)	Document Review
Terry L. Clarke, Esq.	CELRH-OC	NEPA Review
Gus R. Drum, RLA	CELRH-PM-PD-F	Internal Technical Review
Lauren Wyant	CELRH-PM-PD-R	Document Preparation and Review
Wallace E. Dean, CWB	CELRH-PM-PD-R	Principal Author

7.0 BIBLIOGRAPHY

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Cremeans, Bill. 2007. Personal Communication. Huntington District, U.S. Army Corps of Engineers. Huntington District Office. Huntington District Water Quality Lab. Gallipolis Ferry, West Virginia.

Dodgion, Peter K. 2007. Personal Communication. Huntington District, U.S. Army Corps of Engineers. Huntington District Office. Huntington, West Virginia.

Dotson, Tom. 2007. Personal Communication. West Virginia Division of Natural Resources. District V Office. Point Pleasant, West Virginia.

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FINAL ENVIRONMENTAL ASSESSMENT
ISLAND CREEK LOCAL PROTECTION PROJECT
LOGAN COUNTY, WEST VIRGINIA
NOTICE OF AVAILABILITY

The US Army Corps of Engineers, Huntington District, by the Notice of Availability (NOA), advises the public that the Draft Environmental Assessment (DEA) for the Local Protection Plan for the Island Creek Basin, is complete and available for review. The project is located in Logan, West Virginia. A Finding of No Significant Impact (FONSI) is anticipated for the proposed project. A Draft FONSI is included with the DEA for public review.

In compliance with the National Environmental Policy Act (NEPA) and 40 CFR 1501.4, the DEA and Draft FONSI must be available to the public in the affected area for thirty (30) DAYS FOR REVIEW AND COMMENT. Final determination regarding the need for additional NEPA documentation will be made after public review period, which begins on or about November 28, 2007 and ends on or about December 27, 2007. Copies of the documents may be viewed at the following locations:

Logan County Courthouse
300 Stratton Street
Logan, West Virginia 25601

Logan Area Public Library
16 Wildcat Way
Logan, West Virginia 25601

Corps of Engineers, Huntington District
502 Eighth Street
Huntington, West Virginia 25701

Copies of the DEA and Draft FONSI may be obtained by contacting the Huntington District office of the Corps of Engineers at 304-529-5712. Comments pertaining to the documents should be directed by letter to the following address, by December 27, 2007.

Mr. Peter K. Dodgion
Chief, Environmental Analysis Section
Planning Branch
Huntington District of Corps of Engineers
502 Eighth Street
Huntington, West Virginia 25701-2070

Finding of No Significant Impact
Island Creek Basin
Local Protection Project
Logan, West Virginia

1. Members of my staff have conducted a Draft Environmental Assessment (DEA) in the overall public interest concerning implementation of the Island Creek Basin Local Protection Plan. The purpose of this project is to reduce flooding damages within the Island Creek Basin and to improve response time of the community in the event of a flood situation as authorized in WRDA, Public Law (PL-99-662), dated November 17, 1986.

2. The possible consequences of the project have been studied for environmental, cultural and social impacts. Another factor bearing on the assessment was the capability of the project to meet the public needs for which it was proposed. The following references the assessment:

   a. Environmental Considerations. The Huntington District has taken reasonable measures to assemble and present the known or foreseeable environmental impacts of the project in the DEA. These impacts involve biological and human resources. All adverse effects of project implementation have been considered insignificant or will be avoided through best management techniques.

   b. Social Well-Being Considerations. The proposed project will provide reduced flooding damages within the Island Creek Basin and improve response time of the community in the event of a flood situation. No significant economic or social well-being impacts are foreseen as a result of the proposed project. No archeological resources are recorded in the project area. There will be temporary visual and noise impacts associated with construction and during periodic maintenance of the channel; however these are considered minor and will cease once the project is constructed.

   c. Coordination with Resource Agencies. Pursuant to the Fish and Wildlife Coordination Act (FWCA) of 1958, coordination with the U.S. Fish and Wildlife Service (Service) and the West Virginia Division of Natural Resources (WVDNR) has been maintained throughout the study. Appropriate measures and best management practices have been identified and incorporated into the plan. Also, in accordance with the Endangered Species Act (ESA), as amended, the recommended plan would not impact listed species.

   d. Other Pertinent Compliance. No prime or unique farmland under the Farmland Protection Policy Act (FPPA) will be involved. The proposed action is also in compliance with the National Historic Preservation Act (NHPA, (Section 106 32 CFR 300), Executive (EO) 11988 (Floodplain Management) and EO 11990 (Protection of Wetlands).

e. Other Public Interest Considerations. There has been no opposition to the proposed action by Federal, state or local Governments, or organized environmental groups. Comments received during the public review period have been included in the Final Environmental Assessment (FEA). There are no unresolved issues regarding the implementation of the project.

f. Section 176(c) Clean Air Act. The proposed action has been analyzed for conformity applicability pursuant to regulations implementing Section 176 (c) of the Clean Air Act (CAA). It has been determined that the proposed action will not exceed *de minimis* levels or direct emissions of criteria pollutant or its precursors and is exempted by 40 CFR Part 93.153. Any later direct emissions are generally not within the District's continuing program responsibility and generally cannot be practicably controlled by the District. For these reasons a conformity determination is not required for this action.

3. I find the Island Creek Basin Local Protection Project has been planned in accordance with the current authorization as described in the FEA. The project is consistent with National policy, statutes, and administrative directives. This determination is based on a thorough analysis and evaluation of the project and alternative courses of action. In conclusion, I find the proposed Island Creek Basin Local Protection Plan will have no significant adverse effect on the quality of the human and/or natural environment.

____
DATE

____
Colonel Dana R. Hurst
Colonel, Corps of Engineers
District Engineer

Island Creek Local Protection Project
Draft Environmental Assessment, Logan, West Virginia
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FINAL ENVIRONMENTAL ASSESSEMENT

ISLAND CREEK LOCAL PROTECTION PROJECT

LOGAN COUNTY, WEST VIRGINIA

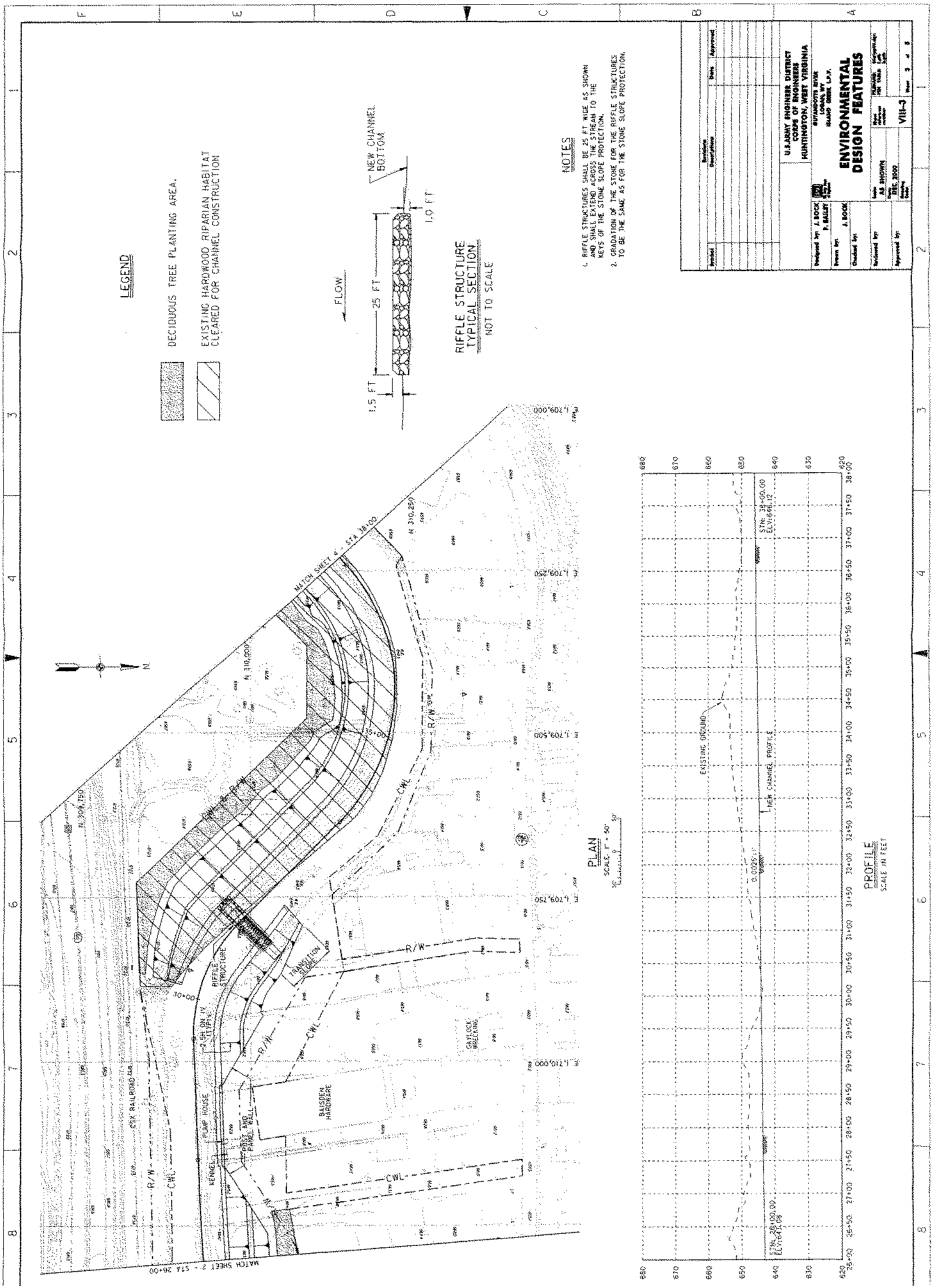
FIGURES 1-5

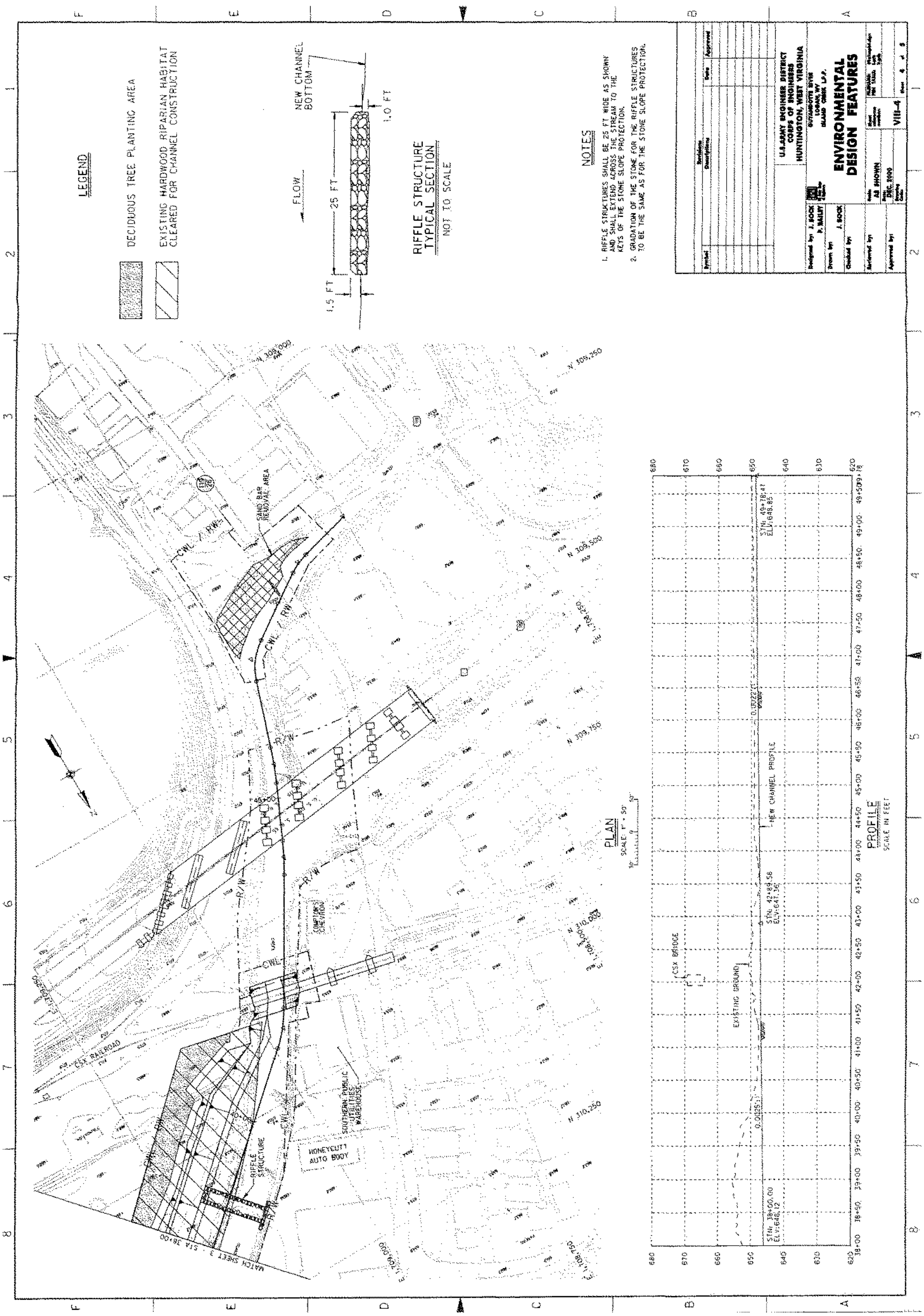
US ARMY CORPS OF ENGINEERS

HUNTINGTON DISTRICT

HUNTINGTON, WEST VIRGINIA

JANUARY 2008


LEGEND
DECIDUOUS TREE PLANTING AREA.
EXISTING HARDWOOD RIPARIAN HABITAT CLEARED FOR CHANNEL CONSTRUCTION
FLOW
25 FT
1.5 FT
1.0 FT
NEW CHANNEL BOTTOM
RIFFLE STRUCTURE TYPICAL SECTION
NOT TO SCALE
NOTES
1. RIFFLE STRUCTURES SHALL BE 25 FT WIDE AS SHOWN AND SHALL EXTEND ACROSS THE STREAM TO THE KEYS OF THE STONE SLOPE PROTECTION.
2. GRADATION OF THE STONE FOR THE RIFFLE STRUCTURES TO BE THE SAME AS FOR THE STONE SLOPE PROTECTION.
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
ENVIRONMENTAL DESIGN FEATURES
AS SHOWN
VIII-3
MATCH SHEET 4 - STA 38+00
MATCH SHEET 2 - STA 26+00
RIFFLE STRUCTURE
TRANSITION SLOPE
PUMP HOUSE
KENNEL
C&K RAILROAD
BAISDEN HARDWARE
GAYLOCK WRECKING
R/W
CWL
PLAN
PROFILE
SCALE IN FEET
EXISTING GROUND
NEW CHANNEL PROFILE
STN. 38+00.00
STN. 26+00.00



LEGEND
DECIDUOUS TREE PLANTING AREA
EXISTING HARDWOOD RIPARIAN HABITAT CLEARED FOR CHANNEL CONSTRUCTION
NEW CHANNEL BOTTOM
FLOW
25 FT
1.0 FT
1.5 FT
RIFFLE STRUCTURE TYPICAL SECTION
NOT TO SCALE
NOTES
1. RIFFLE STRUCTURES SHALL BE 25 FT WIDE AS SHOWN AND SHALL EXTEND ACROSS THE STREAM TO THE KEYS OF THE STONE SLOPE PROTECTION.
2. GRADATION OF THE STONE FOR THE RIFFLE STRUCTURES TO BE THE SAME AS FOR THE STONE SLOPE PROTECTION.
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
ENVIRONMENTAL DESIGN FEATURES
AS SHOWN
DEC 2000
VIII-4
SAND BAR REMOVAL AREA
CWL / RW
R/W
CSX RAILROAD
RIFFLE STRUCTURE
HONEYCUTT AUTO BODY
SOUTHERN PUBLIC UTILITIES WAREHOUSE
MATCH SHEET 3 - STA 38+00
PLAN
PROFILE
SCALE IN FEET
CSX BRIDGE
EXISTING GROUND
NEW CHANNEL PROFILE
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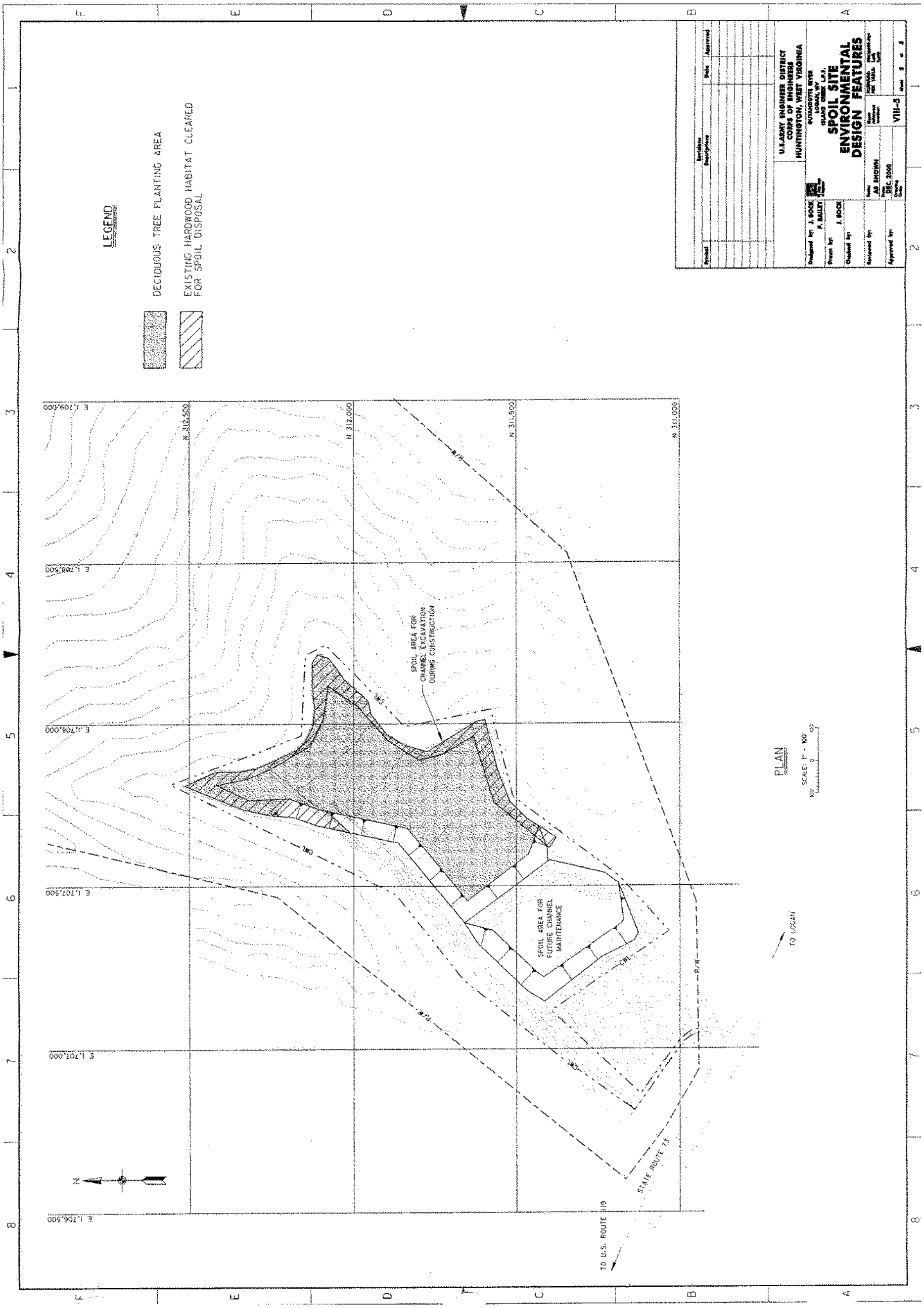
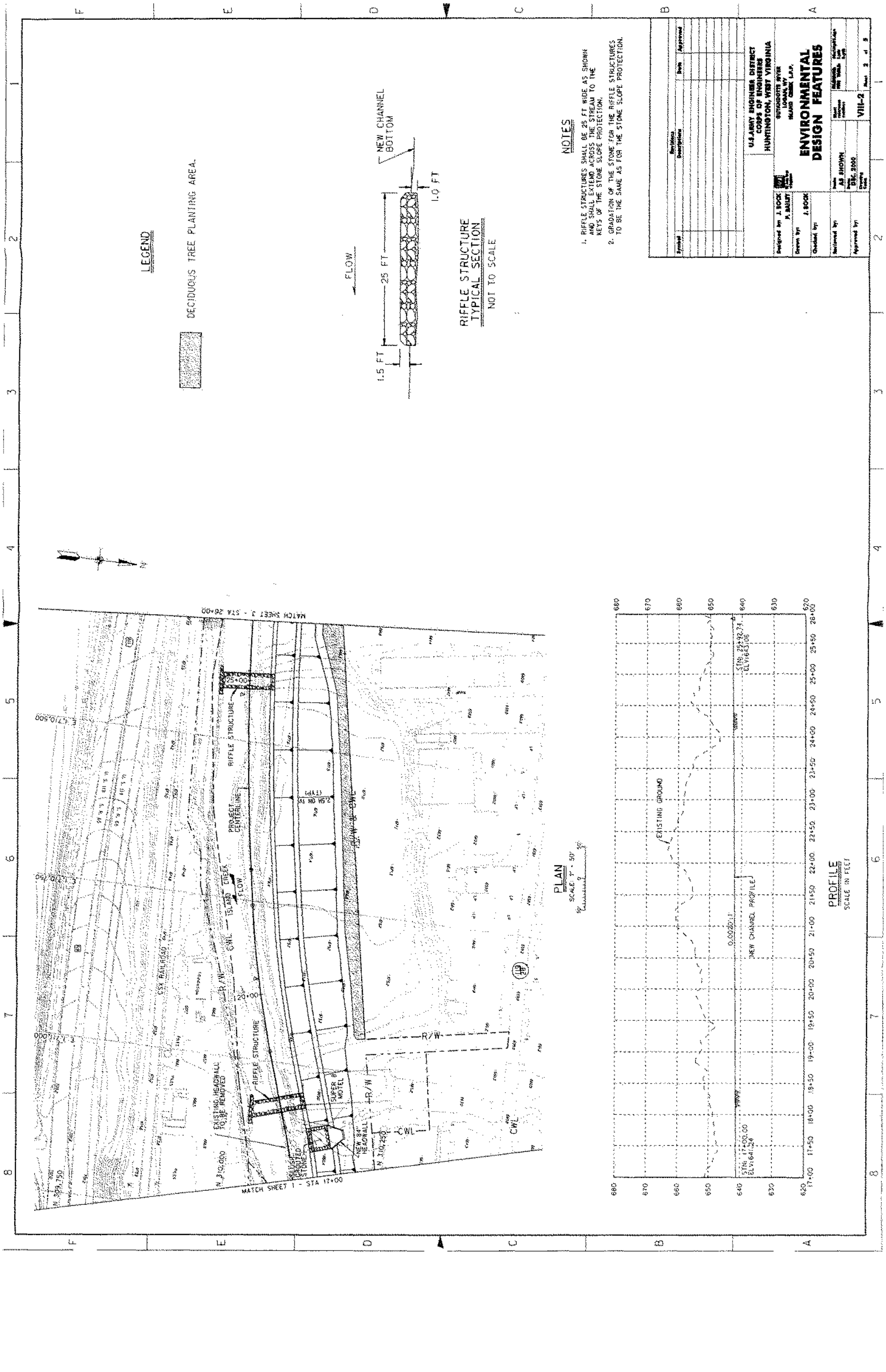
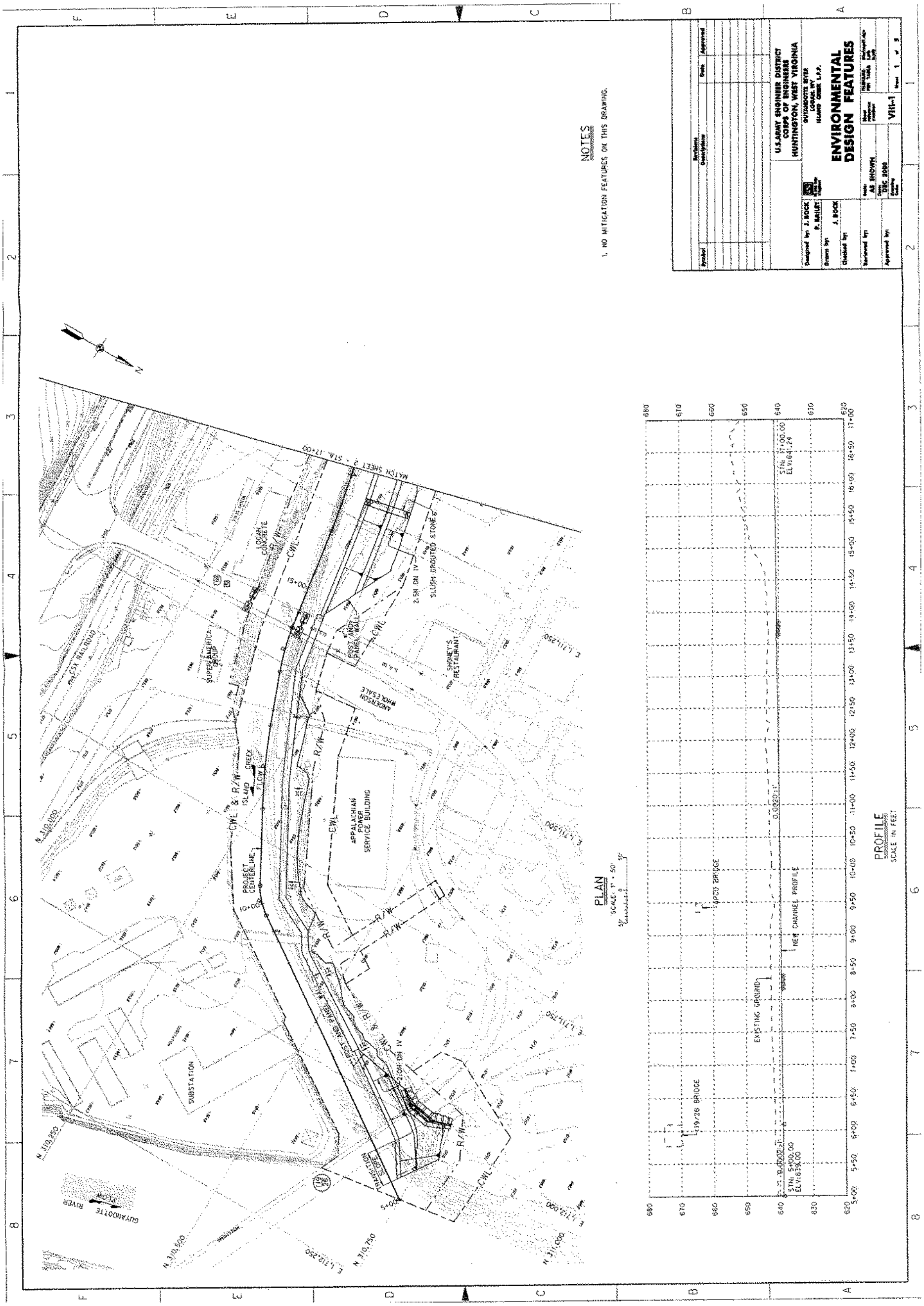
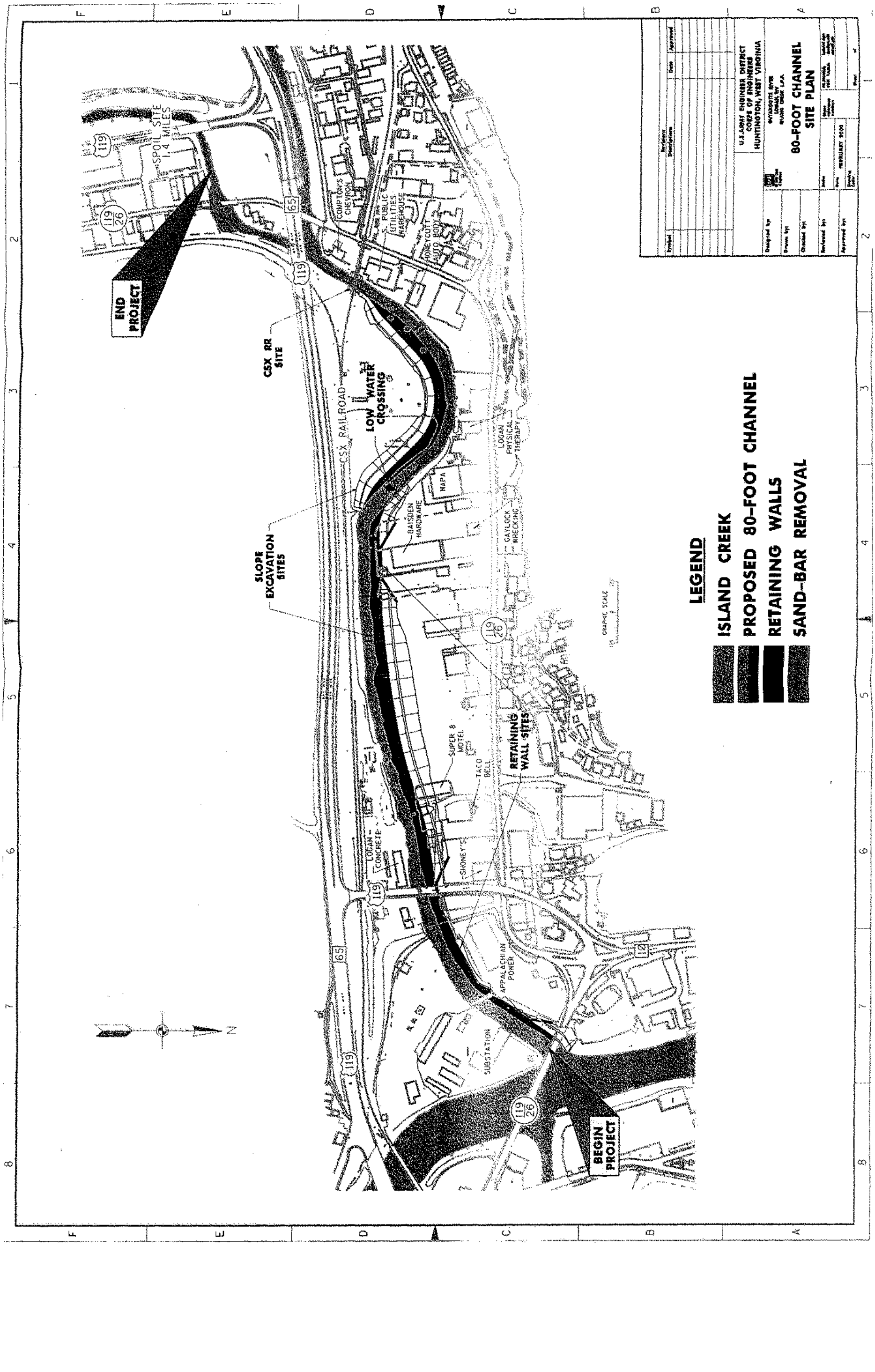
STA: 42+89.56 ELV: 647.36
STA: 49+78.41 ELV: 648.85


LEGEND
DECIDUOUS TREE PLANTING AREA
EXISTING HARDWOOD HABITAT CLEARED FOR SPOIL DISPOSAL
SPOIL AREA FOR CHANNEL EXCAVATION DURING CONSTRUCTION
SPOIL AREA FOR FUTURE CHANNEL MAINTENANCE
PLAN
TO LOGAN
STATE ROUTE 73
TO U.S. ROUTE 119
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
SPOIL SITE
ENVIRONMENTAL
DESIGN FEATURES
VIII-5



LEGEND
DECIDUOUS TREE PLANTING AREA.
NEW CHANNEL BOTTOM
FLOW
25 FT
1.0 FT
1.5 FT
RIFFLE STRUCTURE
TYPICAL SECTION
NOT TO SCALE
NOTES
1. RIFFLE STRUCTURES SHALL BE 25 FT WIDE AS SHOWN AND SHALL EXTEND ACROSS THE STREAM TO THE KEYS OF THE STONE SLOPE PROTECTION.
2. GRADATION OF THE STONE FOR THE RIFFLE STRUCTURES TO BE THE SAME AS FOR THE STONE SLOPE PROTECTION.
U.S.ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
ENVIRONMENTAL
DESIGN FEATURES
AS SHOWN
VIII-2
MATCH SHEET 3 - STA 26+00
MATCH SHEET 1 - STA 17+00
RIFFLE STRUCTURE
PROJECT CENTERLINE
ISLAND CREEK
FLOW
CSX RAILROAD
EXISTING HEADWALL TO BE REMOVED
NEW 84" HEADWALL
R/W
CWL
PLAN
EXISTING GROUND
NEW CHANNEL PROFILE
PROFILE
SCALE IN FEET


NOTES
1. NO MITIGATION FEATURES ON THIS DRAWING.
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
ENVIRONMENTAL
DESIGN FEATURES
PLAN
PROFILE
SCALE IN FEET
APPALACHIAN POWER SERVICE BUILDING
SUBSTATION
SHONEY'S RESTAURANT
ANDERSON WHOLESALE
LOGAN CONCRETE
ISLAND CREEK FLOW
GUYANDOTTE RIVER FLOW
PROJECT CENTERLINE
EXISTING GROUND
NEW CHANNEL PROFILE
SLUSH GROUTED STONE


U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
80-FOOT CHANNEL
SITE PLAN
LEGEND
ISLAND CREEK
PROPOSED 80-FOOT CHANNEL
RETAINING WALLS
SAND-BAR REMOVAL
END PROJECT
BEGIN PROJECT
CSX RR SITE
LOW WATER CROSSING
SLOPE EXCAVATION SITES
RETAINING WALL SITES
CSX RAILROAD
SPOIL SITE 1.4 MILES
COMPTON'S CHEVRON
PUBLIC UTILITIES WAREHOUSE
HONEYCUTT AUTO BODY
LOGAN PHYSICAL THERAPY
NAPA
BAISDEN HARDWARE
GAYLOCK WRECKING
SUPER 8 MOTEL
TACO BELL
LOGAN CONCRETE
SHONEY'S
APPALACHIAN POWER
SUBSTATION

Finding of No Significant Impact
Island Creek Basin
Local Protection Project
Logan, West Virginia

1. I have conducted an environmental assessment in the overall public interest concerning implementation of the Island Creek Basin Local Protection Plan. The purpose of this project is to reduce flooding damages with the Island Creek Basin and to improve response time of the community in the event of a flood situation as authorized in Section 202 of PL 96-367.

2. The possible consequences of the project have been studied for environmental, cultural and social impacts. Another factor bearing on my assessment was the capability of the project to meet the public needs for which it was proposed. The following references the assessment:

a. Environmental Considerations. The Huntington District has taken reasonable measures to assemble and present the known or foreseeable environmental impacts of the project in the environmental assessment. These impacts involve biological and human resources. All adverse effects of project implementation are considered insignificant or will be avoided through best management techniques.

b. Social Well-Being Considerations. The proposed project will provide reduced flooding damages with the Island Creek Basin and improve response time of the community in the event of a flood situation. No significant economic or social well-being impacts are forseen as a result of the proposed project. No archeological resources are recorded in the project area. There would be temporary visual and noise impacts associated with construction, however these are considered minor and will cease once project is constructed.

c. Coordination with Resource Agencies. Pursuant to the Fish and Wildlife Coordination Act (FWCA) of 1958, coordination with the U.S. Fish and Wildlife Service and the West Virginia Department of Natural Resources has been maintained throughout the study. Appropriate measures and best management practices have been identified and incorporated into the plan. Also, in accordance with the Endangered Species Act, as amended, the recommended plan would not impact listed species.

d. Other Pertinent Compliance. No prime or unique farmland under the Farmland Protection Policy Act will be involved. The proposed action is also in compliance with the National Historic Preservation Act, (Section 106 32 CFR 300), Executive (EO) 11988 (Floodplain Management) and EO 11990 (Protection of Wetlands).

Finding of No Significant Impact
Island Creek Basin
Local Protection Project
Logan, West Virginia

e. Other Public Interest Considerations. There has been no significant opposition to the proposed action by State or local Governments, or organized environmental groups. Comments received during the public review period have been included in the Final Environmental Assessment. There are no unresolved issues regarding the implementation of the project.

f. Section 176(c) Clean Air Act. The proposed action has been analyzed for confomity applicability pursuant to regulations implementing Section 176 (c) of the Clean Air Act. It has been determined that the proposed action will not exceed deminimis levels or direct emissions of criteria pollutant or its precursors and is exempted by 40 CFR Part 93.153. Any later direct emissions are generally not within the Districts' continuing program responsibility and generally cannot be practicably controlled by the District. For these reasons a conformity determination is not required for this action.

3. I find the Island Creek Basin Local Protection Plan has been planned in accordance with the current authorization as described in the Environmental Assessment. The project is consistent with National policy, statutes, and administrative directives. This determination is based on a thorough analysis and evaluation of the project and alternative courses of action. In conclusion, I find the proposed Island Creek Basin Local Protection Plan will have no significant adverse effect on the quality of the human and/or natural environment.

1 April 2002
DATE

JOHN D. RIVENBURGH
Colonel, Corps of Engineers
District Engineer

US Army Corps
of Engineers
Huntington District

FINAL ENVIRONMENTAL ASSESSMENT

ISLAND CREEK LOCAL PROTECTION PROJECT
LOGAN COUNTY, WEST VIRGINIA

US ARMY CORPS OF ENGINEERS
HUNTINGTON DISTRICT
HUNTINGTON, WEST VIRGINIA

March 2002

U.S. Army Corps of Engineers
Huntington District

FINAL ENVIRONMENTAL ASSESSMENT
ISLAND CREEK LOCAL PROTECTION PROJECT
LOGAN, LOGAN COUNTY, WEST VIRGINIA

Abstract: The proposed project area is located in southern West Virginia, in Logan County, and is a part of the Island creek Local Protection Project. The proposed actions consist of widening Island Creek to approximately 80 ft. from its confluence with the Guyandotte River to approximately 3600 ft upstream. The material excavated during the channel widening will be spoiled in School House Hollow, located off U.S. Route 119 and State Route 73. Approximately 203,000 cubic yards of material will be place on an existing 12-acre fill to a depth of 19 ft. This Environmental Assessment was undertaken to provide updated information concerning the proposed project. Huntington District's analysis for the human and natural environment and socio-economics determined the proposed action produced insignificant impacts. The action was selected because it provides benefits, is environmentally sound, is socially acceptable and is responsive to the request of the local residents and Logan County.

For Additional Information Contact:

Ms. Lucile V. Mullins
U.S. Army Corps of Engineers
Huntington District
502 Eighth Street
Huntington, West Virginia 25701-2070
Telephone: (304) 529-5712

EXECUTIVE SUMMARY

Introduction: This report was authorized by the Water Resources Development Act of 1986 (Public Law 99-662, dated 17 November 1986). The proposed actions consist of widening Island Creek to approximately 80 ft from its confluence with the Guyandotte River to approximately 3600 ft upstream. The material excavated during the channel widening will be spoiled in School House Hollow, located off U.S. Route 119 and State Route 73. Approximately 203,000 cubic yards of material will be placed on an existing 12-acre fill to a depth of 19 ft.

Permit Coordination Procedures: The resident contractor will be responsible for obtaining all permits necessary for completion of the proposed action.

Alternatives Considered: A number of alternatives with potential for meeting the needs of the proposed action amendments were considered. The selected alternative adequately meets the cost and minimal impact requirement as well as the desires of the local residents and citizens of Logan County.

Environmental Effects of the Action: The proposed action will not have any significant long-term or short-term impacts on the human and/or natural environment.

Mitigation: Mitigation for this action is not required.

SUMMARY

(X) Environmental Assessment

Responsible Office: Environmental Analysis Section
Planning Branch
Planning, Programs, and
Project Management Division
U.S. Army Corps of Engineers
Huntington District
502 Eighth Street
Huntington, West Virginia 25701-2070

Telephone: (304) 529-5712

1. Name of Action: Island Creek Local Protection Plan, Logan, Logan County, West Virginia.

2. Description of Action: The proposed actions consist of widening Island Creek to approximately 80 ft from its confluence with the Guyandotte River to approximately 3600 ft upstream. The material excavated during the channel widening will be spoiled in School House Hollow, located off U.S. Route 119 and State Route 73. Approximately 203,000 cubic yards of material will be place on an existing 12-acre fill to a depth of 19 ft.

3. Environmental Impacts: Impacts on flora and fauna, aquatic and terrestrial, as the result of the proposed action implementation, would result in no significant adverse long-term impacts to the resources within the action area. Endangered/Threatened species, archeological and/or historical sites and wetlands will not be adversely impacted. HTRW is not a concern at the action or spoil sites.

In summation, implementation of the proposed widening of Island Creek a Logan, Logan County, will not adversely affect the long-term quality of the human or natural environmental within the identified action area.

LOCAL PROTECTION PLAN
ISLAND CREEK BASIN, LOGAN COUNTY, WV
ENVIRONMENTAL ASSESSMENT

TABLE OF CONTENTS

1.0 PURPOSE AND NEED

1.1 **Purpose and Need**. The purpose of the Island Creek Local Protection Project at Logan, West Virginia is to reduce flooding damages within the Island Creek Basin and to improve response time of the community in the event of a flood situation. The reevaluation study of the authorized Island Creek LPP has been conducted to affirm the economic feasibility of the project, to identify the National Economic Development (NED) plan and to ensure conformity with current criteria, policy, and guidelines. The intention of the reevaluation report has been to furnish sufficient detail to proceed directly to plans and specifications for the structural portion of the project (the lower 3600 ft channel improvement) and the Flood Warning System (FWS).

1.2 **Changes in Project Conditions.** Since completion of the authorized local protection plan at Logan in 1986, several changes have occurred for which an environmental evaluation is required. First, there have been significant reductions in size and cost for a Federal project at Logan. The project length has been shortened from 19 miles to 3600 ft. Proposed work along Mud and Copperas Mine Fork has been eliminated, as has all non-structural work within the basin. With the authorized project, the lower 3600 ft of Island Creek would be widened to 100 ft, the lower 1000 ft of which was to be concrete-lined. However, the 1993 General Reevaluation Study of the Island Creek Local Protection Project would minimize disturbance to the stream bed by eliminating the use of concrete and reducing the channel width to 80 ft (see Figure 1). Because of the former nonstructural component, a considerable number of housing relocation sites along the Guyandotte River floodplain were required. In addition, several spoil disposal areas would have been needed to accommodate the added excavated materials. Day use recreation facilities were also a part of the authorized plan, but they are not included in the reevaluation study.

Secondly, the project area has experienced some additional economic development since the project was authorized in 1986. On the Guyandotte River, just downstream from the mouth of Island Creek, there is a McDonald's restaurant. From that point upstream on Island Creek for a distance of over 600 feet, an interceptor sewer system has been installed. Just above the U.S. Route 119 bridge over Island Creek, a Shoney's restaurant, a Taco Bell restaurant, and a Super 8 have all been constructed on fill material. Near the upper end of the channel, the former K-City Discount store was remodeled to become the Honeycutt Pontiac dealership and since the 1996 flood has since reverted to a discount store.

Thirdly, the amount of unauthorized dumping along the lower 3600 ft of Island Creek has increased since 1986. The streambanks contain more rubble and automobile bodies at present, suggesting no improvement in environmental awareness regarding stream corridors in the project area.

1.3 **Flood Warning System.** A state-of-the-art Flood Warning System (FWS) is recommended for the Island Creek Basin allowing continual direct access to flood/storm data. Community access to this data would significantly improve response time of the communities in the event of a flooding situation. The recommended system would be a state-of-the-art integration of new and upgraded stream and precipitation gages, radio repeater sites and dedicated computer workstations running software with forecast capability. The system would provide additional warning time for the small communities upstream of Logan. The system would also be beneficial for communities located downstream on the Guyandotte River. The recommended FWS would expand the Integrated Flood Observing and Warning System (IFLOWS) to meet the basin-wide requirement of providing flood warning to the Office of Emergency Service (OES), Directors of Logan County, and possibly some of the surrounding counties. By including stream gauge data into the forecast model, the reliability of flood height predictions and warning times would improve current capability considerably.

One of the three existing river gauge sites on the Guyandotte River that use data loggers/transmitters would be up-graded using state-of-the-art equipment. A maximum of nine (9) new river gages would be installed to forecast flooding upstream of Logan. The locations of the stations were determined during field investigations and took into account recommendations of the Logan County Office of Emergency Services. Equipment to be installed would provide all the functions including satellite communications, data collection, telephone, and IFLOWS transmission capabilities.

2.0 ALTERNATIVES

2.1 Alternative Plans. A number of alternatives with potential for alleviating the flooding problem in the Island Creek Basin have been considered. These include both structural and nonstructural plans. The nature of the study area and magnitude of the flooding problem limit the potential alternatives that are both effective and implementable.

2.2 Plans Eliminated From Further Study. All plans, except those defined subsequently, were eliminated from further consideration in the 1993 General Reevaluation Report due to the economics of the National Economic Development Plan (NED) and to ensure conformity with current criteria, policy, and guidelines. The nonstructural floodproofing and structural floodproofing along upper Island Creek, Copperas Mine Fork and Mud Fork was determined to be infeasible.

2.3 Without Condition (No Federal Action). In the absence of project implementation, the future land use and related conditions within the project area are forecast to remain comparable to conditions, as they currently exist. The "No Action" alternatives will be fully evaluated to comply with NEPA requirements.

2.4 Plan Considered in Detail. The existing Island Creek would be widened to create a trapezoidal channel using 2.5 horizontal to 1 vertical side slopes. Channel widening would begin at the confluence of Island Creek and the Guyandotte River and continue for approximately 3600 ft. In 1993, widths for the channel were studied: to determine feasibility of 60', 80', and 100', with 80' the optimal choice, hence the preferred alternative. Post and panel walls would be constructed in certain locations to avoid the impacts associated with the acquisition of certain structures along the channel.

Attempts would be made to minimize the impacts on existing bridges along the stream. Utility lines and drainage structures would be relocated or adjusted to accommodate construction and operation of the new channel.

Generally, widening would only be accomplished on one side of the channel in any area. Clearing and grubbing would be accomplished only in those areas where walls are constructed or where earthwork cuts would be made. All other areas would remain undisturbed as much as possible. Stone slope protection would be placed along the base of the wall and at the toe of the newly excavated slope to reduce the effects of erosion in the lower level flood frequencies. The remaining area between the stone slope protection and the contractors working limits (CWL) would be seeded. The material removed during channel widening would be spoiled at a nearby site at School House Hollow. The material would be placed as upland fill over approximately 6.5 acres of the 12 acres of existing fill material that was spoiled at the site during the construction of U.S. Route 119 and State Route 73 in the mid-1990s. The material would be placed at an approximate depth of 19 feet. The final graded slopes would be properly drained and seeded and blended into the surrounding terrain. An additional 2.5 acres of the 12 acre site would be utilized by the local sponsor for future disposal of channel sediment.

Integrated Flood Observing and Warning System (IFLOWS) is a wide-area computer network of river and rain gauges with enhanced, full, two-way radio, microwave and satellite and telephone line communications. The primary responsibility for flood forecasting would remain with the National Weather Service (NWS). The real-time data from each of the gauges in the system would be relayed to the NWS forecasting center in Cincinnati, Ohio, where it would be processed by existing software to develop flood forecasts. By including stream gauge data into the forecast model, the reliability of flood height predictions and warning times would improve current capability considerably.

The typical rain gauge/river gauge consists of a 16-foot, 12-inch diameter pipe on which a small antenna, solar panel, and rain-measuring device are mounted. The entire unit, including the mounting pipe weighs 80 pounds. It is installed by setting the pipe in a 2-foot by 2-foot concrete base. In some cases, the equipment is mounted on existing towers and not on the the standard 16-foot pipe. The equipment is easily installed and removed as it is simply bolted onto the existing structures or towers. The new gauges will be located on existing State of West Virginia property (West Virginia Department of Highways (WVDOH) road right-of-way) and constructed by the Corps under a standard WVDOH permit.

The following locations were determined to be suitable for the installation of FWS stations in the Island Creek basin.

Site 1. Mount Gay/Cherry Tree

A FWS station would be located on Island Creek in the community of Mount Gay/Cherry Tree on or near a highway bridge on State Route 44 just south of the S.R. 44/S.R. 73 intersection and just west of a Kawasaki/Suzuki ATV dealership. The site is approximately 0.9 miles upstream of the confluence of Island Creek and the Guyandotte River.

Site 2. Switzer
FWS station would be located on Island Creek just north of the community of Switzer on or near Highway Bridge Number 2946 on State Route 44. The site is approximately 5.3 miles upstream of the confluence of Island Creek and the Guyandotte River.

Site 3. Chauncey
FWS station would be located on Island Creek in the community of Chauncey on or near a timber deck bridge on County Route 119/18 at its intersection with State Route 44. The site is approximately 8.2 miles upstream of the confluence of Island Creek and the Guyandotte River.

Site 4. Omar
FWS station would be located on Island Creek in the community of Omar on or near Highway Bridge Number 3248 on State Route 44 at its intersection with Sandy Bottom Rd. The site is approximately 8.9 miles upstream of the confluence of Island Creek and the Guyandotte River.

Site 5. Cora/Whitman Junction
FWS station would be located on Copperas Mine Fork in the community of Cora on or near highway bridge number S-1810 on Old U.S. Route 119. The site is approximately 1.5 miles upstream of the confluence of Copperas Mine Fork and Island Creek.

Site 6. Trace Junction
FWS station would be located on Copperas Mine Fork in the community of Trace Junction on or near a highway bridge on Price Bottom Road (119/34) at its intersection with Old U.S. Route 119. The site is approximately 2.8 miles upstream of the confluence of Copperas Mine Fork and Island Creek.

Site 7. Holden/Copperas Mine Fork
FWS station would be located on Copperas Mine Fork in the community of Holden on or near a highway bridge on Old U.S. Route 119 adjacent to the CONSOL Coal Group, Mid-Continent Region, Bluefield Operation, Holden Complex building. The site is approximately 3.5 miles upstream of the confluence of Copperas Mine Fork and Island Creek.

Site 8. Holden/Trace Fork
FWS station would be located on Trace Fork in the community of Holden on or near highway bridge with guardrail labeled 3.29 on Old U.S. Route 119 at its intersection with Lower Trace Route A Rd. The site is approximately 0.1 miles upstream of the confluence of Trace Fork and Copperas Mine Fork.

Site 9. Verdunville
FWS station would be located on Mud Fork just east of the community of Verdunville on or near the piers of a bridge on New U.S. Route 119 at its overhead crossing with State Route 5. The site is approximately 1.9 miles upstream of the confluence of Mud Fork and Copperas Mine Fork.

Site 10. Logan
Existing FWS station on the Guyandotte River in Logan would be upgraded and incorporated into the Island Creek FWS.

2.5 Environmental Design Measures. The quality of the environment has been affected in the densely populated study area. The quality of fish and wildlife habitats in the impact area ranges from fair to very poor. Most of this results from the fact that almost all development occurs in the bottomland along the stream due to the steep topography. Most of the bottomlands along Island Creek are limited to a narrow band of riparian vegetation and small stands of hardwoods. Disturbed areas have grown up in old fields adjacent to the nearly continuous string of commercial and industrial development in the project area. Major wildlife species found in the bottom lands of the study area are resident and migrant songbirds, small mammals, amphibians, and reptiles.

The aquatic resources of the area are greatly stressed by dense population. Resource related problems in the area include but are not limited to acid mine drainage, siltation from logging and mining, untreated domestic sewage, trash, dredging and filling, and general stream bank disturbances such as riprap, cribwalls, gas and sewer pipes and bridges. Most of the stream reach has some snag cover and instream structure. Solid substrate is in short supply however, since much of the bottom is unconsolidated sediment. Overhanging riparian vegetation from the steep banks shade much of the stream, but the canopy rarely completely closes over the stream.

Except for the upper reaches of Island Creek, some small relatively undisturbed tributaries, and the Guyandotte River mainstem, the project area has poor water quality that is generally incapable of supporting aquatic life, or at best a depressed resemblance of what would normally occur.

The bottomland and upland habitats are interspersed with small businesses, road, railroads, and some industry throughout the project area. Quality of this habitat type ranges from good to poor. Availability of food items is fair except for the absence of some major food producers, i.e., oaks and dogwoods. Sycamore and river birch are dominant. The stands are of uneven age with most being young. There is a general lack of mast producing species and den sites. Downed logs and detritus, rock and lush vegetation offer adequate small mammal, amphibian, and reptile habitat. High human disturbance (negative interspersion) makes the area undesirable for most game species. Food, cover, and reproduction value to wildlife generally declines downstream due to the increased human population downstream.

A Planning Aid Letter was furnished to the Huntington District in 1993. The USFWS suggested to the district to eliminate the concrete lined channel and utilized an irregular shaped stream bottom. The district agreed that this variation would increase the physical habitat in Island Creek. During construction, vegetation would be snagged and cleared adjacent to the stream bank of Island Creek within the CWL. Approximately 2.5 acres of this cleared vegetation is considered to be bottomland hardwood riparian habitat, which is located along the right descending bank of Island Creek.

In agreement with the USFWS, the District concurred to replace the loss of riparian habitat that the upper slopes of the stream bank would be reseeded with deep rooting native grasses and non-woody annuals and perennials. Approximately 1.0 acre of native bottomland hardwood tree and shrub species would be planted along the stream leaving a 12-foot wide access road for maintenance vehicles. The native bottomland plant community would be maintained as a successional plant community requiring no maintenance such as mowing or herbicide use.

In addition to elimination of the concrete lined channel, riffle/pool complexes would be constructed intermittently along the 3600 ft of Island Creek to be widened. The riffle structures, consisting of stone similar in size to the stone slope protection, would be approximately 25 feet wide and extend across the width of the channel. The riffle structures would be anchored approximately 1 foot into the streambed and rise approximately 1.5 feet above the streambed.

The proposed School House Hollow disposal area consists of a valley containing approximately 105 acres of moderate to steep hillside. The site is vegetated with upland hardwood vegetation. Approximately 12 acres of the valley portion of the site has previously been used as a spoil disposal site during the construction of U.S. Route 119 and State Route 73 in the mid-1990s. The previous fill material consists of rock and soil and is configured in two benches with fill slopes of approximately 2.5 to 1. The existing fill is vegetated with tall grasses and low growing brush. Within the valley, a dirt haul road provides access along the west side of the fill. A shallow ditch around the perimeter of the existing fill collects storm water surface runoff from the hillsides and carries it to the base of the fill where it flows under the access road and State Route 73 via concrete culverts. The placement of channel excavated material over 6.5 acres of the spoil site would require the removal of approximately 1.5 acres of upland and bottomland hardwood trees located on the hillside around the perimeter of the existing fill. The 6.5 acres of new fill would be seeded with native grass, annual and perennial mix and planted with upland deciduous trees and shrubs. The planting would be maintained as a successional plant community requiring no maintenance such as mowing or herbicide use. The spoil disposal site would be acquired in fee to insure control and management.

A copy of the Planning Aid Letter may be found in Appendix C.

2.6 Permits and Other Environmental Compliance

2.6.1 Section 404/401. The Corps of Engineers has coordinated with the State of West Virginia to obtain a Section 401 Water Quality Certification for the authorized project at Logan. Also, a 404 (b) (1) Analysis was completed to incorporate the fill activities occurring at the School House Hollow disposal site. The Water Quality Certification and the 404 (b) (1) Analysis may be found in Appendix B.

2.6.2 Solid Waste Disposal. The contaminated soils discussed below in paragraph 2.6.6 Hazardous, Toxic and Radiological Wastes, would be taken to an appropriate landfill for disposal. All other excavated spoil materials would be disposed of at the School House Hollow spoil disposal site.

2.6.3 Fish and Wildlife Coordination Act. Compliance with the Fish and Wildlife Coordination Act has been conducted concurrent with NEPA compliance. Coordination with Federal and state natural resource agencies has been completed. Please refer to Appendix C for the coordination documentation.

2.6.4 Endangered Species Act. In accordance with the Endangered Species Act of 1973 and the Endangered Species Act Amendments of 1978, the Huntington District requested the views of the U.S. Fish and Wildlife Service concerning the potential presence of special listed or proposed for listing as endangered. USFWS indicated a federally listed species that could occur within the proposed project area is the endangered Indiana bat, Myotis sodalis. This species may use the project area for foraging and roosting between April 1 and November 14.

The Service has determined the number of acres of suitable foraging and roosting habitat on the West Virginia landscape available to each Indiana bat known to occur there. On that basis, it has been determined that small projects, generally affecting 17 acres or less of suitable foraging and roosting habitat, would have an infinitesimally small chance (at the 98% confidence level) of resulting in direct or indirect take. If less than 17 acres of suitable habitat would be disturbed, the Service considers that action discountable and unlikely to adversely affect the endangered Indiana bat at any season of the year.

2.6.5 Hazardous, Toxic, and Radiological Wastes.

Channel Widening Activities

GRW Engineers Inc. of Lexington, KY conducted a Phase I Hazardous, Toxic, and Radiological Waste investigation on the site, (HTRW report dated May, 1991). From this investigation, four Areas of Concern (AOC) were identified as AOC-1 Appalachian Power, AOC-4 Fill Material Area, AOC-5 Baisden Brothers Hardware, and AOC-6 Gaylock Wrecker Service. A Phase II investigation was conducted by personnel from the Huntington and Nashville District Corps of Engineers. Results of the Phase II investigation indicated the following: Polychlorinated biphenyl's (PCBs) contamination was detected at AOC-1, petroleum products and metals contamination was detected in

AOC-4, potential leaking of a kerosene underground storage tank (UST) is suspected in AOC-5 and petroleum contamination was detected in AOC-6.

In May 1993, International Consultants Incorporated (ICI) conducted a further Phase II HTRW Investigation for AOC 4. Fill material encountered during this investigation was consistent with mining operations. The recommendation of this study was for disposal of the soils at AOC 4 as special waste.

In September 2000, WasteTron, Inc. completed another Phase II HTRW Investigation of Areas of Concern 1 and 4. Based on review of the analytical data and the comparison levels to the WV Voluntary Remediation Program De Minimus Levels and USEPA Toxicity Risk Based Concentrations Table for residential soil, there is no contaminated soil at AOC-1 which would require treatment, however, there is some contamination within AOC-4. The contamination identified in AOC-4 consists of TPH-DRO and lead.

The recommended method of treatment is that the approximately 11,000 cy of contaminated soil be taken from AOC-4, AOC-5 and AOC-6 to an appropriate landfill for disposal. The TPH (AOC-4), kerosene (AOC-5), and petroleum (AOC-6) can be disposed in a solid waste facility that accepts petroleum-impacted soil. The lead-impacted soil would require disposal at a properly permitted facility as a special (non-hazardous, contaminated) waste.

Spoil Disposal Location

In accordance with established Corps of Engineers (COE) Hazardous, Toxic, and Radioactive Waste (HTRW) policies, a Limited Phase I HTRW Investigation has been conducted at the request of the Huntington District's Planning Branch for the Island Creek Basin Local Protection Project's proposed spoil site. The spoil site would be used for the disposal of excess soil and rock excavated from the Island Creek channel during construction of the Local Protection Project and would also be used by the local sponsor for future disposal of channel sediment.

A site inspection was performed on the tract within the project's CWL. The site is on the north side of State Route 73, approximately 0.35 miles from its intersection with Old U.S. Route 119 and State Route 44. During the site inspection, it was observed that approximately 12 acres of the valley portion of the site had previously been used as a spoil disposal site during the construction of U.S. Route 119 and State Route 73 in the mid-1990's. During the site inspection, no HTRW concerns were found, including staining or stressed vegetation on the former spoil area or in the surrounding area.

A search of available environmental records for the proposed spoil site was conducted using Environmental Data Resources, Inc. (EDR). This search met the government records search requirements of ASTM Standards Practice for Environmental Site Assessments, E1527-00. Search distances were also as per ASTM standards.

Based on the findings from the above activities, the proposed spoil site was determined to be free of HTRW concerns, nor were any identified in adjacent properties that would have the potential to impact this tract. Therefore, no further HTRW investigations are warranted at this time.

3.O AFFECTED ENVIRONMENT AND CONSEQUENCES OF ALTERNATIVES

3.1 **General**. Island Creek, a tributary of the middle reach of the Guyandotte River, drains approximately 105 square miles of rugged mountainous terrain. Island Creek basin is part of the extensively dissected Appalachian Plateau physiographic province and is comprised largely of steep-sided mountains and narrow stream valleys. Ninety percent of all slopes in Logan County, in which the basin lies, are in excess of 25 percent. Industrial, transportation, and residential land uses and community facilities occupy much of the rather limited level or gently sloping land.

3.2 Physical Resources

3.2.1 Geology and Soils. Most bedrock in the Island Creek watershed is from the Kanawha Formation, which is part of the Pottsville Group. High ridges are capped by bedrock from the Allegheny Formation. These rocks are of sedimentary origin. The Pennsylvanian age geology consists of dominantly massive sandstone interbedded with numerous coal seams, impure fire clays, sandy and argillaceous shales, and a few thin impure lenticular limestones. Coal is the most important economic constitute and is environmentally attractive because of its low sulfur content. The largest reserves have been mined from the No. 5 Block, Coalburg, Peerless, No. 2 Gas, (locally know as Upper and Lower Cedar Grove), and Powellton seams (locally known as Alma seams).

Soils that weather from this sandy geology include the Matewan, Highsplint, and Guyandotte soils on the steep mountain ridges, sideslopes, and cove areas; and the Yeager, Craigsville, and Chavies soils in the narrow floodplains. Most floodplain soils are impacted by residential, industrial and other commercial development, as is the case along this project reach. Natural soils have been disturbed by adding of spoil material and earth moving activities. These disturbed and mostly filled areas consist of land covered by houses, buildings, streets, parking lots, railroad tracks, and other urban components. Natural soil is almost non-existent along this project reach. There is no Prime Farmland, Statewide Important Farmland, Locally Important Farmland, or Hydric soils along this project reach.

3.2.1.1 No Federal Action. The no Federal action alternative would result in no impact on geology and soils.

3.2.1.2 Preferred Plan. The preferred plan when implemented would have no significant impact upon the soils or geology of the area.

3.2.2 Fish and Wildlife. Wildlife habitat is good in most areas of the basin except where impacted by mining operations, residential areas, and roads. Forest game habitat predominates and offers the most potential for wildlife. Farm game habitat is scarce, but good songbird and cottontail rabbit habitat exists in valleys having adequate streambank cover and brushy areas. Good riparian habitat exists in areas where not disturbed or destroyed by urbanization and channelization. In spite of the generally adequate habitat in the basin, wildlife populations are well below the carrying capacity of the land. Game species inhabiting the basin include whitetail deer, turkey, gray squirrel, cottontail rabbit, raccoon, ruffed grouse, Bobwhite, and gray fox. Mink, muskrats, mallards, and wood ducks breed along the streams.

The fishery resources of the Guyandotte River in the vicinity of Logan, West Virginia were surveyed in August 1982 by the West Virginia Department of Natural Resources under contract to the Huntington District Corps of Engineers. Three stations totaling 4.1 surface acres were surveyed using rotenone. Standing crop estimates ranged from 30.4 lbs./acre to 110.3 lbs./acre, and difference were attributed to dissimilar habitats and sampling efficiencies. Channel and flathead catfish are the dominant species in the Guyandotte River at Logan. Gizzard shad are the dominant nongame species. Forty-three species and two hybrids were collected during the survey. The Guyandotte River is presently affected by both domestic and industrial pollution. Silt and sediments and associated high turbidities are presently limiting factors of gamefish species reproduction. In spite of this, game fish populations in the Guyandotte are good and overall standing crop is comparable to other West Virginia streams. Island Creek does not sustain a sport fishery in the project area.

3.2.2.1 No Federal Action. The no Federal action plan would have no impact on fish and wildlife. Current human encroachment on the fish and wildlife resources of the area would continue uninfluenced by a Federal flood damage reduction plan.

3.2.2.2.Preferred Plan. Implementation of the preferred alternative would not have a significant effect upon the fish and wildlife resources of the area. The limited urban wildlife resources found in the project area could be temporarily disrupted or dislocated during the interval of construction; however, no permanent losses are predicted to occur. Riparian losses are to be mitigated on-site with the revegetation of deep rooting grasses and non-woody annuals and perennials beneficial to wildlife. Short-term and temporary siltation effects are expected during construction. The fishery of lower Island Creek is of poor quality, so anticipated impacts to that resource are minimal. A temporary increase in turbidity of the Guyandotte River could affect sport fishing on the Guyandotte below the mouth of Island Creek. Erosion control practices have been addressed in the 404(b)(1) analysis. In-stream environmental design measures include the construction of riffle/pool complexes along the 3600 ft channel widening.

3.2.3 Water Quality. The aquatic environment of the study area may be characterized as severely degraded through natural resource exploitation and man's encroachment and pollution. Coal mining pollution is undoubtedly the major cause of the poor water quality in the study area. Abandoned deep mines are a major source of acid mine drainage. Siltation can be attributed to both the surface mine industry and the lumber companies.

Untreated domestic sewage is a serious problem over most of the watershed and is extremely critical during low flow periods.

Island Creek proper receives acid mine drainage, siltation from surface mine and logging activities, and domestic sewage. Tributary streams of Island Creek suffer similar abuses plus physical degradation from channelization by landholding companies and residents. Such practices periodically destroy certain segments of aquatic habitats.

The Huntington District's Water Quality Section established water monitoring stations throughout the basin in 1978-79. Findings of the two-year study revealed that the water quality of the major streams in the Island Creek Basin was fair to poor. Most stations having poor water quality had low pH values, measurable dissolved iron or both, and had low numbers of benthic organisms. Most of Copperas Mine Fork, Mud Fork, and main Island Creek below Miller Branch had poor water quality. Upstream from Miller Branch, Island Creek is considered fair-to-good water quality.

3.2.3.1 **No Federal Action**. Without the implementation of a Federal project in Logan, the status of surface water quality in the project area would be expected to either remain the same or deteriorate.

3.2.3.2 **Preferred Plan**. Implementation of the preferred alternative for the lower 3600 ft of Island Creek would result in the temporary degradation of lower Island Creek and the Guyandotte River near the mouth of Island Creek due to siltation and turbidity. An erosion control plan has been addressed in the 404(b)(1) analysis and may be found in Appendix B. Siltation effects are expected to be minor and short-term. The removal of automobile bodies and other solid waste materials along the stream channel would contribute to the overall improvement of the stream environment. Such cleanup would eliminate potential sources of contamination to surface waters in the project area.

3.2.4 **Wetlands**. One jurisdictional wetland was identified in the early 1980s during field studies and literature search. It consisted of a quarter acre Palustrine Emergent and Scrub-Shrub variety interpreted within an old field and bottomland hardwood area not far from the mouth of Island Creek. Intense human disturbance along the Island Creek corridor within the project area has led to the disappearance all of the former wetlands except a few isolated cattails.

3.2.4.1 **No Federal Action**. No wetlands would be affected.

3.2.4.2 **Preferred Plan**. No wetlands would be affected by implementation of the preferred channel plan at Logan.

3.2.5 **Endangered Species**. A federally listed species that could occur within the proposed project area is the endangered Indiana bat, Myotis sodalis. This species may use the project area for foraging and roosting between April 1 and November 14. Indiana bat summer foraging habitats are generally defined as riparian, bottomland, or upland forest, and old fields or pastures with scattered trees. Roosting/maternity habitat consists primarily of live or dead hardwood tree species, which have exfoliating bark that provides space for bats to roost between the bark and the bole of the tree. Tree cavities, crevices, splits, or hollow portions of tree boles and limbs also provide roost sites.

There are 29 known hibernacula for the Indiana bat in the limestone region of eastern West Virginia in Preston, Tucker, Randolph, Pendleton, Pocahontas, Greenbrier, Monroe, and Mercer Counties. The population of the hibernacula in West Virginia range in size from one to 9,000 Indiana bats. Recent data indicate that the area within an approximate 5.0 mile radius of a hibernaculum is important foraging and roosting habitat for the Indiana bat in the fall swarming period, August 15 through November 14.

3.2.5.1 <u>No Federal Action</u>. The No Federal Action alternative would have no impact on the Indiana bat's foraging and roosting habitat.

3.2.5.2 <u>Preferred Plan</u>. The USFW Service has determined the number of acres of suitable foraging and roosting habitat on the West Virginia landscape available to each Indiana bat known to occur there. On that basis, it has been determined that small projects, generally affecting 17 acres or less of suitable foraging and roosting habitat, would have an infinitesimally small chance (at the 98% confidence level) of resulting in direct or indirect take. If less than 17 acres of suitable habitat would be disturbed, the Service considers that action discountable and unlikely to adversely affect the endangered Indiana bat at any season of the year. The preferred plan has no impact on the Indiana bat habitat since the entire project would disturb less than 17 acres. Please refer to the coordination documents dated December 2, 1993, June 19, 2000, and February 6, 2001.

3.3 <u>Sensitive Resources</u>

Sensitive Resources in the Island Creek LPP can be described as Socio-economic Factors, Education, Recreation, Aesthetics, Cultural Resources, Air Quality and Noise Impacts. The Island Creek LPP potential impacts are discussed for each of these resources.

3.3.1 <u>Socio-economic Factors</u>. Economic conditions throughout the project area have, for many years, been far below average for the United States. In general, the economy of the basin is dependent upon the coal industry, either directly or indirectly. Industrial and housing development are restricted by the rugged topography of the region and the flooding potential. Income, living conditions, employment, and necessary facilities have been behind national averages, although they have grown closer to these averages during the past 10-15 years.

3.3.1.1 <u>No Federal Action</u>. No Federal action in the project area would result in a continuation of certain commercial and residential structures being subjected to periodic flood damage, with the resulting increase of adverse social and economic impacts.

3.3.1.2 <u>Preferred Plan</u>. Implementation of the preferred alternative for property damage reduction and saving lives along lower Island Creek would make a positive contribution to economic health and social well being. Although one commercial structure, The

Super 8 Motel, would be removed during construction, the reduced threat of flooding would have a beneficial effect upon the socio-economic factors bearing upon the local project area.

3.3.2 **Education**. In 1970, a median number of school years completed for Logan County residents 25 years of age and older was 8.9. This compared unfavorably with both West Virginia and the nation, which reported median levels of education of 10.6 years and 12.1 years, respectively. Between 1970 and 1980, school enrollment in the county decreased about 3.0 percent, from 12,847 students to 12,471 students. Between 1980 and 1990, school enrollment in the county decreased 10.6 percent from 12,471 students to 11,142 students. Bureau of Census data in 1990 indicated that 53.4 percent of the county residents have completed high school compared with 66 percent for the state.

3.3.2.1 **No Federal Action**. No Federal action in the project area would result in no effect upon education.

3.3.2.2 **Preferred Plan**. Project implementation would have no anticipated effects upon education.

3.3.3 **Recreation**. The study area has no major recreational facilities within its boundaries. However, there are a number of facilities within a one hour drive. Chief Logan State Park is located five miles north of Logan on U.S. Route 10. Laurel Creek Public Hunting Area is located 15 miles west of Logan in Mingo County. About 30 miles further north, the Cabwaylingo State Forest is located in Wayne, Cabell, Lincoln and Mingo Counties. The City of Logan has a park located on Hatfield Island in the Guyandotte River. Much land owned by coal and timber companies is available as hunting lands throughout the county. Fishing resources are poor throughout the county because of degraded streams and the lack of reservoirs. R.D. Bailey Lake, on the Guyandotte River in adjoining Wyoming County, is approximately 35 miles south of Logan. East Lynn Lake, 50 miles north from Logan, also is in operation and available to the study area inhabitants.

3.3.3.1 **No Federal Action**. Because no recreation development occurs in the project area, no impacts would result.

3.3.3.2 **Preferred Plan**. Because no recreation development occurs in the project area, no impacts would result.

3.3.4 **Aesthetics**. Aesthetics in the project area range from fair to poor. Indiscriminate dumping of refuse along the road network and streambank in the study area is a common practice, making aesthetics generally less than appealing. Stream banks in the study area are frequently observed to be littered with refuse as well as automobile bodies. A portion of Island Creek above the confluence with the Guyandotte River contains many such discarded automobile bodies.

3.3.4.1 **No Federal Action**. The no action plan would contribute to the decline of the aesthetic environment in the project area.

3.3.4.2 Preferred Plan. Implementation of the preferred plan would consist of both positive and negative attributes. Improvements to the overall scenic appearance would result from removal of existing litter and refuse. The replacement of portions of the riparian vegetation with rock riprap is considered by some to be unnatural and unpleasing to the eye. Where feasible, all disturbed banks are to be reseeded and replanted with plant species favored by wildlife resources.

3.3.5 Cultural Resources. Section 106 of the National Historic Preservation Act of 1966 requires the Corps to identify historic properties affected by the proposed action and to evaluate the eligibility of those properties for the National Register of Historic Places. An archeological literature survey of the Island Creek Basin was conducted in 1983. As part of the EA, a request was submitted to the West Virginia SHPO for comments regarding any adverse impacts that the proposed project may have on cultural resources. Information received from the West Virginia SHPO indicated that the project site has the potential to contain archeological sites.

In accordance with this information, a Corps of Engineers' archeologist performed a site reconnaissance and prepared a report to describe the findings of the site visit and investigation to the West Virginia SHPO. The WVSHPO responded to the report with concurrence letter dated April 27, 2001 that the proposed activities will have no adverse effect on two structures that are eligible for listing in the National Register of Historic Places (Appalachian Power Company building and the CSX railroad bridge). The two structures that are affected by the project are not eligible for the National Register of Historical Places. The WVSHPO was in concurrence with reconnaissance report regarding that the testing of the project area had not located previously recorded archaeological sites, therefore, no further consultation is necessary. Please refer to Appendix C to review the coordination effort.

3.3.5.1 No Federal Action. No impacts are anticipated under the no action plan

3.3.5.2 Preferred Plan. Implementation of the preferred alternative would not have an effect on cultural resources of the area.

3.3.6 Air Quality Logan County is currently in attainment for all criteria pollutants according to the USEPA.

3.3.6.1 No Federal Action No impacts are anticipated under the no action plan.

3.3.6.2 Preferred Plan Channel widening would have minor impacts on air quality. Vehicular emissions from construction equipment would be limited and temporary. Heavy truck traffic associated with the hauling of material to the disposal site would not be expected to cause major impacts on air quality.

3.3.7 Noise Commercial and residential traffic, CSX traffic and local business noise are the current sources of noise in the project vicinity.

3.3.7.1 **No Federal Action** No impacts are anticipated under the no action plan.

3.3.7.2 **Preferred Plan** Construction of the channel widening in Island Creek would generate additional construction noise in the region. Heavy construction equipment, material handling, and truck traffic would temporarily generate noise in the construction area. Upon completion of the channel widening, the construction noise would cease.

4.0 PUBLIC AND AGENCY COORDINATION

4.1 **Required Coordination**. The Huntington District has coordinated the Local Protection Project and Environmental Assessment for the Island Creek Basin with the U.S. Fish and Wildlife Services and the West Virginia Department of Natural Resources. The following agencies have received project plans and NEPA documents for review and comment:

U.S. Fish and Wildlife Service
U.S. Environmental Protection Agency
West Virginia Department of Natural Resources
West Virginia Department of Transportation
West Virginia State Historic Preservation Office

4.2 **Public Involvement.** Public meetings, workshops, public announcements, literature and close cooperation with local citizens have been and would continue to be important to the implementation of a recommended alternative. The following summarizes public involvement since the reevaluation study update began in October 1999:

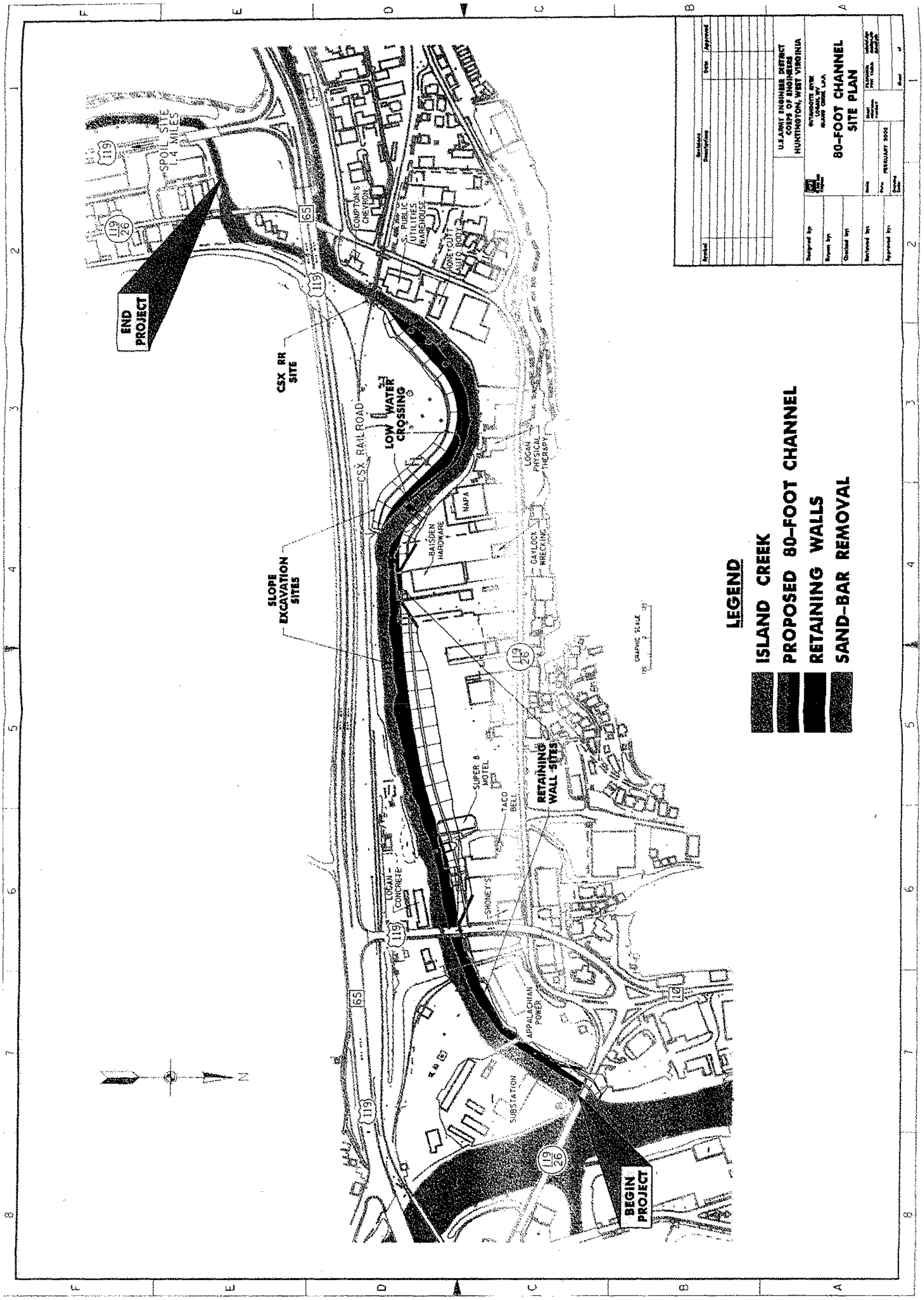
A Public Meeting held at Logan, WV on February 9, 2000 to collect information for assessing impacts to the community of Logan for the intended project to reduce flooding along the lower 3600 ft of Island Creek. Logan County Commission and local residents attended the meeting. Comments included support for a flood warning system, a suggestion to use the channel around Hatfield Island as spoil disposal, and a suggestion to extend channel widening further upstream.

5.0 BIBLIOGRAPHY

U.S. Army Corps of Engineers. 1993. Main Report and Environmental Assessment for Island Creek At Logan, West Virginia, Local Flood Protection Project. Huntington District. Huntington, West Virginia.

U.S. Army Corps of Engineers. 1985. Final Feasibility Report on Island Creek Basin, Guyandotte River Basin Study, West Virginia. Huntington District. Huntington,West Virginia.

FIGURES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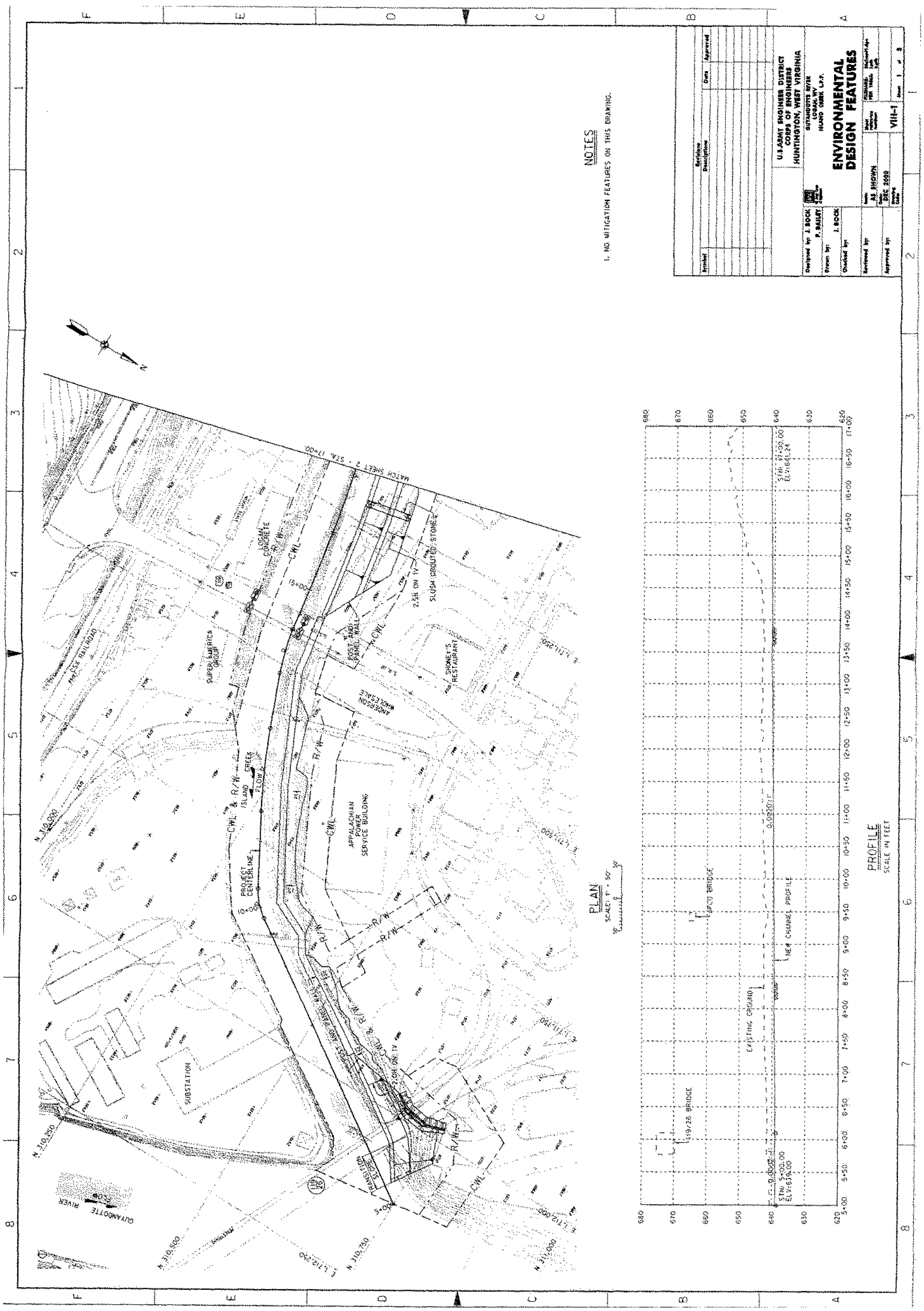
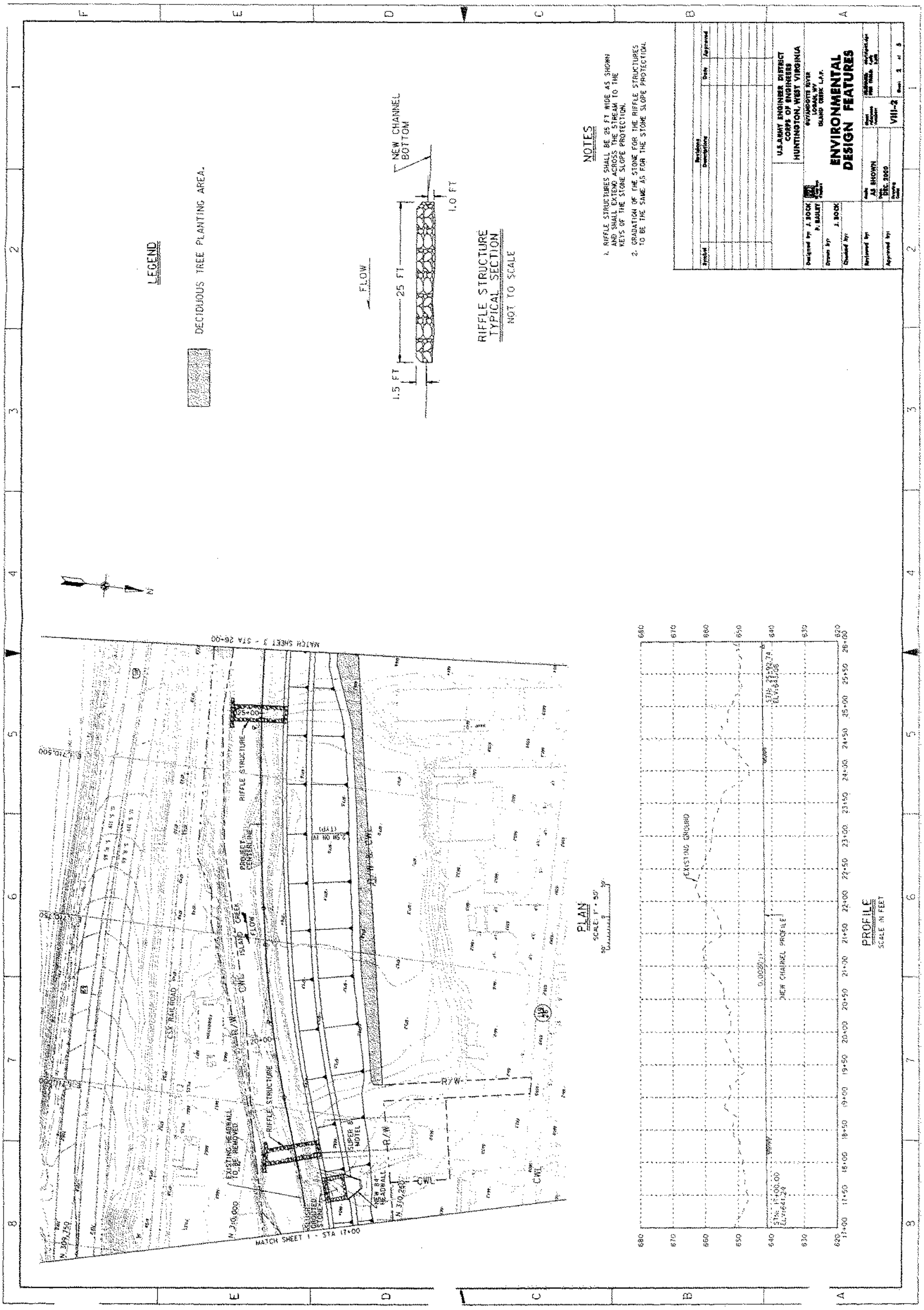
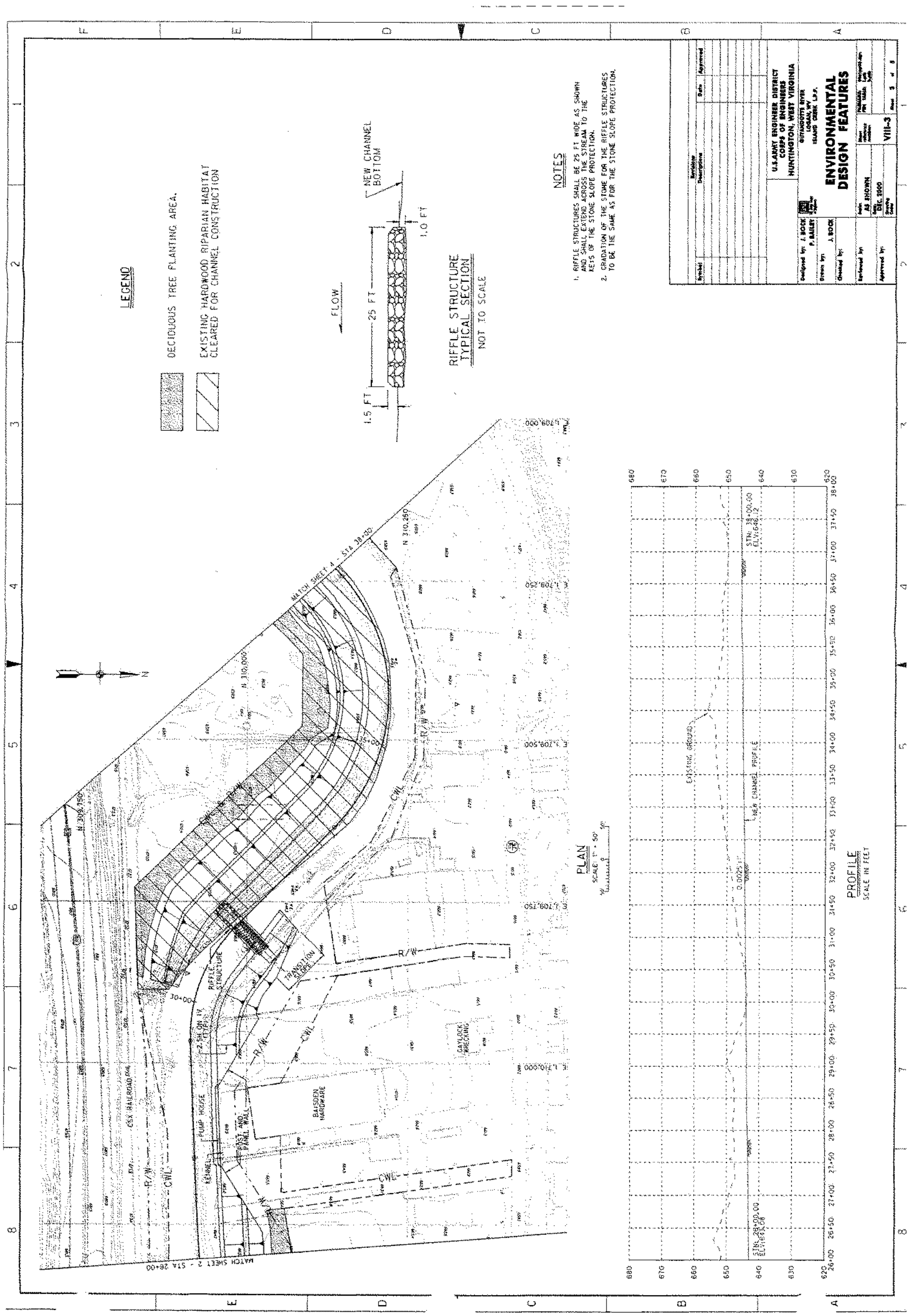
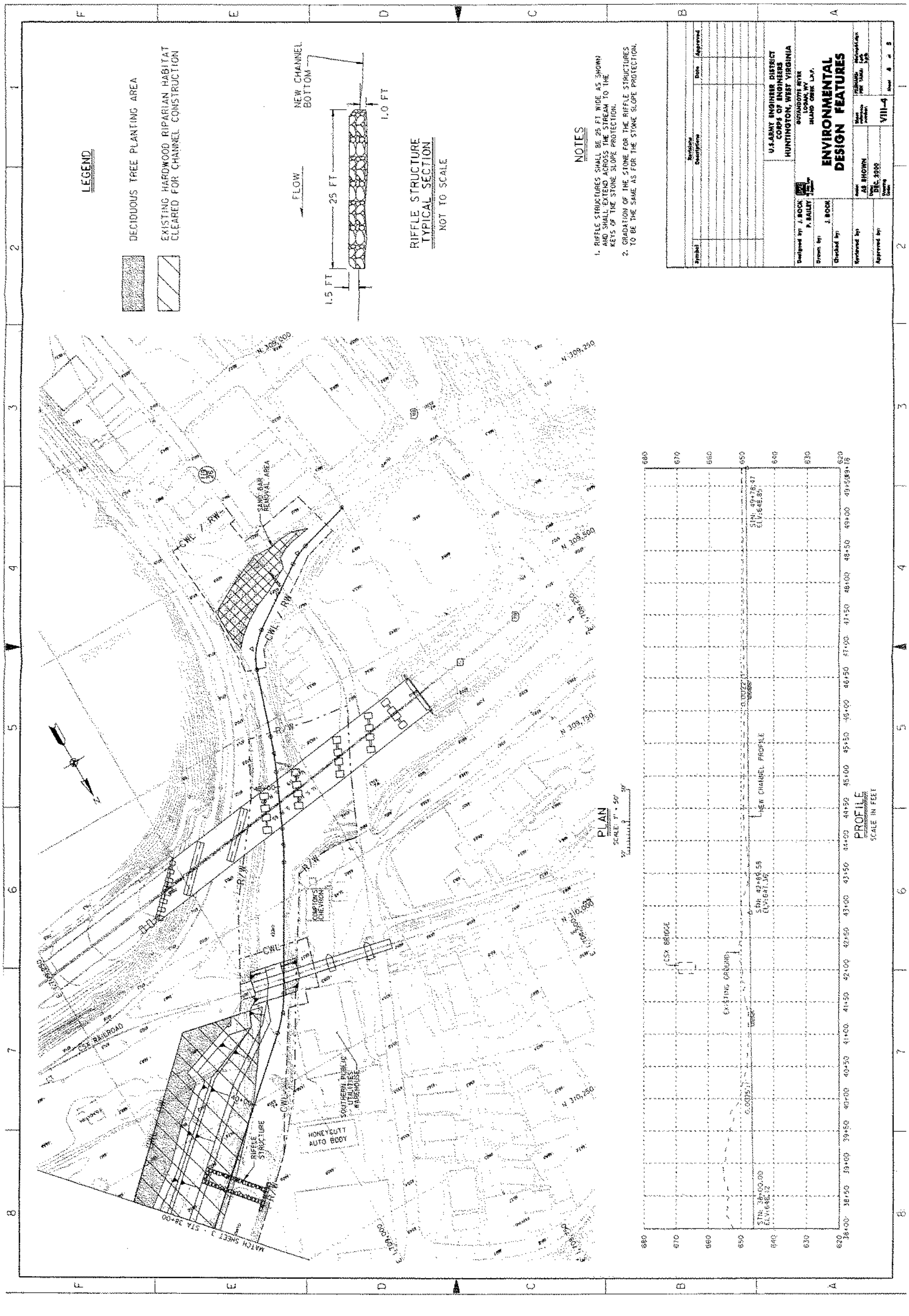
ISLAND CREEK
PROPOSED 80-FOOT CHANNEL
RETAINING WALLS
SAND-BAR REMOVAL
END PROJECT
BEGIN PROJECT
SPOIL SITE 1.4 MILES
CSX RR SITE
CSX RAILROAD
LOW WATER CROSSING
SLOPE EXCAVATION SITES
RETAINING WALL SITES
COMPTON'S CHEVRON
PUBLIC UTILITIES WAREHOUSE
HONEYCUTT AUTO BODY
NAPA
LOGAN PHYSICAL THERAPY
BAISDEN HARDWARE
GAYLOCK WRECKING
SUPER 8 MOTEL
TACO BELL
SHONEY'S
LOGAN CONCRETE
APPALACHIAN POWER
SUBSTATION
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
80-FOOT CHANNEL
SITE PLAN

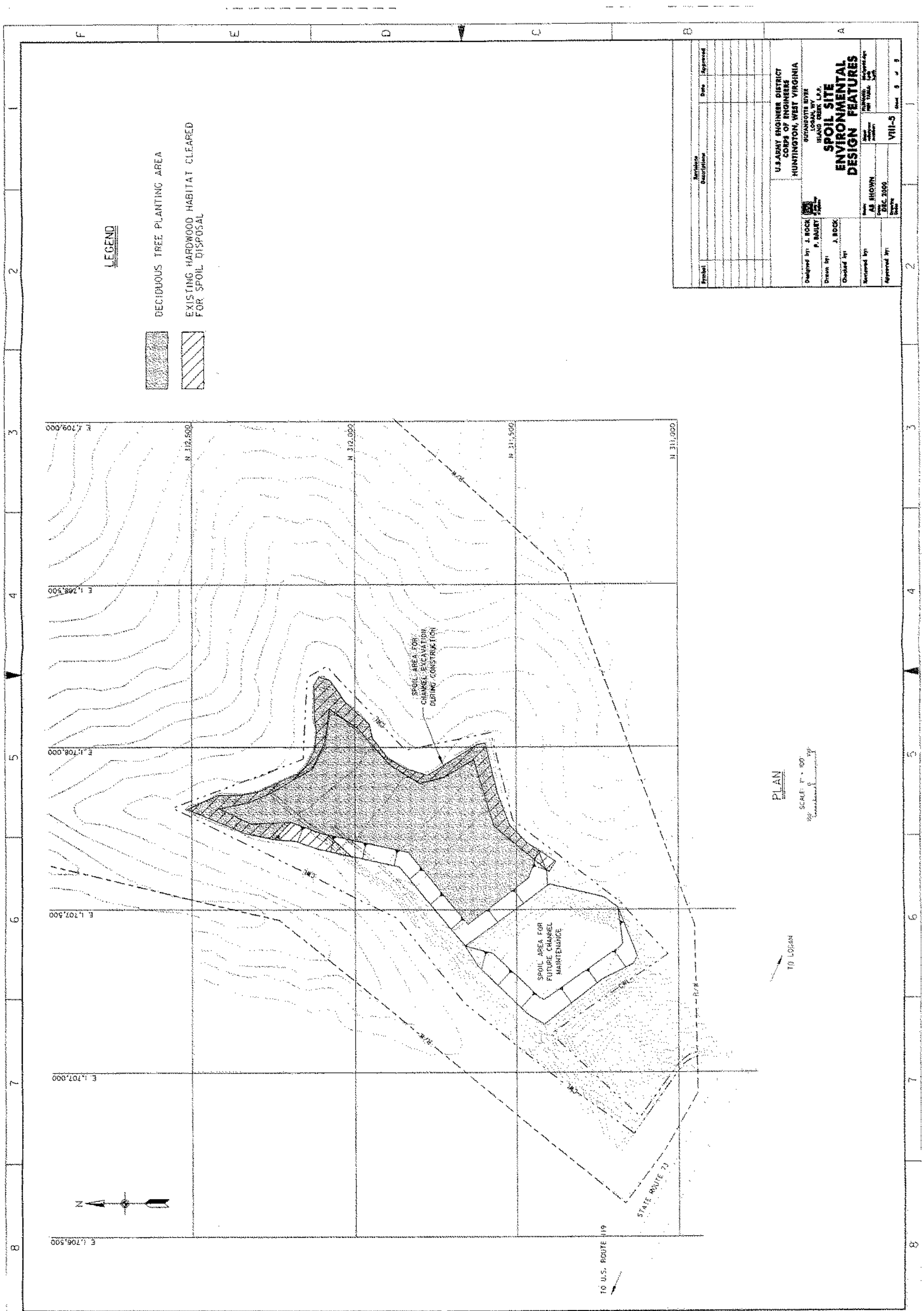

NOTES
1. NO MITIGATION FEATURES ON THIS DRAWING.
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
ENVIRONMENTAL
DESIGN FEATURES
PLAN
PROFILE
APPALACHIAN POWER SERVICE BUILDING
SUBSTATION
PROJECT CENTERLINE
EXISTING GROUND
NEW CHANNEL PROFILE



LEGEND
DECIDUOUS TREE PLANTING AREA.
FLOW
NEW CHANNEL BOTTOM
25 FT
1.5 FT
1.0 FT
RIFFLE STRUCTURE
TYPICAL SECTION
NOT TO SCALE
NOTES
1. RIFFLE STRUCTURES SHALL BE 25 FT WIDE AS SHOWN AND SHALL EXTEND ACROSS THE STREAM TO THE KEYS OF THE STONE SLOPE PROTECTION.
2. GRADATION OF THE STONE FOR THE RIFFLE STRUCTURES TO BE THE SAME AS FOR THE STONE SLOPE PROTECTION.
U.S.ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
ENVIRONMENTAL
DESIGN FEATURES
AS SHOWN
VIII-2
MATCH SHEET 3 - STA 26+00
MATCH SHEET 1 - STA 17+00
RIFFLE STRUCTURE
EXISTING HEADWALL TO BE REMOVED
CSX RAILROAD
ISLAND CREEK
PROJECT CENTERLINE
PLAN
EXISTING GROUND
NEW CHANNEL PROFILE
PROFILE
SCALE IN FEET


LEGEND
DECIDUOUS TREE PLANTING AREA.
EXISTING HARDWOOD RIPARIAN HABITAT CLEARED FOR CHANNEL CONSTRUCTION
NEW CHANNEL BOTTOM
FLOW
25 FT
1.5 FT
1.0 FT
RIFFLE STRUCTURE TYPICAL SECTION
NOT TO SCALE
NOTES
1. RIFFLE STRUCTURES SHALL BE 25 FT WIDE AS SHOWN AND SHALL EXTEND ACROSS THE STREAM TO THE KEYS OF THE STONE SLOPE PROTECTION.
2. GRADATION OF THE STONE FOR THE RIFFLE STRUCTURES TO BE THE SAME AS FOR THE STONE SLOPE PROTECTION.
U.S.ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
ENVIRONMENTAL DESIGN FEATURES
Designed by: J. BOCK
P. BAILEY
Drawn by: J. BOCK
AS SHOWN
DEC. 2000
VIII-3
MATCH SHEET 4 - STA 38+50
MATCH SHEET 2 - STA 28+00
RIFFLE STRUCTURE
TRANSITION SLOPE
2.5H ON 1V
PUMP HOUSE
KENNEL
POST AND PANEL WALL
BAISDEN HARDWARE
GAYLOCK WRECKING
CSX RAILROAD
R/W
CWL
PLAN
PROFILE
SCALE IN FEET
EXISTING GROUND
NEW CHANNEL PROFILE


LEGEND
DECIDUOUS TREE PLANTING AREA
EXISTING HARDWOOD RIPARIAN HABITAT CLEARED FOR CHANNEL CONSTRUCTION
NEW CHANNEL BOTTOM
FLOW
25 FT
1.5 FT
1.0 FT
RIFFLE STRUCTURE TYPICAL SECTION
NOT TO SCALE
NOTES
1. RIFFLE STRUCTURES SHALL BE 25 FT WIDE AS SHOWN AND SHALL EXTEND ACROSS THE STREAM TO THE KEYS OF THE STONE SLOPE PROTECTION.
2. GRADATION OF THE STONE FOR THE RIFFLE STRUCTURES TO BE THE SAME AS FOR THE STONE SLOPE PROTECTION.
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
ENVIRONMENTAL DESIGN FEATURES
VIII-4
SAND BAR REMOVAL AREA
CSX RAILROAD
RIFFLE STRUCTURE
HONEYCUTT AUTO BODY
SOUTHERN PUBLIC UTILITIES WAREHOUSE
COMPTONS CHEVRON
MATCH SHEET 3 - STA 38+00
PLAN
CSX BRIDGE
EXISTING GROUND
NEW CHANNEL PROFILE
PROFILE
SCALE IN FEET


LEGEND
DECIDUOUS TREE PLANTING AREA
EXISTING HARDWOOD HABITAT CLEARED FOR SPOIL DISPOSAL
SPOIL AREA FOR CHANNEL EXCAVATION DURING CONSTRUCTION
SPOIL AREA FOR FUTURE CHANNEL MAINTENANCE
PLAN
TO LOGAN
TO U.S. ROUTE 119
STATE ROUTE 73
N 312,500
N 312,000
N 311,500
N 311,000
E 1,709,000
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E 1,708,000
E 1,707,500
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E 1,706,500
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA
SPOIL SITE
ENVIRONMENTAL
DESIGN FEATURES
Designed by: J. ROCK
P. BAILEY
Checked by: J. ROCK
AS SHOWN
DEC. 2000
VIII-5

APPENDIX A

NOTICE OF AVAILABILITY

Notice of Availability

The US Army Corps of Engineers, Huntington District, by the Notice of Availability (NOA), advises the public that the Draft Environmental Assessment (DEA) for the Local Protection Plan for the Island Creek Basin, is complete and available for review. The project is located in Logan, West Virginia. A Finding of No Significant Impact (FONSI) is anticipated for the proposed project. A Draft FONSI is included with the DEA for public review.

In compliance with the National Environmental Policy Act (NEPA) and 40 CFR 1501.4, the DEA and Draft FONSI must be available to the public in the affected area for thirty (30) DAYS FOR REVIEW AND COMMENT. Final determination regarding the need for additional NEPA documentation will be made after public review period, which begins on or about January 5, 2001 and ends on or about February 5, 2001. Copies of the documents may be viewed at the following locations:

Logan County Courthouse
300 Stratton Street
Logan, West Virginia 25601

Logan Area Public Library
16 Wildcat Way
Logan, West Virginia 25601

Corps of Engineers, Huntington District
502 Eighth Street
Huntington, West Virginia 25701

Copies of the DEA and Draft FONSI may be obtained by contacting the Huntington District office of the Corps of Engineers at 304-529-5712. Comments pertaining to the documents should be directed by letter to the following address, by February 5 2001.

Ms. Ginger Mullins
Chief, Environmental Analysis Section
Planning Branch
Huntington District of Corps of Engineers
502 Eighth Street
Huntington, West Virginia 25701-2070

Notice of Availability

The Notice was provided to the following newspapers for public information:

The Logan Banner
435 Stratton Street
Logan, West Virginia 25601

Charleston Gazette
1001 Virginia Street, East
Charleston, West Virginia 25301

FRANTZ/akf/7445

Planning Branch
Environmental Analysis Section

SEE ATTACHED

Dear

The Corps of Engineers is providing the enclosed Draft Environmental Assessment (DEA) for public review and comment. The document concerns the Island Creek Local Protection Plan, Logan, West Virginia.

Please include the DEA in an appropriate location along with other documents for public review and comment. A Notice of Availability (NOA) will be published in the Charleston Gazette and The Logan Banner, advising any interested publics of the report. The thirty-day review and comment period, beginning on or about January 8, 2001, is considered appropriate for review.

Please direct any questions concerning the document to Ms. Ginger Mullins, of my staff, who can be reached at 304-529-5712.

Thank you for your assistance regarding this matter.

Sincerely,

MULLINS PM-PD-R
WORKMAN PM-PD

for Larry E. Workman
Acting Chief, Planning Branch

Enclosure

January 5, 2001

Planning Branch
Environmental Analysis Section

Logan County Commission
ATTN: Julie Propst
Logan County Courthouse
Room 103
300 Stratton Street
Logan, West Virginia 25601

Dear Ms. Propst:

The Corps of Engineers is providing the enclosed Draft Environmental Assessment (DEA) for public review and comment. The document concerns the Island Creek Local Protection Plan, Logan, West Virginia.

Please include the DEA in an appropriate location along with other documents for public review and comment. A Notice of Availability (NOA) will be published in the Charleston Gazette and The Logan Banner, advising any interested publics of the report. The thirty-day review and comment period, beginning on or about January 8, 2001, is considered appropriate for review.

Please direct any questions concerning the document to Ms. Ginger Mullins, of my staff, who can be reached at 304-529-5712.

Thank you for your assistance regarding this matter.

Sincerely,

Larry E. Workman
Acting Chief, Planning Branch

Enclosure

January 8, 2001

Planning Branch
Environmental Analysis Section

Logan Area Public Library
ATTN: Kim Thompson
16 Wildcat Way
Logan, WV 25601

Dear Ms. Thompson:

Please find enclosed, for your review and comment, a copy of the Draft Environmental Assessment (DEA) for Island Creek Local Protection Plan, Logan County, West Virginia. The document was accomplished to identify and evaluate any potential environmental impacts that may be associated with the proposed project. If you have any comments regarding this document, please address them to:

Chief, Environmental Analysis Section
U.S. Corps of Engineers
502 Eighth Street
Huntington, West Virginia 25701

Commercial Telephone:	304-529-5712
Commercial Fax:	304-529-5136

Comments should be received within the thirty (30) day public review period beginning on or about January 8, 2001. The Notice of Availability (NOA) for the document will be published once a week for four (4) consecutive weeks in the Charleston Gazette and The Logan Banner. If you have any questions, please contact Ms. Ginger Mullins, of my staff, at the above listed commercial telephone number.

Sincerely,

Larry E. Workman
Acting Chief, Planning Branch

Enclosure

APPENDIX B

404 (b) (1) ANALYSIS
AND
401 WATER QUALITY CERTIFICAITON

SECTION 404 (b) (1) EVALUATION
ISLAND CREEK BASIN
LOGAN COUNTY, WEST VIRGINIA
LOCAL PROTECTION PLAN

This report concerning disposal of excavation materials at School House Hollow, Logan County, West Virginia is submitted in accordance with Section 404 of the Clean Water Act of 1977 (Public Law 95-217).

I. PROJECT DESCRIPTION

A. Location.

The project is located along the north and south banks of Island Creek in Logan County West Virginia. The proposed disposal site is located in Logan, West Virginia at School House Hollow, an area adjacent to and to the east of Milkhouse Hollow. The disposal site is on the north side of State Route 73, approximately 0.35 miles from its intersection with Old U.S. Route 119 and State Route 44. A 12-foot wide paved road provides access to the site from State Route 73.

B. Description of Proposed Work.

The project consists of widening the lower portion of Island Creek to increase the channel width to 80 ft. Channel widening will begin at the confluence of Island Creek and the Guyandotte River and continue upstream for approximately 0.7 miles. Generally widening is accomplished on only one side of the channel in any area. Clearing and grubbing will be accomplished only in those areas where walls are constructed or where earthwork cuts will be made. All other areas will remain undisturbed as much as possible. Post and panel walls will be constructed in certain locations to avoid impacts associated with the acquisition of certain structures along the channel. Stone slope protection will be placed along the base of the wall and at the toe of the newly excavated slope to reduce the effects of erosion in the lower level flood frequencies. The remaining area between the stone slope protection and the CWL will be seeded. The material removed during the channel widening will be spoiled at a nearby site at School House Hollow.

Approximately 203,000 cy of soil and rock excavated from the Island Creek channel will be spoiled at a depth of 19 feet over the 6.5 acres of the 12 acres of existing fill. The site contains sufficient acreage to allow benching and flattening of slopes to ensure slope stability. Drilling and testing of the previous fill and insitu soils will be completed prior to placement of the fill. Ditches will be placed around the outside of the new fill to collect and carry storm water surface runoff from the fill and the valley hillsides to the toe of the fill slope, where it will flow through existing drainage culverts beneath the access road and State Route 73.

C. Authority and Purpose.

The Corps is undertaking structural measures to alleviate the flooding problems experienced in the Island Creek Basin as authorized by the Water Resources Development Act of 1986 (PL 99-62).

D. Description of Material.

1. General Characteristics of Proposed Fill Material.
Approximately two hundred and three thousand cubic yards of soil and rock will be spoiled in the disposal area.

2. Source of Material.
The soils and rock will be excavated from the lower 0.7-mile of Island Creek and its banks during construction. Currently, the commercial neighborhood of Black Bottom and unoccupied lots occupy most of the proposed construction area.

E. Description of Proposed Discharge.

1. Location.
Please refer to Section I.A.

2. Size.
The disposal fill is approximately 203,000 cy of soil and rock excavated from the Island Creek channel and will be spoiled at a depth of 19 ft over the 6.5 acres of the 12 acres of existing fill. The site contains sufficient acreage to allow benching and flattening of slopes to ensure slope stability. Drilling and testing of previous fills and insitu soils will be completed so the proposed fill slopes can be designed. Ditches will be placed around the outside of the new fill to collect and carry storm water surface runoff from the fill and the valley hillsides to the toe of the fill slope, where it will flow through existing drainage culverts beneath the access road and State Route 73.

3. Type of Disposal Site and Habitat.
The spoil site is a valley containing 105 acres of moderate to steep hillside with upland hardwood vegetation. Approximately 12 acres of the valley portion of the site has been utilized in the past as an excess spoil location during the construction of U.S. Route 119 and State Route 73. The previous fill material consists of rock and soil and is configured in two benches with fill slopes of approximately 2.5 to 1. These 12 acres are vegetated with tall grasses and low growing brush. Within the valley, a dirt haul road provides access along the west side of the fill. A shallow ditch around the perimeter of the existing fill collects storm water surface runoff from the hillsides and carries it to the base of the fill where it flows under the access road and State Route 73 via concrete culverts.

4. Timing and Duration of Discharge.
The proposed construction work is expected to last approximately 15 to 18 months (2004 initiate 2006 completion). Construction will be performed during high, normal and low flow periods. Excavation of disposal material will be greatest during the first phase of construction.

F. Description of Disposal Method.
The earth and rock fill will be placed with standard land-based construction machinery.

II. FACTUAL DETERMINATIONS.

A. Physical Substrate Determination.

1. Substrate Elevation and Slope.
Fill material application is designed to cover existing fill material along with surrounding land area.

2. Sediment Type.
Covering of existing substrates and surrounding area with earth fill and rock are proposed.

3. Dredged/Fill Material Movement.
Project intent is to transport excess fill material excavated through construction of channel widening to School House Hollow for disposal. The disposal fill will be seeded and landscaped in an environmentally beneficial manner once construction is complete. Standard sediment control measures will be observed throughout the process.

4. Physical Effects on Benthos.
Any existing benthic populations occupying Island Creek will be disturbed during widening of the channel. However, benthos will colonize the channel rather quickly from undisturbed upstream and downstream sources. Placement of the fill material will not disturb any benthic populations since the previous activity at the site had disturbed any benthic populations present.

5. Other Effects.
Cultural /historical resources are not present within the project area.

6. Actions Taken to Minimize Impacts.
Impacts listed are expected to be permanent; however, on-site environmental design measures will not only minimize impacts, but over time will improve areas designated for wildlife habitat.

B. Water Circulation, Fluctuation, and Salinity Determinations.

1. Water.
   a. Salinity. Not Applicable
   b. Water Chemistry. During construction, run-off will introduce some suspended solids into the Guyandotte River and temporarily increase sedimentation down river to an extent

2. Clarity. Only short term increases in turbidity are expected. Standard best management practices and seeding are planned to prevent run-off erosion.

C. Color. No effect.

D. Odor. No effect.

E. Taste. No effect.

F. Dissolved Gas Levels. No effect.

G. Nutrients.

No significant nutrient effects aside from possible dissolution of carbonates should limestone be used as the graded stone source. If this is the case, impacts would be beneficial.

H. Eutrophication. No effect.

I. Other as Appropriate.

Temporary increases in turbidity would not have significant impacts on municipal water systems. Run-off erosion during construction will have only minor effects on water supplies due to the small source, approximately 0.7 mile of creek bank, in comparison to other sources of sediments in this watershed which experiences high levels of erosion.

1. Current Patterns and Circulation.

a. Current Patterns and Flow. The Island Creek channel will be expanded in width, however, the flow gradient will not be effected by this project.
b. Velocity. Water velocity will not be effected by the proposed project.
c. Stratification. Not applicable.
d. Hydrologic Regime. No significant changes.

2. Normal Water Level Fluctuations.

Normal water level fluctuations will not be affected by this action. Riffle/pool complexes will be constructed within the stream to mimic the natural stream bed.

3. Salinity Gradients. Not applicable.

4. Actions that will be taken to minimize impacts.

Appropriate measures have been identified and incorporated in the proposed plan to minimize adverse effects of the project on the aquatic environment. These measures include stone slope protection of erosion prone areas, proper design and construction, use of environmentally acceptable fill material, and revegetation of exposed soils not protected by stone. Riffle/pool complexes will also be constructed to return a more natural contour to the stream bed while also improving dissolved oxygen levels.

J. Suspended Particulate/Turbidity Determinations.

1. Expected changes in suspended particulates and turbidity levels in vicinity of disposal site. Fill materials consist of natural granular materials and rock and are not expected to create significant turbidity or sedimentation.

2. Effects on chemical and physical properties of the water column.

a. Light Penetration. See Section II.B.(2). Minor reduction will occur during construction period due to turbidity. Best management practices will be employed during construction to minimize turbidity levels.

b. Dissolved Oxygen. Riffle/pool complexes will be constructed within the channel of lower Island Creek. The riffle/pool complex will be constructed approximately 1.5 feet above the streambed. During low flow and normal average flow, the riffle/pool complex will improve the dissolved oxygen concentrations.

c. Toxic Metals and Organics. Phase I and II HTRW studies indicated the granular materials and natural stone fill are not likely to contain harmful contaminants. Discussions of the results of all testing and clean-up plans are included in the Engineering Appendix.

d. Pathogens. See Section II.J.2.(c) , immediately above.

e. Aesthetics. Although the fill area may have an artificial appearance, debris and refuse removal should result in an overall improvement in aesthetic values. The landscaping plan greatly increases edge effects and compliments the disposal fill.

3. Effects on Biota.

a. Primary Production, Photosynthesis. No significant effects.
b. Suspension/Filter Feeders. No significant effects.
c. Sight Feeders. No significant effects.

4. Action to Minimize Impacts. Fill areas will be protected as soon as possible to prevent erosion. Placed rock would minimize bank erosion and related turbidity levels.

K. Contaminant Determination. See Section II.J.2.(c) .

L. Aquatic Ecosystem an Organism Determinations.

1. Effects on Plankton. Turbidity levels may temporarily affect plankton populations through abrasions by suspended material and light transmission reduction. However, neither phyto- nor zooplankton are present in appreciable quantities.

2. Effects on Benthos. See Section II.A.4 and Section II.J.3.b.

3. Effects on Nekton. Ordinarily, adverse effects on fisheries would be possible from temporary turbidity and sedimentation during the construction period, especially during spawning periods. It is unlikely that turbidity will exceed normal levels.

4. Effects on Aquatic Food Web. Loss of riparian vegetation associated with the project is not considered significant enough to affect stream allochthonous energetics or temperature regimes given recent clearing activities.

5. Effects on Special Aquatic Sites.

a. Wetlands. There are no wetlands in the proposed project area.
b. Threatened and Endangered Species. According to the Federal List of Endangered Species, the USFWS and Huntington District's field investigations, there are no federally listed endangered species in the project area.

6. Other wildlife. Impacts of the channel widening would be of temporary nature during construction activity. Over the life of the project, wildlife habitat will be enhanced by the proposed disposal and environmental design features.

7. Actions to Minimize Impacts. The proposed material placement activities would be accomplished under conditions that would minimize, to the extent practicable, adverse effects on aquatic ecosystem. Best management practices will be employed to avoid sedimentation.

M. Proposed Disposal Site Determinations.

1. Mixing Zone Determination. No discharge of liquid material would be involved with project construction.

2. Determination of Compliance with Applicable Water Quality Standards. Fill activities would be in conformance with the State of West Virginia standards.

3. Potential Effects on Human Use Characteristics.

a. Municipal and Private Water Supply. See II.I.
b. Recreational and Commercial Fisheries. See II.J.3.b., II.J.3.c., and II.L.3.
c. Water Related Recreation. No impact.
d. Aesthetics. See II.J.2.e.
e. Parks, National and Historical Monuments, National Seashores Wilderness Areas Research Sites, and similar Preserves. None.

N. Determination of Cumulative Effects of the Aquatic Ecosystem.

Protection of the riverbank will reduce stress associated chronic turbidity, failed soil and related sediment yields. Placement of fill will expand habitat diversity and hence population diversity within the ecosystem.

O. Determination of Secondary Effects on Aquatic Ecosystems. See II.N.

III. FINDINGS OF COMPLIANCE OR NONCOMPLIANCE WITH THE RESTRICTIONS ON DISCHARGE.

A. No significant adaptations of the guidelines were made relative to this evaluation.

B. Alternatives. Two disposal alternatives for excavation materials were considered for the project.

1. Alternative A utilized School House Hollow, which is a site previously used by the Department of Highways for an excess spoil disposal site.

2. The No Action Alternative would result in continued property damage for both residents and commercial property in the vicinity.

C. Description of Proposed Work. Work to be performed consists of Alternative A, listed above.

D. The proposed placement of fill material will not result in significant adverse effects on human health and welfare, including drinking water supplies, recreation and commercial fishing, plankton, fish, shellfish, wildlife, or special aquatic sites. Aquatic life and other wildlife will not be adversely affected. No significant adverse effects on aquatic ecosystem diversity, productivity and stability, or recreational, aesthetic and economic values will occur.

E. Appropriate steps to minimize potential adverse impacts from any discharges on aquatic systems have been incorporated.

OFFICE OF WATER RESOURCES
1201 Greenbrier Street
Charleston, West Virginia 25311-1088
Telephone Number: 304/558-1052

West Virginia Department of Environmental Protection

Bob Wise
Governor

Michael O. Callaghan
Secretary

May 17, 2001

Ginger Mullins, Acting Chief
Planning Branch
U.S. Army Corps of Engineers
502 Eighth Street
Huntington, West Virginia 25701-2070

Dear Ms. Mullins:

The West Virginia Department of Environmental Protection-Office of Water Resources (OWR) has reviewed the Section 404 (b) (1) evaluation of the Local Protection Plan for Island Creek Basin and offers the following comments.

The project is located along the north and south banks of Island Creek in Logan County, West Virginia. The proposed disposal site is located in Logan at School House Hollow, an area adjacent to the east of Milkhouse Hollow.

The project consists of widening the lower portion of Island Creek to increase the channel width to 80 feet. Channel widening will begin at the confluence of Island Creek and the Guyandotte River and continue upstream for approximately 0.7 miles. Approximately 203,000 cubic yards of soil and rock excavated from the Island Creek channel will be spoiled at a depth of 19 feet over the 6.5 acres of the 12 acres of existing fill. The spoil site is a valley containing 105 acres of moderate to steep hillside with upland hardwood vegetation. Approximately 12 acres of the valley portion of the site has been utilized in the past as an excess spoil location during the construction of U.S. Route 119 and State Route 73.

Based on correspondence received in this office on January 11, 2001 and the work planned, any modification must be submitted in writing. Therefore, State Certification, as required by the Clean Water Act, is granted. Certification shall be effective fifteen(15) days after receipt unless appealed under Title 47, Series 5A, Section 8 of the Code of State Regulations, <u>State Certification of Activities Requiring Federal Licenses and Permits</u>. The appeal must be in writing and set forth the action complained of and the

grounds upon which the appeal is based. It should be directed to: Chief, Office of Water Resources, West Virginia Division of Environmental Protection, 1201 Green brier Street, Charleston, West Virginia 25311-1088; Attention: Regulatory Review Program.

Sincerely,

OFFICE OF WATER RESOURCES

Allyn G. Turner

Allyn G. Turner, Chief

AGT/sas

cc: Lyle B. Bennett - OWR

APPENDIX C

COORDINATION DOCUMENTATION
AND
COMMENT RESOLUTION

CECW-PC

23 October 2001
Final Response: 1 February 2002

HQUSACE POLICY COMPLIANCE REVIEW COMMENTS

ISLAND CREEK LOCAL PROTECTION PROJECT
LOGAN, WEST VIRGINIA

GENERAL REEVALUATION REPORT
(May 2001)

1. **BACKGROUND.**

a. Study Area Location. The Island Creek Basin is about 105 square miles of rugged mountainous terrain located in southwestern West Virginia. Three major streams drain the basin—Island Creek, Copperas Mine Fork, and Mud Fork. The study area encompasses the 500-year floodplain of Island Creek at the community of Logan, Logan County, West Virginia.

b. Problem. The project area has experienced numerous damaging floods in the past. A flood with a 1-percent chance of occurring in any year on the 10.4 miles of Island Creek originally under study would inundate approximately 950 residences and 255 commercial structures. Under present conditions, flood damages that would be caused by the 1-percent chance event would exceed $40.5 million (October 2000 prices). The current report focuses on the 500-year floodplain adjacent to Island Creek upstream of its confluence with the Guyandotte River. The GRR cites expected annual damages in the current study area of $6,500,000 under existing conditions.

c. Authorized Project. The project was authorized by Section 401 of the Water Resources Development Act of 1986 (PL 99-662). The authorized project addresses flooding adjacent to a total of about 19 miles of Island Creek (10.4 miles), Copperas Mine Fork (5.1 miles), and Mud Fork (3.9 miles). The plan includes both structural and non-structural components. The structural component of the plan provides for a channel with a 100-foot wide bottom on Island Creek for a distance of 0.7 miles upstream of its confluence with Guyandotte Creek. The lower 1,000 feet was to be a concrete-lined channel. The project area adjacent to remaining 9.3 miles of Island Creek, and both Copperas Mine Fork and Mud Fork, would be treated with a variety of non-structural measures. Non-structural plans call for raising over 1,200 residential structures, flood proofing about 80 non-residential structures in-place, and relocating over 500 other structures to flood-free housing and community development sites. The project was authorized at a cost $86 million (October 1984 Prices).

d. Study Authority. The project was authorized by Section 401 of the Water Resources Development Act of 1986. PED was initiated in 1989. It was found that the non-structural costs included in the project had been significantly under estimated in the feasibility phase.

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The inclusion of the non-structural features would have led to an uneconomical project; therefore, they were dropped from consideration. The sponsor, the Logan County Commission, subsequently concluded in 1993 that they were unable to financially support the project at that time; consequently, PED studies were suspended. In 1998, PED resume with the financial sponsorship of the West Virginia Soil Conservation Agency resulting in the current General Reevaluation Report and Environmental Assessment. The current report documents the reevaluation of the authorized project features to confirm economic feasibility and document the NED plan.

Clarification – During the early stages of PED (1990), it was determined that the actual costs associated with raising structures in place were significantly higher than those used during the Feasibility Phase to estimate project costs for the authorized project. This determination was based on the District's experience with other ongoing nonstructural projects. However, no detailed reevaluation or determination of economic feasibility of the nonstructural component of the authorized project was completed at that time because no qualified non-Federal sponsor who supported implementation of the nonstructural component had been identified. The decision was made to defer reevaluation of the nonstructural component until a future date when such updated information would be needed to make decisions regarding implementation of this component. There was recommendation to modify the authorized project at that time, and ORD concurred with the decision to defer this reevaluation.

The Logan County Commission had expressed interest in the implementation of the structural component (0.7 mile of channel modification) of the authorized project. PED efforts during this time period consisted of a reevaluation and preliminary design of the structural component of the authorized project. In 1993 the Logan County Commission formally notified the District that they were unable to financially support the project at that time and requested that project implementation be deferred until they could identify additional funding assistance. All PED activities were suspended at that time.

In 1998, at the request of the Logan County Commission with financial support from the West Virginia Soil Conservation Agency (WVSCA), PED activities were resumed. The WVSCA and the Logan County Commission requested that PED activities be directed towards the reevaluation of the structural component of the authorized project and that reevaluation of nonstructural measures continue to be deferred until additional funding sources could be identified. The current GRR presents a reevaluation of only the structural component documenting economic feasibility, optimization of project scope, NEPA compliance and minor design changes. The report concludes that the deferral of the reevaluation of the nonstructural component should continue and does not recommend any significant changes to the Island Creek Local Protection Project authorized in WRDA 1986.

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e. Recommended Plan. The recommended improvements are slightly smaller in scope than the project authorized by WRDA 1986. The recommended plan provides for trapezoidal channel with an 80-foot bottom width on Island Creek for a distance of 0.7 miles upstream of its confluence with the Guyandotte River. The ~~plan~~ channel configuration includes two discontinuous post and panel wall segments totaling 1,290 linear feet, to ~~protect specific commercial structures~~ minimize impacts to existing commercial development. An existing sand bar located approximately 400 feet upstream of the confluence of Island Creek and Copperas Mine Fork would be removed. Additional plan components include a flood warning system (FWS) and aquatic and terrestrial ~~mitigation~~ environmental design features. One commercial structure and an outbuilding on the property of an existing business would be removed ~~and another relocated~~ to accomplish the required channel widening. The total length of the project is about 4,500 feet. The report indicates that the channel widening would allow this stream segment to handle runoff from storms with an average recurrence interval of 10 to 20 years. Nine new gages and one upgraded gage would be associated with the proposed FWS. These gages would be located on Island Creek (4), Copperas Mine Fork (3), Trace Fork, Mud Fork, and the Guyandotte River. The Logan County Commission will serve as the non-Federal Project sponsor. The West Virginia Soil Conservation Agency will provide the non-Federal share of project costs.

f. Economic Evaluation. The estimated initial cost of the project is $20,774,000 at October 2000 prices. This amount includes $6,933,000 for LERRD and $227,000 to implement the proposed FWS. Based on a 6.375 percent discount rate and a 50-year period of economic evaluation, equivalent annual benefits are cited as $3,830,000. Equivalent annual costs are estimated as $1,690,000, including $73,000 in equivalent annual OMRR&R costs. Indicated equivalent annual net benefits are $2,140,000. The indicated ratio of benefits-to-costs ratio is 2.3 to 1.

2. **REVIEW SUMMARY**. The GRR does not comply with current policy in regard to employing analyses of risk and uncertainty for flood damage reduction studies. The basis of the flood damage reduction benefits claimed is not documented in the GRR. Additional review concerns include cost apportionment, plan formulation, environmental policy compliance, local cooperation and real estate.

3. **PROJECT DESCRIPTION**. Inconsistent descriptions of the project are cited throughout the GRR. Portions of the report indicate that two commercial structures would be "removed"; other sections cite one commercial relocation. The GRR should be revised to consistently describe the recommended plan throughout the report.

Response - The proposed project will require acquisition/removal of one commercial structure (Super 8 Motel) and a small outbuilding located near the stream on the

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property of an existing business (Baisden Hardware Store). Text will be revised throughout the report for consistency and to accurately describe commercial acquisitions.

4. **POST AUTHORIZATION CHANGES.** There is no evaluation of post authorization changes in the GRR; however, the recommended plan appears to have a significantly different scope, output, and cost from the authorized project, due to the elimination of the flood proofing and raising features and reduction in channel width from 100 to 80 feet. The Ohio River Division gave its approval to defer the evaluation of the uneconomical non-structural components in 1991. However, the revised GRR should present sufficient information to address the significance of the post authorization changes and to determine the appropriate authority for approval of changes, including the decrease in project costs relative to Section 902.

Response – The GRR does not recommend any significant changes to the Island Creek Local Protection Project authorized in WRDA 1986. The authorized project consists of both structural and nonstructural components. This report recommends implementation of the structural component (0.7 mile of channel modification) of the authorized project as a separable element and a flood warning system (non-structural). The structural component recommended in this report differs slightly from the original structural component identified in the Island Creek Feasibility Report dated March 1985. The design of the channel modification has been refined in response to changes in the project area and the availability of additional engineering data. Changes to the scope, costs and outputs related to the structural component are relatively minor and are primarily related to design refinements. At the request of the local sponsor and with the concurrence of LRD, the evaluation of the nonstructural components of the authorized project has been deferred. Any discussion of post authorization changes and appropriate authority for approval should be postponed until such time that entire project has been reevaluated and significant changes identified.

5. **RISK AND UNCERTAINTY ANALYSIS.** The GRR indicates that risk and uncertainty analyses as required by ER 1105-2-100 were not completed for the current proposal. The GRR should be revised to comply with current policy in regard to R&U analyses for flood damage reduction studies.

Response - The risk and uncertainty analysis required by ER 1105-2-100 will be performed for the current proposal and the results incorporated into the main report and the economic appendix of the GRR.

6. **ECONOMIC EVALUATION.** ER 1105-2-100, appendix G, paragraph G-9.h.(3) states the following: "Detailed economic data and any derivations from that data to support plan

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formulation, forecasts, and detailed explanations of benefits should be provided. Describe the with and without project physical, biological and economic conditions of the study area and how each category of benefits was computed." The GRR does not include an economics appendix. There is only minimal information on the derivation of flood damage reduction benefits claimed. The main report provides some information about the substantially larger project area that was associated with authorized project. However, there is no information on the numbers and types of structures subject to flooding in the current evaluation. There is no information on structure and content value assumptions, etc. Absent this information, the reasonableness of the evaluation can not be assessed. Additionally, Table 10 of the GRR indicates that without-project damages are 9.7 million while table 12 indicates "base condition" damages as $6.5 million. Details of the economic evaluation should be included in the revised GRR.

Response - An economic appendix will be prepared to provide detailed information about the flood damage analysis. A summary of the economic evaluation will also be incorporated in the main report. Text will be added to the main report and the economic appendix to clarify the difference between the authorized project area and the area impacted in the current analysis. Table 10 results will be modified so that existing damages match with Table 12.

7. **POST AND PANEL WALL SEGMENTS**. Notes to the M-CACES estimate state that the two post and panel wall segments are included in the plan to avoid acquisition of two commercial structures on the left descending bank of Island Creek. The revised GRR should document that the cost of each wall segment is less than the cost of structure acquisition. Verify that the recommended plan is the NED plan.

Noted. The statement in the M-CACES is inaccurate and will be deleted. The recommended project (with the two post and panel walls) produces the greatest net benefits when compared to other plans with and without the walls as shown in Table 10. Clarification: Post and panel walls as presented in the report represent segments of the channel configuration not a flood wall type structure.

8. **FLOOD WARNING SYSTEM**. A flood warning system is included in the final array of alternatives leading to the selection of the recommended plan. However, it is not evident that there was an explicit analysis of the benefits and costs of the system or whether it would reduce the benefits attributed to the structural features by increasing the time available for temporary evacuation of damageable property from the flood plain. The GRR should demonstrate that the FWS is economically justified.

Response – The FWS will be considered a nonstructural component of the recommended project. An analysis will be prepared to demonstrate that the FWS is

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justified based on its cost and the estimated reduction to residual damages within the project area.

9. **SUNK PED COSTS**. The M-CACES estimate shows $2,000,000 assigned to "post feasibility studies." Verify that all past PED expenditures have been included in the estimate of total project costs to be apportioned. Note that sunk PED expenditures should not be included in the current economic evaluation of alternatives.

Response - The sunk PED expenditures will be removed from the economic evaluations and the correct results incorporated into the GRR.

10. **COST SHARING**. Since the project was authorized in WRDA 1986, cost sharing as specified in section 103(a) of this Act appears to be applicable. The project proposal includes both structural and non-structural components. Cost sharing requirements are slightly different for these components—the minimum 5 percent cash requirement is not applicable to non-structural flood control features. Verify that cost sharing shown in the report is correct.

Response – As stated in comment #8, the FWS will be considered a non-structural component and the appropriate language regarding cost sharing will be added to the text.

11. **ENVIRONMENTAL POLICY COMPLIANCE REVIEW**.

a. Mitigation Versus "Sound Environmental Design Practice." The report consistently points out that project will have minimal environmental impacts; however the Executive Summary also states that aquatic and terrestrial mitigation features will be constructed. In paragraph 2.5 (*Environmental Design Measures*), of the Environmental Assessment various "mitigation" elements such as riffle/pool complexes, planting of native vegetation, etc. are proposed. Several plates included in the EA identify "deciduous tree planting area for on-site mitigation" and "typical section" for riffle structures. These measures are proposed to mitigate for loss of riparian habitat, loss of upland and bottomland hardwoods, and for disturbance of aquatic and benthic life. How were these measures selected and what coordination took place to decide which measures would be appropriate? The remainder of the report (text, cost estimates, etc) is virtually silent on mitigation. Recommended mitigation features need to be fully justified. Such justification must be based on determination of significance of losses, incremental analysis, and cost effectiveness, etc. See ER 1105-2-100, Appendix C, paragraph e., beginning on page C-15. Based on the scant information provided in the GRR, in this instance, rather than mitigation, this appears to be a case of "sound environmental design". The report needs to be modified to both fully describe and justify any mitigation features or reflect that these features are simply sound environmental design features.

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Response - During 1993, the project recommended implementation of the structural component as a separate element and the non-structural element was deferred. The structural component consisted of construction of channel modifications along the 0.7 mile of lower Island Creek and a spoil area at Wilkinson. At that time, a draft EA was circulated to the resource agencies but was not completed with a FONSI. A planning aid letter (PAL) was received from the USFWS during this time.

In 2000, the project was looked at again and it was decided by the District that the impacts were not significant enough to warrant mitigation measures, but that environmental features, developed in cooperation with resource agencies, were incorporated into the design. Also, in late 2000, the decision was made to utilize an existing disposal site at Schoolhouse Hollow rather than using the Wilkinson site. This change decreased the environmental impacts of the project. The report will be changed to reflect that these features are simply sound environmental design features.

The EA will reference that the PAL and coordination letters may be found in Appendix C

b. Coordination. The report references (See FONSI and USFWS letter dated February 6, 2001) a December 1993 USFWS Planning Aid Letter (PAL). The PAL should be included in the report. On page 15 under Public and Agency Coordination, it is stated that agencies would receive documents. At this stage of project planning, coordination should be in its final or completed stages. Has a Public Notice (PN) gone out for public review and comment?

Response - The PAL will be included in the report. The tense of the sentence is incorrect. Public Notice (PN) may be found in Appendix A labeled as Notice of Availability (NOA). The NOA advised the public that the document was available for review and comment from January 5, 2001 through February 5, 2001.

c. Status of Environmental Compliance. Several statements are made on pages 7 and 8 of the Environmental Assessment (EA), dated May 2001, that coordination will or would be obtained for Water Quality Certification and the Fish and Wildlife Coordination Act. The EA also states that if significant historic properties are encountered then appropriate mitigation measures will be incorporated, and the Corps will fully comply with Section 106 consultation. Since this is the Final EA, coordination and compliance with appropriate agencies should be completed and not deferred to a later time. The Coordination Act Report from the US Fish and Wildlife Service should be included, as well as responses to recommendations resulting for Federal and state agency comments resulting from the coordination (see ER 1105-2-100, Appendix C, paragraph c.(1)(a), as an Appendix to the Final EA.

Response - Coordination with the US Fish and Wildlife has occurred since the beginning of this project. Please refer to the PAL (1993) and two supporting letters received by this district within the last year. A Coordination Act Report was not prepared by the USFWS since the project to be implemented was not found to significantly impact the resources. The PAL and the correspondence letters may be found in Appendix C.

The 404(b)(1) analysis has been completed and is located in Appendix B. The State 401 Water Quality Certification dated May 17, 2001, has been received and is included in Appendix B.

Coordination with the State Historic Preservation Office has occurred. The EA will have a reference to the location of the coordination letters dated January 31 and April 27, 2001 and the Cultural Resources Reconnaissance Report for the Island Creek LPP dated April 2001. All references are located in Appendix C.

The EA will be revised to reflect the completion of the compliance issues referenced in the comment.

d. <u>Water Quality</u>. Page 11 of the EA mentions that water quality is poor in the study area and that "Abandoned deep mines are a major source of acid mine drainage" and that "Untreated domestic sewage is a serious problem". These issues, as well as, siltation and turbidity concerns should be addressed for the Water Quality Certification. There is a statement that an erosion control plan <u>would</u> be prepared. The GRR should address the state of erosion control or other plans that have been prepared or that are in preparation.

Response - The WV Water Quality Certification was received by this district on May 17, 2001. The 404 (b)(1) Analysis addressed the issue of erosion control plans by using Best Management Practices. The EA will reference the location of the 404(b)(1) Analysis in Appendix B.

e. <u>Endangered Species Act Compliance</u>. Page 12 under Endangered Species, the EA mentions effects to the Indiana bat and its habitat "would have an infinitesimally small chance of resulting in direct or indirect take". Has a Biological Assessment been made, as required by ER 1105-2-100, Appendix C paragraph .c.(2)(a)(1) and has the US Fish and Wildlife Service issued a Biological Opinion, or a letter of concurrence with a finding of "no adverse effect" as described in paragraph c.(2)(b)(2)?

Response - The February 6, 2001 letter received from the Fish and Wildlife Service indicated in paragraph two that "We indicated that projects disturbing less than 17 acres of potential Indiana bat summer foraging and roosting habitat were considered by the Service to have a very small chance (at the 98% confidence level) of resulting in direct or indirect take." Also, in the third paragraph the FWS stated "Therefore, *<u>the Service</u>*

considers the proposed action discountable and unlikely to adversely affect the Indiana bat. Therefore, no further Section 7 consultation under the Endangered Species Act (87Stat. 884, as amended; 16 U.S.C. 1531 et seq.) is required."

f. Cultural Resources. Page 12 under Sensitive Cultural Resources, there is no discussion. Page 14 under Cultural Resources, there is mention of a literature investigation. A literature search is only the beginning of the compliance process, further investigations are required to locate, identify and evaluate historic properties that will be impacted by project construction. This should include historic assessments and determinations of eligibility for the buildings and structures that will be removed or altered by project activities. The EA also states that, "If significant historic properties are encountered during construction, appropriate mitigation measures will be incorporated". The National Historic Preservation Act requires agencies to locate and evaluate historic properties and to mitigate for potential impacts before construction starts. The report should include documentation of concurrence of findings from SHPO.

Response - A discussion under Sensitive Cultural Resources will be written to explain briefly what is considered sensitive cultural resources.

The Island Creek Cultural Resources Report (located in Appendix C) was performed by this district in April 2001. Correspondence with WVSHPO indicated their concurrence with the findings of the report. Both entities concluded that two historically significant structures (Appalachian Power Company building and the CSX railroad bridge) were located adjacent to the project but will not be affected by the project. An April 27, 2001 letter from the WVSHPO concluded that the proposed activities would have *No Adverse Effect* on these two structures. The correspondence with the WVSHOP is located in Appendix C.

g. FONSI. The FONSI states under section 2.b. that "No archeological resources are recorded in the project area". As commented above, a literature search is only the beginning of the cultural resources compliance process. The appropriate investigations should be completed and coordinated with the State Historic Preservation Officer (SHPO). Under section 2.d. of the FONSI, reference to the proper citation should be Section 106 and 32 CFR Part 800.

Response - The proper documentation of investigation was recorded in the Island Creek Local Protection Plan Cultural Resources Reconnaissance Report. The report was provided to the WVSHPO and this district received a response concerning the Reconnaissance Report on April 27, 2001 that indicated no further action was necessary.

CECW-PC
Subject - HQUSACE Policy Compliance Review Comments - Island Creek Local Protection Project, Logan, West Virginia, General Reevaluation Report (May 2001)

h. Cultural Resources. The Cultural Resources Reconnaissance Report does not mention the buildings and bridges that will be altered or removed, and therefore, impacted by project activities.

Response - The Super 8 Motel and the outbuilding on the Baisden Hardware Store property were not included in the Cultural Resources Reconnaissance Report because both building are less than 50 years old and are obviously not eligible for inclusion in the National Register.

12. **DISTRICT LEGAL REVIEW**. The subject report was submitted without evidence that the District Office of Counsel has certified it as legally sufficient. This certification is required in order for the Office of the Chief Counsel to complete its review. Certification of legal review should be submitted with the revised GRR.

Response - A signed certification sheet will be added to the GRR.

13. **MULTIPLE SPONSORS**. The report identifies the Logan County Commission, West Virginia as the local sponsor with financial support from the West Virginia Soil Conservation Agency. Current Corps policy places a high preference on implementing a project through a secure partnership with a single sponsor. It is not uncommon for sponsors to enter into cooperative arrangements or sub-agreements with other entities to enable it to provide all aspects of its required cooperation. However, the Corps normally prefers to avoid the additional burden of reviewing the capabilities and commitment of such third parties and relying upon cooperation among various parties during project implementation. If multiple sponsorship is deemed to be absolutely necessary, the report should document whether and in what manner any local cooperation requirements will be divided among multiple parties, including assignment of liability risk.

Response - A single agreement is anticipated with the Logan County Commission.

14. **ITEMS of LOCAL COOPERATION**. Pages 35 to 38 of the report contain an inaccurate and incomplete description of local cooperation requirements for the project. A complete and accurate list is required. The Office of Chief Counsel, HQUSACE offers the following draft list. The District should review this list carefully, with the assistance of its Office of Counsel, and revise it further as needed to address the needs or the current project.

a. Provide a minimum of 25 percent, but not to exceed 50 percent of total project costs as further specified below:

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(1) Enter into an agreement which provides, prior to execution of the project cooperation agreement, 25 percent of design costs;

(2) Provide, during construction, any additional funds needed to cover the non-federal share of design costs;

(3) Provide, during construction, a cash contribution equal to 5 percent of total project costs assigned to structural flood control;

(4) Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations determined by the Government to be necessary for the construction, operation, and maintenance of the project;

(5) Provide or pay to the Government the cost of providing all retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring features and stilling basins, that may be required at any dredged or excavated material disposal areas required for the construction, operation, and maintenance of the project; and

(6) Provide, during construction, any additional costs as necessary to make its total contribution equal to at least 25 percent of total project costs.

b. Give the Government a right to enter, at reasonable times and in a reasonable manner, upon land which the local sponsor owns or controls for access to the project for the purpose of inspection, and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the project.

c. Assume responsibility for operating, maintaining, replacing, repairing, and rehabilitating (OMRR&R) the project or completed functional portions of the project, including mitigation features without cost to the Government, in a manner compatible with the project's authorized purpose and in accordance with applicable Federal and State laws and specific directions prescribed by the Government in the OMRR&R manual and any subsequent amendments thereto.

d. 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 non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element.

e. Hold and save the Government free from all damages arising for the construction, operation, maintenance, repair, replacement, and rehabilitation of the project and any project-related betterments, except for damages due to the fault or negligence of the Government or the Government's contractors.

f. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project to the extent and in such detail as will properly reflect total project costs.

g. Perform, or cause to be performed, 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 USC 9601-9675, that may exist in, on, or under lands, easements or rights-of-way necessary for the construction, operation, and maintenance of the project; except that the non-Federal sponsor shall not perform such investigations on lands, easements, or rights-of-way that the Government determines to be subject to the navigation servitude without prior specific written direction by the Government.

h. Assume complete financial responsibility 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 Government determines necessary for the construction, operation, or maintenance of the project.

i. Agree that, as between the Federal Government and the non-Federal sponsor, the non-Federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and, to the maximum extent practicable, operate, maintain, repair, replace, and rehabilitate the project in a manner that will not cause liability to arise under CERCLA.

j. Prescribe and enforce regulations to prevent obstruction of or encroachment on the Project that would reduce the level of protection it affords or that would hinder operation or maintenance of the Project.

k. 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 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR part 24, in acquiring lands, easements, and rights-of-way, and performing relocations for construction, operation, and maintenance of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act.

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l. Comply with all applicable Federal and State laws and regulations, including Section 601 of the Civil Rights Act of 1964, Public Law 88-352, 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 Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), requiring non-Federal participation and implementation of floodplain management plans;

m. 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, in accordance with the cost sharing provisions of the agreement;

n. Participate in and comply with applicable Federal floodplain management and flood insurance programs;

o. Do not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is authorized.

p. Inform affected interests, at least annually, regarding the limitations of the projection afforded by the project.

Response - The GRR will be revised accordingly.

15. **REAL ESTATE**.

a. General. The Real Estate Plan submitted as a part of the General Reevaluation Report meets the requirements of Chapter 12, section of ER 405-1-12. The district has done a thorough job in determining the acquisition criteria for the project.

b. Relocations Assistance. Paragraph 8 of the Real Estate Plan refers to Public Law 91-646 Relocation Data. Although it would have been more accurate to title it "Relocation Assistance Data", the paragraph correctly describes the types of benefits that are available to persons displaced from businesses and residences. However, the summary version found in paragraph B of Page 30 of the main report is misleading. Residences are not relocated and neither are businesses. In the second paragraph, the sentences should read, "No residences are to be acquired. There is one commercial acquisition."

Response - The text in the main report will be revised as suggested.

CECW-PC
Subject - HQUSACE Policy Compliance Review Comments – Island Creek Local Protection Project, Logan, West Virginia, General Reevaluation Report (May 2001)

16. **DESIGN DOCUMENTS**. The text indicates that the reevaluation report contains sufficient detail to eliminate the need for a GDM and proceed with the preparation of project plans and specifications. Note that ER 1110-2-1150 replaces the General Design Memorandum with an Engineering Documentation Report (EDR), which is a living document that continues through the preparation of Plans and Specifications. The revised text should state that the PED will consist primarily of the preparation of Plans and Specifications and that documentation in the EDR would be minimized based on the detail contained in the GRR.

Response - Text will be revised to indicate that a Design Documentation Report (DDR) will be prepared. Upon approval of the design, we will proceed with Plans and Specifications and update the DDR as these develop.

17. **AUTHORIZED PROJECT**. The subject GRR makes many references to the "authorized" project. Recommend revising these references to the "original" project. Thus, the report will distinguish between the two plans as the original project and the recommended project.

Response – As previously stated, the GRR does not recommend any significant changes to the Island Creek Local Protection Project authorized in WRDA 1986. The report recommends implementation of the structural component of the authorized project (0.7 mile of channel modification) as a separable element and deferral of the implementation of nonstructural measures. The structural component recommended in this report differs slightly from the structural component presented in the Feasibility Report due to design refinements. The report will be revised to distinguish between the "original" structural component and the "recommended" structural component. A discussion of the changes will be included in the report.

JAMES E. WARREN, PE
Policy Compliance Review Manager

CONVERSATION RECORD | TIME 9:35 | DATE 2-21-02

TYPE ~~VISIT~~ ☐ CONFERENCE ☒ TELEPHONE ☐ INCOMING ☐ OUTGOING

ROUTING

NAME/SYMBOL	I.

Location of Visit/Conference:

NAME OF PERSON(S) CONTACTED OR IN CONTACT WITH YOU	ORGANIZATION (Office, dept., bureau, etc.)	TELEPHONE NO.
Randy Kelley	WVDNR	792-7075

SUBJECT New FONSI for Island Creek LPP 792-7078

SUMMARY I will send him our comments & response ie HQ, for him to Review. He will let me know if he has any concerns.

ACTION REQUIRED TO FAX RANDY A COPY OF THE CORRECTIONS

NAME OF PERSON DOCUMENTING CONVERSATION	SIGNATURE	DATE
Amy Frantz	Amy K Frantz	2/21/02

ACTION TAKEN Faxed Randy the HQ Comments

SIGNATURE	TITLE	DATE
Amy K Frantz	Ecologist	2/21/02

50271-101 **CONVERSATION RECORD** OPTIONAL FORM 271 (12-76) DEPARTMENT OF DEFENSE

02-21-02

To: Randy Kelly Office Symbol:

Fax Number 792-7078

Phone Number 792-7075

This transmission has (6) pages including this sheet

If you did not receive the correct number of pages or had transmission problems, please call:...(304)-529-5636

Fax Number:...(304)-529-5136
Confirmation Number:...(304)-529-5636

US Army Corps of Engineers
Huntington District

Comments: Randy,

SECTION 11 pertains to the EA + FONSI. Let me know if you have any problems with the responses.

Thanks
Amy Frantz

ph. 528-7445

CONVERSATION RECORD

CONVERSATION RECORD	TIME 9:25	DATE 2-26-02

TYPE ☐ VISIT ☐ CONFERENCE ☒ TELEPHONE ☐ INCOMING ☒ OUTGOING

ROUTING NAME/SYMBOL

Location of Visit/Conference:

NAME OF PERSON(S) CONTACTED OR IN CONTACT WITH YOU	ORGANIZATION (Office, dept., bureau, etc.)	TELEPHONE NO.
RACHEL Black	WVSHPO	558-0220

SUBJECT New FONSI For Island Creek.

SUMMARY I explained to her about the corrections and that a new FONSI had to be signed.

ACTION REQUIRED FAX her comments from HQ (and corrections).

NAME OF PERSON DOCUMENTING CONVERSATION	SIGNATURE	DATE
Amy Frantz	Amy K Frantz	2-26-02

ACTION TAKEN

FAXED HER COMMENTS.

SIGNATURE	TITLE	DATE
Amy K Frantz	Ecologist	2-26-02

50271-101 CONVERSATION RECORD OPTIONAL FORM 271 (12-76) DEPARTMENT OF DEFENSE

2-21-02

To: Rachel Black Office Symbol: WVSHPO

Fax Number 558-2779 FR# 01-443-LG-1

Phone Number 558-0220

This transmission has (6) pages including this sheet

If you did not receive the correct number of pages or had transmission problems, please call:..(304)-529-5636

Fax Number:..(304)-529-5136
Confirmation Number:..(304)-529-5636

US Army Corps
of Engineers
Huntington District

Comments: Rachel,
attached are the HQ comments we discussed on the phone. Let me know if you have any comments.

Amy Frantz
528-7445 ph

WEST VIRGINIA DIVISION OF
CULTURE AND HISTORY

March 08, 2002

Ms. Ginger Mullins
U.S. COE
502 Eighth Street
Room 3100
Huntington, West Virginia 25701

RE: Draft Environmental Assessment
Island Creek Local Protection Plan
FR#: 01-443-LG-2

Dear Ms. Mullins:

We have reviewed the above mentioned project to determine its effects to cultural resources. As required by Section 106 of the National Historic Preservation Act, as amended, and its implementing regulations, 36 CFR 800: "Protection of Historic Properties," we submit our comments.

Thank you for submitting the comments for the Draft Environmental Assessment for the Island Creek Local Protection Plan. We concur with the comments and changes that will be made in the Plan affecting Cultural Resources. We look forward to reviewing the final product.

We appreciate the opportunity to be of service. *If you have questions regarding our comments or the Section 106 process, please call Rachel Black, Staff Archaeologist at (304) 558-0220.*

Sincerely,

Joanna Wilson

Joanna Wilson
Senior Archaeologist

reb

THE CULTURAL CENTER • 1900 KANAWHA BOULEVARD, EAST • CHARLESTON, WEST VIRGINIA 25305-0300
TELEPHONE 304-558-0220 • FAX 304-558-2779 • TDD 304-558-3562
EEO/AA EMPLOYER

CONVERSATION RECORD

TIME: ~~0~~ 9:00

DATE: 2-22-02

TYPE

☐ VISIT ☐ CONFERENCE ☒ ~~TELEPHONE~~

☐ INCOMING

☐ OUTGOING

Location of Visit/Conference:

ROUTING	
NAME/SYMBOL	INT

NAME OF PERSON(S) CONTACTED OR IN CONTACT WITH YOU	ORGANIZATION (Office, dept., bureau, etc.)	TELEPHONE NO.
JEFF TOWNER	FWS	636-~~6856~~ 6586

SUBJECT New Fonsi for Island Creek

SUMMARY I explained the issue of having to obtain a new Fonsi and I faxed him the HQ corrections.

He said he will let me know about concurrence.

ACTION REQUIRED

NONE - WAIT FOR USFWS TO CALL BACK

NAME OF PERSON DOCUMENTING CONVERSATION	SIGNATURE	DATE
Amy Frantz	Amy Frantz	2/22/02

ACTION TAKEN

Met with Jeff Towner concerning HQ corrections. He said they were fine

SIGNATURE	TITLE	DATE
Amy K Frantz	Ecologist	3/14/02

50271-101 CONVERSATION RECORD OPTIONAL FORM 271 (12-76) DEPARTMENT OF DEFENSE

To: JEFF TOWNER Office Symbol: USFWS

Fax Number 636-7824

Phone Number

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Fax Number:....................(304)-529-5136
Confirmation Number:....................(304)-529-5636

US Army Corps of Engineers
Huntington District

Comments: Jeff,
Here are the comments from HQ. and our responses. Please call if you have any questions or comments.

Thanks
Amy Frantz

528-7445

Resolutions to Comments
Received for
Island Creek Local Protection Plan

1. Comment from Mr. David R. Stillwell, council member of the Town of West Logan, pertaining to the City of Logan's existing sanitary sewer along the left descending bank of Island Creek.

Response: Although not specifically mentioned in the Environmental Assessment, the existing 15-in gravity sanitary sewer on the left descending bank of Island Creek, between the existing manhole located in the parking lot beside Super 8 Motel and the manhole just north of the new Water Street Bridge (at the confluence of Island Creek and the Guyandotte River, will be relocated along the south edge of State Route 119/26. The drawing showing this relocation is included in the Engineering Technical Appendix as Drawing 102/01.

2. Comment from United States Department of Agriculture, Natural Resources Conservation Service, on Section 3.2.1 Geology and Soils.

Response: Concur. The text has been changed to reflect the comments of the NRCS on page 9 of the Environmental Assessment.

3. Comment from U.S. Fish and Wildlife Service on Section 3.2.5 Endangered Species.

Response: Concur. The project will disturb less than 17 acres of potential Indiana Bat summer foraging and roosting habitat.

4. Comment from WV Division of Natural Resources on Section 2.4 and 2.5 Plan Considered in Detail and Environmental Design Measures.

Response: Please refer to response letter located in this appendix.

5. Comment from WV Division of Cultural and History dated 31 January 2001 over concerns on Section 3.3.5 of addressing Architectural and Archaeological Resources.

Response: Concur. An abbreviated technical report was prepared by the Army Corps of Engineers addressing these concerns.

02/08/2001 THU 10:05 FAX

324 First Avenue

West Logan, WV 25601-3206

2/8/01

Chief, Environmental Analysis Section
U. S. Corps of Engineers
502 Eighth Street
Huntington, WV 25701

Sir:

I only today received the opportunity to briefly review the Draft Environmental Assessment (DEA) for Island Creek Local Protection Plan, Logan County, WV. after receiving a copy sent to my employer, American Electric Power Company.

My only comment is to point out an ongoing problem I'm aware of which certainly becomes, in my opinion, an even greater problem during flooding conditions and which should be addressed in your study. The City of Logan Sanitary Board apparently maintains a wastewater or sewage collection system extending along lower Island Creek from what I understand might be Super 8 Motel and Shoney's Restaurant, past American Electric Power's Service Building, and on to their treatment plant north of Logan. Many times over the past year or longer a manhole just a few feet above normal pool of Island Creek at the base of the power company's retaining wall has overflowed with wastewater, creating severe odor conditions. This wastewater flows directly into Island Creek and the Guyandotte River a short distance away. It is my clear understanding that the City of Logan and the EPA have been contacted by interested parties on several occasions. Apparent blockages were cleared and the overflows ceased temporarily. Then the discharges reoccurred.

The City of Logan's manhole is undoubtedly within the flood plain and uphill of the main Island Creek channel. I believe your study and improvement plans should address this condition.

I am not herein representing American Electric Power, just a concerned citizen of Logan County. I am presently a council member of the Town of West Logan and an electrical engineer with the Power Company.

I trust my fax of this letter will arrive in time to be within your 30 day public review period. Thank you for your time.

Sincerely,

David R. Stillwell

David R. Stillwell

t tates
! lent of
A .ture

Natural
Resources
Conservation
Service

75 High Street,
Room 301,
Morgantown, WV
26505

Phone:
(304) 284-7540

Fax:
(304) 284-4839

February 1, 2001

Larry E. Workman
Acting Chief, Planning Branch
Environmental Analysis Section
Department of the Army
Huntington District, Corps of Engineers
502 Eighth Street
Huntington, WV 25701-2070

RE: DEA for Island Creek Local Protection Plan, Logan County, WV

Dear Mr. Workman:

This is in response to your letter of January 8, 2001, requesting our comments on the above referenced project. Accordingly, my staff has reviewed the DEA, and our comments are as follows:

-(page 9)**3.2.1 Geology and Soils.** Most bedrock in the Island Creek watershed is from the Kanawha Formation, which is part of the Pottsville Group. High ridges are capped by bedrock from the Allegheny Formation. These rocks are of sedimentary origin. This Pennsylvanian age geology consists of dominantly massive sandstone interbedded with numerous coal seams, impure fire clays, sandy and argillaceous shales, and a few thin, impure lenticular limestones. Coal is the most important economic constituent and is environmentally attractive because of its low sulfur content. The largest reserves have been mined from the No. 5 Block, Coalburg, Peerless, No. 2 Gas, (locally known as Upper and Lower Cedar Grove), and Powellton (locally known as Alma seams).

Soils that weather from this sandy geology include the Matewan, Highsplint, and Guyandotte soils on the steep mountain ridges, sideslopes, and cove areas; and the Yeager, Craigsville, and Chavies soils in the narrow floodplains. Most floodplain soils are impacted by residential, industrial, and other commercial development. This is the case along this project reach. Natural soils have been disturbed by added spoil material and earth moving activities. These disturbed and mostly filled areas consist of land covered by houses, buildings, streets, parking lots, railroad tracks, and other urban components. Natural soil is almost non-existent along this project reach. There is no Prime Farmland, Statewide Important Farmland, Locally Important Farmland, or Hydric soils along this project reach.

Thank you for the opportunity to respond. Should you need further clarification of our comments, please contact Mr. Rob Pate, Resource Soil Scientist, at the following address:

USDA-Natural Resources Conservation Service
465 Ragland Road
Beckley, WV 25801

Telephone: 304-253-9597

Sincerely,

Paul S. Dunn, Acting STC
WILLIAM J. HARTMAN
State Conservationist

cc:
Paul Dunn, ASTC-Technology, NRCS, Morgantown, WV
Kelley Sponaugle, ASTC-FO, NRCS, Beckley, WV
Alan Boone, DC, NRCS, Hamlin, WV
Rob Pate, Resource Soil Scientist, NRCS, Beckley, WV
Lynn Shutts, Environmental Biologist, NRCS, Morgantown, WV

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United States Department of the Interior

FISH AND WILDLIFE SERVICE

West Virginia Field Office
694 Beverly Pike
Elkins, West Virginia 26241

FEB 06 2001

Ms. Ginger Mullins, Chief
Environmental Analysis Section
Huntington District Corps of Engineers
502 Eighth Street
Huntington, West Virginia 25701-2070

Dear Ms. Mullins:

This is in response to your January 16, 2001 letter of transmittal of the Draft Environmental Assessment (EA) Island Creek Local Protection Project, Logan County, West Virginia. The project purpose is reduction of flooding damages within the Island Creek Basin. The structural project component includes channel widening of 0.7 mile of lower Island Creek in the town of Logan. With the exception of the addition of a Flood Warning System, the proposed project has not changed since the original EA was circulated in 1993.

The Service provided a Planning Aid Letter to the Corps in December, 1993. In April, 2000 a preliminary Draft EA was transmitted to our office with a request for any undated information relating to potential environmental impacts from the proposed project. In June, 2000, the Service provided a letter that stated that the endangered Indiana bat, Myotis sodalis could occur within the proposed project area. We indicated that projects disturbing less than 17 acres of potential Indiana bat summer foraging and roosting habitat were considered by the Service to have a very small chance (at the 98% confidence level) of resulting in direct or indirect take.

The Draft EA indicated that the proposed project will disturb less than 17 acres of potential Indiana bat summer habitat. Therefore, the Service considers the proposed action discountable and unlikely to adversely affect the Indiana bat. Therefore, no further Section 7 consultation under the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) is required with the Service on the proposed Island Creek Local Protection Project. Should project plans change, or if additional information on listed and proposed species or species of concern becomes available, this determination may be reconsidered.

If you have any questions concerning these comments, please contact Linda Smith of my staff at (304)636-6586, extension 17 or at the letterhead address.

Sincerely,

Jeffrey K. Towner

Jeffrey K. Towner
Field Supervisor

United States Department of the Interior

FISH AND WILDLIFE SERVICE

West Virginia Field Office
P.O. Box 1278
Elkins, West Virginia 26241

JUN 1 9 2000

Mr. Nick Krupa
U.S. Army Corps of Engineers
Attn: Environmental Analysis Branch
502 Eight Street
Huntington, West Virginia 25701

Dear Mr. Krupa:

We received a letter and the preliminary Draft Environmental Assessment for the Island Creek Local Flood Control Project, Logan County, West Virginia on April 17, 2000 from Dr. Jagan Valluri of your staff. Dr. Valluri stated that the Island Creek project has not changed since our Planning Aid Letter was written to the District in December, 1993. You requested any updated information relating to this project.

A federally listed species that could occur within the proposed project area is the endangered Indiana bat, Myotis sodalis. This species may use the project area for foraging and roosting between April 1 and November 14. Indiana bat summer foraging habitats are generally defined as riparian, bottomland, or upland forest, and old fields or pastures with scattered trees. Roosting/maternity habitat consists primarily of live or dead hardwood tree species, which have exfoliating bark that provides space for bats to roost between the bark and the bole of the tree. Tree cavities, crevices, splits, or hollow portions of tree boles and limbs also provide roost sites.

There are 29 known hibernacula for the Indiana bat in the limestone region of eastern West Virginia in Preston, Tucker, Randolph, Pendleton, Pocahontas, Greenbrier, Monroe, and Mercer Counties. The population of the hibernacula in West Virginia range in size from one to 9,000 Indiana bats. Recent data indicate that the area within an approximate 5.0 mile radius of a hibernaculum is important foraging and roosting habitat for the Indiana bat in the fall swarming period, August 15 through November 14. The project area is outside a five mile radius of a known hibernaculum. Therefore, fall-swarming behavior is not expected in the proposed project area.

The 1999 capture of a young of-the-year Indiana bat during the maternity period, May 15 to August 15, near Richwood in Nicholas County suggests that female Indiana bats may utilize West Virginia for summer maternity range. Also in summer of 1999, an adult male Indiana bat was captured in Clay County. The Service is concerned with the possibility of direct take or habitat disturbance within a 2-mile radius around known maternity roosts and capture sites. The project area is outside a two mile radius of a known capture site.

The Service has determined the number of acres of suitable foraging and roosting habitat on the West Virginia landscape available to each Indiana bat known to occur there. On that basis, we have determined that small projects, generally affecting 17 acres or less of suitable foraging and roosting habitat, will have an infinitesimally small chance (at the 98% confidence level) of resulting in direct or indirect take. If less than 17 acres of suitable habitat will be disturbed, the Service considers that action discountable and unlikely to adversely affect the endangered Indiana bat at any season of the year. A determination should be made as to the amount of suitable habitat that will be removed as a result of this project. This should include all portions of the construction area including spoil disposal areas. If less than 17 acres will be disturbed, tree removal can occur at any season of the year. If 17 acres or more will be disturbed, the Service recommends one of two options. Mist net surveys can be conducted to determine if the summer foraging and roosting habitat within the area affected by the proposed project is occupied. A survey plan should be submitted to the Service and the West Virginia Division of Natural Resources for concurrence prior to conducting the work. The survey should follow the standard Indiana bat mist net protocol from the Draft Indiana Bat Recovery Plan, and be conducted between May 15 and August 15 by a qualified mammalogist with experience in identifying Indiana bats.

If Indiana bats are collected, the data should be incorporated into a Biological Assessment pursuant to Section 7 of the ESA. Biological Assessments are designed to assist Federal agencies in determining if formal consultation is required. The Service recommends that the following steps be taken in preparation of the BA.

1. Conduct recent interviews of recognized experts on the species at issue, including those within the Service, West Virginia Division of Natural Resources (WVDNR), U.S. Forest Service, universities and others who may have data not yet found in scientific literature.

2. Review up to date literature and other scientific data to determine the species distribution habitat needs, and other biological requirements.

3. Analyze the effects of the action on individuals and populations of the species and its habitat, including <u>indirect and cumulative effects of the action</u>.

4. Analyze alternative actions that may provide conservation measures.

5. Conduct any studies necessary to fulfill the requirements of (1) through (4) above.

6. Review any other relevant information.

If you determine that the proposed action "may affect" a federally listed species you must request, in writing, formal consultation with this office, pursuant to Section 7(a) of the ESA. If the determination is "no effect", no further consultation is necessary, unless requested by the Service. Regardless of your findings, you should provide this office a copy of the survey results and any other relevant information that assisted you in reaching your conclusion.

Another option you may use to address Indiana bat concerns is to assume Indiana bats are present and schedule timber removal operations during the hibernation period, between November 15 and March 31. If that option is chosen, you must then submit a calculation of the percentage of suitable Indiana bat summer habitat that would remain within a two-mile radius of the project area after the proposed disturbance. If the Service determines that the extent of disturbance is significant and may affect the Indiana bat, you must request formal Section 7 consultation with the Service or conduct mist net surveys to determine if Indiana bats are, in fact, present. If Indiana bats are collected during mist netting, you must prepare a Biological Assessment, as described above.

If you have any questions regarding these comments, please contact Linda Smith, of my staff, at (304)6363-6586.

Sincerely,

Jeffrey K. Towner
Field Supervisor

United States Department of the Interior

FISH AND WILDLIFE SERVICE
West Virginia Field Office
Post Office Box 1278
Elkins, West Virginia 26241

December 2, 1993

Colonel Earle C. Richardson
District Engineer
Huntington District, Corps of Engineers
502 Eighth Street
Huntington, West Virginia 25701

Dear Colonel Richardson:

This constitutes a Planning Aid Letter for the Island Creek Local Flood Control Project, Logan County, West Virginia. This letter provides general information on existing environmental resources within the project area and the potential impacts to those resources as a result of the project. We include preliminary recommendations for your use in completing the General Reevaluation Report (GRR) on the project. This letter is provided as technical assistance in accordance with the Fish and Wildlife Coordination Act (48 STAT. 401, as amended; 16 U.S.C. 661 et seq.) and under terms of the July, 1993 Scope of Services for the Island Creek Re-evaluation Study.

Project Description

An authorized local flood protection project in the Island Creek Basin was described in the U.S. Army Corps of Engineers' Feasibility Report dated 1985. The project consisted of structural and non-structural flood control measures. The non-structural cost estimates were reevaluated based on actual implementation cost figures obtained from the Tug Fork projects and determined to be economically infeasible. Accordingly, study on the non-structural housing measures of the upper reaches of this project were deferred. The Huntington District is now considering a reduced structural portion of the Island Creek Local Flood Protection Project as a separable element of the project.

The structural components include channel widening to 80 feet which will begin at the confluence of Island Creek and the Guyandotte River and continue 0.7 miles up Island Creek. Widening will only occur on one side of the stream in any area and stone slope protection will be placed along the newly excavated slope. The existing stream channel will be deepened and leveled and formed in a trapezoidal channel using 2.5 horizontal to one vertical side slopes. At the upstream reach of the project, a sandbar will be removed. Post and panel walls will be constructed in certain locations and stone slope protection will be placed along the base of the wall. Vegetation will be snagged and cleared from the stream to the construction work line (CWL) where walls are constructed or earthwork cuts made. The material removed during channel widening will be spoiled at two upland sites near Wilkinson, West Virginia.

Description of the Project Area

A field review of the revised project area was conducted with Huntington District staff on July 21, 1993. Informal consultation with personnel of West Virginia Division of Natural Resources (WVDNR) was conducted. A review was made of the 1983 Habitat Evaluation Procedures (HEP) report (US Department of the Interior 1983) for the proposed Island Creek project. Habitat unit value (HUV) from the HEP for the various habitats in the project were used in this report. The HUV's have not changed significantly in the ten years since the HEP was conducted.

The bottomland habitat that will be impacted by stream widening of the lower 0.7 miles of Island Creek is in the town of Logan. The habitat is predominately urban with narrow bands of good riparian vegetation consisting of young to medium age hardwoods, shrubs, and herbaceous vegetation, mainly along the stream bank. The HEP rated this urban riparian habitat a habitat unit value of 28 due to the disturbed nature of the urban environment. 1.5 ac

There are two blocks of land without development in the project area. One is located west of and adjacent to the Super 8 Motel. It is approximately 1.8 acres of early old field habitat with a band of bottomland hardwoods next to the stream. This area has been used for fill disposal and supports herbaceous vegetation. It holds value for wildlife species that use old field, wooded riparian, and edge habitat such as songbirds, small game and non-game mammals, reptiles, hawks, and owls. Old field habitat in Lower Island Creek Planning Segment has a HUV of 55. 1.8 ac

The other undeveloped block of land within the project is approximately 2.5 acres on the south bank of Island Creek and immediately east of the CSX Railroad bridge. The habitat is of medium age to mature deciduous hardwoods interspersed with shrubs and herbaceous vegetation typical of late old field habitat. A 0.2 acre palustrine emergent and scrub-shrub wetland also occurs here. This area has good interspersion value. Areas such as this provide habitat for many wildlife species that use ecotone, old field, and wooded riparian areas. Small game and non-game mammals, resident and migrant songbirds, wood ducks (<u>Aix sponsa</u>), owls, reptiles, and amphibians will use this area. Japanese knotweed (<u>Polygonum cuspidatum</u>) is abundant in much of the riparian area throughout the project. It is an exotic species that is very invasive and out-competes many native species. This plant is not valuable to wildlife and replaces species that could be valuable. There is also human disturbance in this area in the form of Off Road Vehicle (ORV) trails. This combination of old field and bottomland hardwoods habitat has a HUV of 50. 2.5 ac 1.0 ac. old F. 1.5 ac. Bottom hardw.

Spoil disposal will occur on two adjacent sites in a steep ravine in Wilkinson Hollow that were previously surfaced mined. The sites are presently covered with upland hardwoods approximately 60 years old. The total spoil area is approximately seven acres in size. The existing site provides good upland habitat for songbirds, game and non-game mammals and reptiles. HUV of upland hardwood habitat in this area is 50. 7.2 ac

13 ac

The aquatic habitat of the project area has historically been degraded by water quality problems due to mine drainage, untreated domestic sewage, trash, dredging and filling, and other stream bank disturbances such as bridges and gas and sewer lines. The WVDNR reports that the standing crop/acre of fish was starting to rise a few years ago and conditions were improving for stocking of fish . However, new and continued discharge of mine drainage have prevented further consideration for stocking until this problem is corrected.

Within the project area, no federally listed threatened or endangered species are known to occur except for occasional transient species. Therefore, no Biological Assessment or further Section 7 Consultation under the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) is required. Should project plans change, or if additional information on listed or proposed species becomes available, this determination may be reconsidered.

<u>Project Impacts</u>

The impacts from the 0.7 mile stream channelization and widening and the disposal of spoil material are:

1) Permanent destruction and severe short-term disturbance to aquatic and riparian habitats along 0.7 miles of Island Creek due to channelization, snagging and clearing, post and panel walls, and construction activity.

Channelization will eliminate low water areas behind rocks, refugia, and other aquatic habitat.

2) Loss of approximately 7 acres of good upland hardwood habitat from spoil disposal. deleted

3) Short-term impacts to the fishery in the Guyandotte River during construction phases and until all disturbed areas are revegetated and stabilized. Increased sediment and turbidity will cover suitable substrate and hamper invertebrate production and fish spawning. Turbidity will also impact feeding activity of sight feeding fish and irritate fish gills.

4) Resuspension of streambed sediment pollutants during channel construction increasing bio-availability to fish and other aquatic species.

5) Decomposition of organic matter released during channelization and removal of sandbar. Higher BOD and lower DO can adversely affect fish downstream in the Guyandotte where reoxygenation is more difficult.

<u>Preliminary Mitigation Recommendations</u>

We recommend excavation of the stream be designed to leave an irregular shaped stream bottom and a low flow V notch. Historical minimum instream flow should dictate the design of low flow channel. Recommendations as to exact capacity and configuration of low flow channel will be provided as planning progresses. V-notch To the extent possible, bedrock ledges and outcrops should be left to provide refuge for fish within the main channel. If this is not possible, then boulder clusters and rock ring deflectors should be added to the excavated channel. We believe that these physical habitat measures should be provided to allow future recovery of fish and other aquatic life should stream water quality improve.

Mitigation for terrestrial losses should be based on habitat unit values. There is a deficit of 218.5 habitat units between the approximately 623 habitat units lost (Table 1) and the mitigation that has been proposed in the Huntington District's Environmental Design Measures (Table 2). Consequently, approximately five additional acres of bottomland hardwoods will need to be planted in addition to that in the environmental design. The plantings should consist of fruit-bearing trees and shrubs and other riparian tree species typical of this area. Additional mitigation plantings could be done by: 1) extending an easement in the remainder of the old field adjacent to the Super 8 Motel; 2) including the area within the CWL to be vacated by the Super 8 Motel; 3) including the area that is within the CWL adjacent to the removed sandbar at the upstream end of the project area. A conservation easement at the undeveloped bottomland hardwoods site adjacent to the CSX railroad bridge could provide additional mitigation land.

If the above measures do not provide adequate acreage to mitigate for habitat units lost then creation of habitat with a higher unit value per acre should be considered. This could involve creation of wetland habitat in an extended easement of the project boundary in the undeveloped site east of the CSX railroad bridge. This area has a 0.2 acre palustrine emergent and scrub-shrub wetland and investigation into this site for additional wetland creation is advised.

The maintenance road designed to parallel the top of the stone slope of the widened stream should be redesigned to avoid the top of slope and approach the mitigation area perpendicular to the stream. Planting of seedlings should start from the top of the stone slope. Establishment of vegetated buffer strips of 50 foot widths along the project length would provide for additional mitigation for riparian loss.

The contract with the Operation & Maintenance (O & M) sponsor should require permanent protection of the mitigation lands from development, vandalism, ORV damage, filling, and any activity that conflicts with the goals of preserving, restoring and maintaining mitigation areas. Evaluation of maintenance performance should be conducted by field inspection a minimum of two times per year until plantings are established and yearly thereafter. Survival of seedlings would be acceptable at 80% or greater after one year. Any amount less than that should be replanted.

Mitigation for the seven acres of upland hardwoods lost to spoil disposal should consist of revegetation of the spoil site. Revegetation should consist of well-mulched seeding of grasses for immediate erosion control and plantings of fruit-bearing trees and shrubs such as dogwoods (Cornus sp.), oaks (Quercus sp.), and viburnums. Plantings of trees and shrubs should be grouped to allow for maximum amount of edge. The area should be posted and otherwise protected against vandalism, dumping of trash, and ORV damage. This area will be particularly vulnerable until plantings are established because of a four wheel drive road through the site. Annual inspection of this area should occur to ensure its protection as a permanent mitigation area. deleted from project

Investigation and testing for contaminants in the old field west of the Super Eight 8 Motel should be conducted. This area has been filled and piles of soil are evident throughout the field; at least one small area was covered with black plastic in an apparent attempt to cover something. Removal of toxic materials during channel widening could release contaminants into the stream.

The fishery will be adversely impacted in the Guyandotte River during the construction phase. This loss should be compensated. Fishing opportunities in the project area are limited mainly to the Guyandotte River due to present water quality problems in Island Creek. A fishing access point on the Guyandotte near Logan could mitigate for the temporary reduction in fishing opportunities.

Please contact Linda Smith of my staff at 304-636-6586 if you have any questions regarding these comments. Please keep us advised of your progress on project plans.

Sincerely,

Christopher M Clower

Christopher M. Clower
Supervisor

Table 1. Baseline terrestrial habitat units in the Island Creek Project area and Wilkinson area spoil sites.

Upland Hardwoods			Bottomland hardwoods			Old Field			Riparian urban/industrial			Terrestrial (combined)	
HUV[1]	Area[2]	HU[3]	HUV	Area	HU	HUV	Area	HU	HUV	Area	HU	Area	HU
50	7.2	360	45	1.5	67.5	55	2.8	154	28	1.5	42	12.8	623.5

1/ Habitat Unit Values
2/ Acres
3/ Habitat Units

Table 2. Mitigation land as outlined in Environmental Design Measures.

Upland Hardwoods			Bottomland hardwoods			Old Field			Riparian urban/industrial			Terrestri (combined,	
HUV[1]	Area[2]	HU[3]	HUV	Area	HU	HUV	Area	HU	HUV	Area	HU	Area	HU
50	7.2	360	45	~~1.5~~ 1.0	45.0	-	-	-	-	-	-	51.0	405.0

1/ Habitat Unit Values
2/ Acres
3/ Habitat Units

References

United States Department of the Interior. Habitat Evaluation Procedures Report and Draft Fish and Wildlife Coordination Act Report. June 29, 1983. 32pp.

Barry

PD-1

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

DIVISION OF ECOLOGICAL SERVICES
1825B Virginia Street
Annapolis, Maryland 21401

June 29, 1983

Colonel John W. Devens
District Engineer
Huntington District, Corps of Engineers
502 Eighth Street
Huntington, West Virginia 25701

Dear Colonel Devens:

This constitutes our combined Habitat Evaluation Procedures (HEP) report and draft Fish and Wildlife Coordination Act (FWCA) report on the proposed Island Creek local flood protection project near Logan, Logan County, West Virginia. This report is submitted in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). It is intended to describe baseline conditions (1982) on the quantity and quality of fish and wildlife habitats in the Island Creek project area and quantify the impacts associated with the proposed project components. The report will provide a detailed mitigation plan for each project alternative. Major build components of the project are stream relocation and channelization, elevated floodway construction, and non-structural measures (floodway evacuation and flood proofing in-place).

Since 1978 we have submitted three planning aid letters. Our letter of June 6, 1978 described existing fish and wildlife resources, discussed resource-related problems and made suggestions for management or improvement of these resources. Letters of April 23, 1981 and March 9, 1982, discuss impacts associated with project alternatives being considered at that time and provided general mitigation measures to offset losses to fish and wildlife resources.

Description of Study Area

The major portion of the project impact area is the 100 year floodplain associated with 10.0 miles of Island Creek, 5.6 miles of Copperas Mine Fork, and 3.9 miles of Mud Fork. Four commercial/housing relocation sites being considered are located along the Guyandotte River upstream of Logan near McConnel. These sites are located in the floodplain of the Guyandotte River, although flood heights and frequencies have been significantly reduced by the completion of R. D. Bailey Dam near Justice. Four spoil disposal sites are located in the Island Creek watershed above the floodplain. Depending on the alternative, all or a portion of these areas could be employed.

The quality of the environment has been significantly affected in the densely populated study area. Including the relocation and spoil sites, the quality of fish and wildlife habitats in the impact area range from good to very poor. Most of this results from the fact that almost all development occurs in the bottomland along the stream due to the steep topography.

Most of the bottomlands along Island Creek, Copperas Mine Fork, and Mud Fork are limited to a narrow band of riparian vegetation and small stands of hardwoods. Disturbed areas have grown up in old fields adjacent to the dispersed, nearly continuous string of small towns. Major wildlife species found in the bottomlands of the study area are shore and wading birds, songbirds, furbearers, small mammals, amphibians, and reptiles. The bottomland and upland habitats associated with the spoil and relocation sites in particular are fair to good. Especially notable is the diverse breeding populations of resident and migrant songbirds. These relatively undisturbed well vegetated bottomlands and uplands provide the best wildlife habitat in the project area.

The aquatic resources of the impact area are greatly stressed by dense population. Resource related problems in the area include but are not limited to acid mine drainage, siltation from logging and mining, untreated domestic sewage, trash, dredging and filling, and general stream bank disturbances such as riprap, cribwalls, gas and sewer pipes and bridges.

Except for the upper reaches of Island Creek, some small relatively undisturbed tributaries, and the Guyandotte River mainstem, streams in the area have poor water quality which is generally incapable of supporting any aquatic life or at best a depressed resemblance of what would normally occur. However, due to good basic water chemistry and physical structure, many streams have the potential of supporting excellent aquatic communities Although game fish are present in Island Creek, mainly the upper reach, it supports a limited fishery. The Guyandotte River, however, does provide a good sport fishery featuring spotted bass, smallmouth bass, bluegill, walleye, flathead catfish, and channel catfish.

Terrestrial Habitat Evaluation

The bottomland and upland habitats are interspersed with housing, roads, railroads, industry, and small businesses throughout the major impact area. Habitat types evaluated include bottomland hardwoods (BH), upland hardwoods (UH), late old field (OF), agricultural (A), urban/industrial (U/I), and riparian urban/industrial (RU/I). The latter habitat type was separated out because of its inherent values to wildlife regardless of the high degree of disturbance or close association with the adjacent U/I habitat type, and these areas are likely to be most affected by any structural measure.

A very small, 0.2 acre, palustrine emergent and scrub-shrub wetland occurs along lower Island Creek (Planning Segment 1) and is surrounded by OF. The area was evaluated with the OF because of its small size, but its presence and benefits are reflected in an increased interspersion value for the OF.

Methods and Procedures

A 3-person team conducted the terrestrial habitat evaluation on the project area. The team members were Mr. Wallace Dean, Huntington District, Corps of Engineers (COE); Mr. Daniel Cincotta, West Virginia Department of Natural Resources (WVDNR), Wildlife Resources Division; and Mr. William Tolin, U.S. Fish and Wildlife Service (USFWS). Mr. Barry Passmore replaced Mr. Wallace Dean as the team representative for the COE on the aquatic HEP. Ms. Jackie Burns, USFWS, prepared the project cover maps.

Cover Mapping. The first step in preparation for the HEP was the construction of a base cover map to identify habitat types and determine the acreage of different habitat types subject to project impacts. This was accomplished through remote sensing techniques.

The Service obtained aerial photo mosaic/maps of the Island Creek, Copperas Mine Fork, and Mud Fork basins from the U.S. Army Corps of Engineers (COE). These mosaic/maps were printed on frosted mylar at a scale of approximately 1" = 500'. Since these mosaic maps did not include all the areas designated as possible spoil disposal or commercial/housing relocation sites, other aerial photos at a scale of approximately 1" = 1,000' were obtained from COE. These were standard 9x9 inch positive prints. Some were black and white (along the Guyandotte River) and some were color (along Island Creek, Copperas Mine Fork, and Mud Fork).

The photos and photo mosaic/maps were interpreted using a light table, hand magnifying glass and, for the photos only, a Bausch and Lomb (10x) double reflecting mirror stereoscope with zoom capabilities and Bausch and Lomb light table. Cover-type maps were made using frosted mylar, 3 mil. thick, and Pelikan China T ink.

Two criteria were used to select the habitat types to be mapped and evaluated: (1) the type must be describable and separable from aerial photographs and (2) the types must provide significantly different values to wildlife. Five distinct habitat types were mapped: upland hardwoods, bottomland hardwoods, late old field, agricultural, and urban-industrial. The habitat type riparian urban/industrial (RU/I) was evaluated but not mapped. Acreage of RU/I was estimated by multiplying length by average width.

The five habitat types were delineated by overlaying the mylar on the photos or photo mosaic maps. Leroy lettering templates and scriber were used to label the maps and legend. Acreages of the five major habitat types were determined by use of a Numonics electronic planimeter, Model 253-113. Xerox copies of the cover maps were provided to the COE to aid in preparation of the Draft Environmental Impact Statement (DEIS). The originals will not be presented in this report and are located in the Elkins Sub-office.

Evaluation Method. The method of HEP chosen by the team was a modified version of the basic habitat evaluation theory. The habitat is rated on its suitability to support all wildlife which would be expected. This method is often referred to as the Modified Missouri Method. No evaluation species were selected. The evaluation was essentially based on species guilding concept where groups of species, i.e., songbirds or furbearers or species representing a guild were discussed. A rating from 1 - 10 was assessed on a suitability of the habitat to provide food, cover, and reproduction requirements to wildlife. The habitat suitability values, or habitat unit value (HUV), then multiplied by the area of habitat (acres) is the habitat units (HU). The HUV was adjusted to the base 100 for ease of computation and for easier comparison purposes. This value can then be used to compute losses and gains at different stages during the life of the project. Due to the good accessibility to the project area, the entire project was censused and evaluated. Although the system is mostly subjective, based on biological value judgments, the figures are invaluable to make alternative comparisons, reflecting losses and gains, and identifying areas where project modification (impact reduction) or management can effect a change in habitat units.

Because the project area has a rather wide diversity of habitat quality, the area was broken into planning segments. These planning segments are similar in habitat quality and the impacts within these segments are similar. This segmentation allows a fairer evaluation overall since it prevents averaging good and poor habitats together which are subject to different degree and type of impact.

Table 1 presents a list of the planning segments along Island Creek, Copperas Mine Fork, and Mud Fork and the commercial/housing relocation and spoil disposal sites in the project area.

Baseline Assessment

Tables 2 and 3 summarize the terrestrial baseline HEP results. Standard Form No. 3-1101, usually used in recording and justifying HEP values, was not used. These tables and the following discussion provides the general rationale for assigning the habitat unit values.

Bottomland Hardwoods (BH). Quality of this habitat type ranges from poor to good. Availability of food items are fair except for the absence of some major food producers, i.e., oaks and dogwoods. Sycamore and river birch are dominant, although species diversity is high. The stands are uneven age with most being young. There is a general lack of mast producing species and den sites. Downed logs and detritus, rock, and lush vegetation offer adequate small mammal, amphibian, and reptile habitat. High human disturbance (negative interspersion) and very poor attitude toward wildlife make the area undesirable for most game species. Food, cover, and reproduction values to wildlife generally declines downstream due to the increased human population downstream.

Bottomland hardwoods on the commercial/housing relocation along the Guyandotte River are of much better quality. This is due mainly to the lesser amount of human disturbance. The areas have a greater diversity of mast producing tree species and den sites. These areas were uneven age as well, favoring mature individuals. Interspersion with the

Table 1. Breakdown of study area planning segments, commercial/housing relocation, and spoil sites.

FLOODPLAIN PLANNING SEGMENTS	
(Lower) Island Creek # 1	Confluence of Island Creek with Guyandotte River to mouth of Copperas Mine Fork.
(Middle) Island creek # 2	Mouth of Copperas Mine Fork upstream to Rossmore bridge.
(Upper) Island Creek # 3	Rossmore bridge to Barnabus.
Copperas Mine Fork # 4	Confluence with Island Creek to Davis.
Mud Fork # 5	Confluence with Copperas Mine Fork to Hedgeview.
COMMERCIAL/HOUSING RELOCATION	
# 2	Davy Branch on left descending bank of Guyandotte River upstream of Logan near Lyburn.
# 3	Sugar Branch on left descending bank of Guyandotte River near McConnel.
# 4	Beech Branch on left descending bank of Guyandotte River near McConnel.
# 5	Along left descending bank of Guyandotte River at Dabney upstream of Logan.
SPOIL SITES	
Milkhouse Hollow	Small tributary to Mud Fork at Lintz Addition.
Wilkinson	Small tributary to Island Creek at Wilkinson.
Lynn Branch	Island Creek just above Rossmore.
Miller Branch	Tributary to Island Creek at Chauncey.

Table 2. Results of baseline aquatic and terrestrial habitat evaluation on main floodplain planning segments.

PLANNING SEGMENT	TERRESTRIAL HABITAT TYPES					AQUATIC
	BH	UH	OF	U/I	RU/I	RUP 2/
(Lower) Island Creek # 1	45 1/	38	55	11	28	23.3
(Middle) Island Creek # 2	40	50	47	13	38	31.3
(Upper) Island Creek # 3	45	50	47	15	42	47.3
Copperas Mine Fork # 4	32	45	40	12	30	18.3
Mud Fork # 5	20	43	40	11	30	16.0

1/ Habitat Unit Value on a scale of 10 to 100.

2/ RUP - Riverine Upper Perrenial.

Table 3. Results of terrestrial habitat evaluation, baseline habitat units, for the commercial/housing relocation and spoil sites.

SITES	BOTTOMLAND HARDWOODS			UPLAND HARDWOODS			HABITAT TYPES OLD FIELD			URBAN/INDUSTRIAL			AGRICULTURE (A)			TOTALS	
	HUV 1/	AREA 2/	HU 3/	HUV	AREA	HU	HUV	AREA	HU	HUV	AREA	HU	HUV	AREA	HU	AREA	HU
COMMERCIAL/HOUSING																	
# 2	35	2.6	91	-	-	-	35	4.0	140	15	16.6	249	-	-	-	23.2	480
# 3	70	6.4	448	70	9.2	644	65	14.2	923	25	11.0	275	-	-	-	40.8	2,290
# 4	70	14.7	1,029	70	4.7	329	-	-	-	25	2.0	50	-	-	-	21.4	1,408
# 5	70	18.0	1,260	70	7.8	546	65	0.8	52	-	-	-	68	6.1	415	32.7	2,273
SPOIL																	
Milkhouse Hollow	-	-	-	50	50.9	2,545	40	1.8	72	15	1.1	16	-	-	-	53.8	2,633
Wilkinson	-	-	-	50	55.8	2,790	47	0.7	33	13	8.3	108	-	-	-	64.8	2,931
Miller Branch	-	-	-	50	41.8	2,090	-	-	-	15	9.6	144	-	-	-	51.4	2,234
Lynn Branch	-	-	-	50	38.8	1,940	47	3.0	141	-	-	-	-	-	-	41.8	2,123

1/ Habitat Unit Value.
2/ Acres
3/ Habitat Units = area x HUV.

Guyandotte River and relatively uudisturbed upland habitats make these bottomlands the best wildlife habitat in the study area. Species such as fox squirrel, wood duck (1 brood), kingfisher, raccoon, muskrat, and bull frog were observed utilizing these bottomland habitats.

Upland Hardwoods (UH). Upland hardwood communities are high in plant species diversity. Basic oak-hickory and cove hardwood communities make up this forest type. Characteristic of the study area is uneven age timber of fair quality. The habitat is more than adequate for songbirds, small mammals, and reptiles. However, problems pertaining to fire and general human disturbance degrades the habitat to most game species and degrades the habitat for all wildlife. The habitat value is inversely proportional to the degree of human disturbance. The habitats associated with the spoil sites are less subjected to human disturbances and are of average wildlife value. However, the uplands bordering the bottomlands on the commercial/ housing relocation sites are of even higher value due to their less disturbed nature and interspersion with the bottomlands.

Late Old Field (OF). This habitat type is less frequent in the basin and is the result of past human disturbance (old building, equipment, or stockpile sites, or logging). These areas are important to many wildlife species, including obligatory old field species, and also those edge or ecotone species needing it for only a portion of their life requirements. Its interspersion with other habitat types is, therefore, very important.

Old fields in the study area range from fair to good. Plant species diversity and abundance is high. These sites are generally better due to the richer bottomland soils. As with the other habitats it is degraded by human disturbance. Small game and non-game mammals, and birds heavily utilize these areas.

Urban/Industrial (U/I). The team decided that these areas at their very best could never provide average wildlife habitat. The team agreed that the best U/I habitat possible to achieve is an HUV of 40; the best we found in the study area is a 25. This is the most abundant habitat type in the study area. It provides very little value to wildlife because of its crowded unorganized nature. The U/I includes housing, mining, logging roads, gob piles, etc.

Early Old Field (EO) and Agricultural (A). None of the EO habitat type currently exists in significant independent sections to be mapped. However, significant amounts would be created and maintained as a result of any action alternative. Many existing acres, mainly U/I and RU/I, would be maintained in this habitat type. The maximum HUV achievabl for these habitat types would be 80. Because of the future crowded nature and use of these areas, and because these areas will be intersperse with some remaining major features such as a highway, railroads, or parking lots, these areas will provide below average wildlife habitat, 30, although of greater value than the existing U/I habitat type.

Riparian Urban/Industrial (RU/I). As explained earlier, these riparian areas were not mapped. It borders the U/I habitat type and provides, by far, the most valuable habitat associated with these highly developed areas. Most of these riparian areas are in an early seral stage, old field to immature bottomland. Sycamore, river birch, black willow, rose, grape and numerous herbaceous species comprise this community, although it is highly variable. Its extent was measured by multiplying length by its estimated width. These riparian areas could receive high impacts from those alternatives featuring elevated floodway construction. Limiting factors are the high human disturbance and often degraded water quality. Value of these areas to wildlife again decreases downstream.

Aquatic Habitat Evaluation

Methods and Procedures

The physical, chemical, and biological parameters of the aquatic habitats were evaluated and then rated on the 1 to 10 scale for quality or suitability for fish and other aquatic organisms. As with the terrestrial HEP, these habitat suitability values, HUV's were adjusted to the base 100 for ease of computation and comparison. The team gave these parameters equal weight based on its assumption that the quality of each, independent of the others, is a limiting factor for the aquatic ecosystem.

The field evaluation emphasized the physical feature of the habitat such as instream and riparian cover. The chemical and biological parameters were evaluated from existing field and literature surveys and observations made before and during the aquatic habitat evaluation.

The aquatic habitats of the project were broken down into stream reaches with similar physical, chemical, and biological values.

Baseline Assessment

Forms No. 3-1101 for the respective planning segments presents the results and justification for the aquatic evaluation (Appendix A). Table 2 summarizes these results and presents the baseline HUV's.

Summary of Terrestrial and Aquatic HEP

The evaluation describes a natural environment degraded by human disturbances. Problems stemming from poor land use practices and poor environmental attitudes have severely stressed the value to fish and wildlife resources in the main study area. This situation is the root of the need for the local flood protection project along Island Creek, Copperas Mine Fork, and Mud Fork. Significantly higher wildlife values are found in the relatively undisturbed bottomland along the Guyandotte River and uplands associated with the spoil areas. The basic vegetative communities and water chemistry of the area, however, have the potential to support viable urban and small game, fish, and wildlife populations. Improved land management practices, organized urban development, sewage treatment, and enforcement of existing environmental laws could improve the area.

WQ ? ?

Description of Alternatives

Although no final or official plans have been received in our office describing the project alternatives, the following is a description of the project as we understand it. The project life is assumed to be 50 years.

Alternative A

No action.

Alternative B

This alternative, simply stated, is purchase and evacuation of the 100 year floodway (establishment of a flowage easement) and floodproofing (raising in place) of structures in the fringe of the 100 year floodplain. This evacuation would establish a terrestrial flowage easement totalling approximately 300 acres, along 19.5 miles of stream, totalling 75.2 acres. Four commercial/housing relocation sites totalling approximately 118.0 acres along the Guyandotte River would be developed for the relocatees Project construction and implementation would take 7-1/2 years (1990 - 1997) and would be implemented in three phases: Island Creek (Phase I), Mud Fork (Phase II), and Copperas Fork Mine (Phase III).

Alternatives C and D

These alternatives are essentially identical except for order and timing of construction phases. Both plans entail dredging, filling, stream relocation, some evacuations, and constructing an elevated 100 year floodway. The total floodway construction plan for Island Creek is referred to as Channel Plan 1 (CP-1). This plan is segmented into 2 sections: CP-1A and CP-1B. Channel plan 1A involves 0.7 mile of lower Island Creek (Planning Segment # 1). A trapezoidal concrete lined channel would be constructed along the lower 1,000 feet above its confluence with the Guyandotte River. The rest of the reach would be rechanneled and have an elevated floodway. Channel Plan 1B involves 9.3 miles of middle and upper Island Creek (Planning Segments # 2 and # 3). The 100 year floodway would be evacuated and structures in the fringe would be raised. Except for the small section of Island Creek just upstream of the confluence of Copperas Mine Fork, the proposed channel construction does not involve direct disturbance to the stream bottom. The channel floodway would be constructed beginning one-foot above normal pool elevation. However, significant amounts of sediment will enter Island Creek and the Guyandotte River during construction. These sediment loads will reduce through time after construction.

Three of four commercial/housing relocation sites along the Guyandotte River, totalling approximately 97.0 acres, would be used. Four spoil sites, totalling 211.8 acres (three along Island Creek and one along Mud Fork) would be used.

The proposed 100 year flowage easement for Plans C and D would be approximately 214 acres, which is approximately 54 acres less than would be necessary to evacuate under Alternative B. This means that the structural channel work associated with Alternatives C and D reduces acquisition needs by approximately 54 acres.

Alternative C would be implemented in four phases over approximately eight years, 1990 thru 1998. The basic sequence would be to construct all channel work and then implement floodway evacuation. Floodway construction on Island Creek (Phase I) and flowage easement evacuation along Mud Fork, Copperas Mine Fork, and Island Creek (Phase II, III, and IV respectively) comprise the sequence.

Alternative D would be implemented in five phases over approximately eight years, 1989 through 1997, interspersing the channel work with evacuation. Phase I would entail structural work along lower Island Creek (CP-1A). Phase II and III would entail non-structural measures along Mud Fork and Copperas Mine Fork. Phase IV is structural work on middle and upper Island Creek (CP1B). Phase V entails non-structural work through this same section.

Alternative E

Alternative E is exactly the same as Alternative D with the exception that channel construction along middle and upper Island Creek, CP-1B, is eliminated. The project would begin in 1989 and be completed in 1997. Flowage easement evacuation would be approximately 240 acres, approximately 26.0 acres greater than Alternatives C and D. Therefore, channel construction of 9.3 miles of Island Creek would not have a significant effect on the level of protection, as it would only reduce acquisition needs by approximately 26.0 acres.

Impact Assessment

The following tables itemize baseline habitat units for each project alternative and habitat unit losses and gains by habitat type for each alternative, based on a comparison of future without project and future with project. Baseline data is the result of the modified HEP conducted during 1982. Baseline conditions vary among the alternatives because the alternatives involve different study area sizes. Future with and without project conditions is based on projections by the team of habitat type, quantity, and quality. Future without project conditions is based on an expected 20 percent population increase over the next 50 years, which we assumed would degrade the terrestrial values by 20 percent. Increased stream HUV's over the same period are based on the construction of a sewage treatment system for the project area and possible actions by Office of Surface Mining and WVDNR, Reclamation Division, to reclaim major coal mine pollution sources. Future with conditions is based on the floodway management decisions to maintain the evacuated U/I and R U/I areas and new floodways in early oldfield (EO) habitats, and allow existing BH, OF, and R U/I habitats not subjected to construction to succeed to BH. Spoil areas will be mulched, seeded, and planted with native trees and shrubs and allowed to revert naturally. On the commercial/housing sites, a buffer of 75 feet to the river and major tributaries would be maintained in BH.

Alternative A

The projected future without project conditions under the No Action Alternative would be the same as for Alternatives C and D (Table 8) with the addition of the data from housing relocation Site 4, which was not needed for C and D. Terrestrial acres would be 576.2 and terrestrial HU's would be 18,715.

Alternative B

Tables 4, 5, 6, and 13, summarize quantity and quality of fish and wildlife habitats in the impact area, baseline, future without project, and future with project. No aquatic or terrestrial compensation is required with this Alternative.

Alternatives C and D

Tables 7, 8, 9, and 13, summarize quantity and quality of fish and wildlife habitats in the impact area, baseline, future without project, and future with project. No terrestrial compensation will be required. However, substantial aquatic compensation will be required. Assuming an average 40 HUV/acre projected without project, a permanent loss of 392 HU's would require approximately 10 acres of lotic (stream) habitat. Assuming that lotic habitat is at least 2.5 times more productive than lentic habitat, construction of an impoundment of approximately 25 acres, including operation and maintenance funds, would be needed to replace these lost habitat units.

Alternative D has greater short-term impacts than C, since stream disturbance spans over the nine year construction and implementation period, while Alternative C stream work would be completed within the first three years. Short-term construction impacts are severe and require short-term compensation. These impacts include increased suspended sediments and turbidity to the Guyandotte River, which would reduce productivity and fishability. Increased suspended sediments and turbidity affects the aquatic community by filling in and covering suitable substrates, hampering invertebrate production and fish spawning. These conditions also raise water temperatures, often limiting aquatic productivity during lower flows usually experienced in the summer months. Additionally, these conditions impact the feeding activity of sight feeding fishes; bass, walleye, and sunfish, which are the desired game species, causing greatly reduced catchability. Over extended periods, species composition shifts can occur, favoring rough fish. The Guyandotte River is the only fishery in the immediate area and receives heavy fishing pressure. The loss of this fishery, even over the short-term, needs to be compensated.

Alternative E

Tables 10, 11, 12, and 13, summarize quantity and quality of fish and wildlife habitats in the impact area, baseline, future without project,

HABITAT TYPES

.D	URBAN/INDUSTRIAL			RIPARIAN URBAN/ INDUSTRIAL 4/			AGRICULTURE (A)			TERRESTRIAL (COMBINED)		AQUATIC RIVERINE UPPER PERENNIAL		
HU	HUV	AREA	HU	HUV	AREA	HU	HUV	AREA	HU	AREA	HU	HUV	AREA	HU
143	11	43.1	474	28	2.1	59	-	-	-	56.0	1,045	23.3	3.5	82
244	13	50.5	657	38	6.4	243	-	-	-	91.3	2,312	31.3	16.1	504
498	15	28.8	432	42	5.9	248	-	-	-	84.5	2,942	47.3	23.8	1,126
328	12	37.8	454	30	11.8	354	-	-	-	71.0	1,558	18.3	22.2	406
124	11	15.7	173	30	8.5	255	-	-	-	34.1	688	16.0	9.6	154
140	15	16.6	249	-	-	-	-	-	-	23.2	480	-	-	-
923	25	11.0	275	-	-	-	-	-	-	40.8	2,290	-	-	-
-	25	2.0	50	-	-	-	-	-	-	21.4	1,408	-	-	-
52	-	-	-	-	-	-	68	6.1	415	32.7	2,273	-	-	-
2,452		205.5	2,764		34.7	1,159		6.1	415	455.0	14,996		75.2	2,272

Table 5. Projected habitat units in impact area of Alternative B, future without project. 1/

PLANNING SEGMENTS	TERRESTRIAL AREA	TERRESTRIAL HU	HUV 2/	AQUATIC AREA 3/	HU 4/
# 1	-	-	30	3.5	105
# 2	-	-	35	16.1	564
# 3	-	-	47.3	23.8	1,126
# 4	-	-	30	22.2	666
# 5	-	-	30	9.6	288
TOTALS	455.0	11,997		75.2	2,749

1/ 20 percent degradation of terrestrial habitats assumed.

2/ Habitat Unit Value.

3/ Acres.

4/ Habitat Unit (area x HUV).

Table 6. Projected habitat units affected in impact area of Alternative B, future with project.

PLANNING SEGMENTS	HABITAT TYPES: BOTTOMLAND HARDWOODS			URBAN/INDUSTRIAL			EARLY OLD FIELD			TERRESTRIAL (COMBINED)			RIVERINE UPPER PERENNIAL		
	HUV 1/	AREA 2/	HU 3/	HUV	AREA	HU	HUV	AREA	HU	HUV	AREA	HU	HUV	AREA	HU
(Lower) Island Creek # 1	50	12.9	645	-	-	-	30	40.4	1,212	28	53.3	1,857	35	3.5	123
(Lower) Island Creek # 2	50	40.8	2,040	-	-	-	30	40.6	1,218	38	81.4	3,258	40	16.1	644
(Upper) Island Creek # 3	50	55.7	2,785	-	-	-	30	23.1	693	42	78.8	3,478	50	23.8	1,190
Copperas Mine Fork # 4	40	33.2	1,328	-	-	-	30	30.9	927	30	64.1	2,255	35	22.2	777
Mud Fork # 5	30	18.4	552	-	-	-	30	9.5	285	30	27.9	837	35	9.6	336
							(30	- 6.0	180)		(-6.0	180)			
Commercial/Housing Relocation															
# 2	50	4.9	245	15	18.3	275	-	-	-	-	23.2	520	-	-	-
# 3	50	7.2	360	15	33.6	504	-	-	-	-	40.8	864	-	-	-
# 4	50	3.4	170	15	18.0	270	-	-	-	-	21.4	440	-	-	-
# 5	50	5.1	255	15	27.6	414	-	-	-	-	32.7	669	-	-	-
TOTALS		181.6	8,380		97.5	1,463		138.5	4,155		417.6	13,998		75.2	3,070

1/ Habitat Unit Values.
2/ Acres.
3/ Habitat Units (HUV x AREA).

Table 7. Baseline habitat units in impact area of Alternatives C and D.

SITES	HABITAT TYPES: BOTTOMLAND HARDWOODS			TERRESTRIAL: UPLAND HARDWOODS			TERRESTRIAL: OLD FIELD			URBAN/INDUSTRIAL			RIPARIAN URBAN/ INDUSTRIAL 4/			AGRICULTURE (A)			TERRESTRIAL (COMBINED)		AQUATIC RIVERINE UPPER PERENNIAL		
	HUV 1/	AREA 2/	HU 3/	HUV	AREA	HU	HUV	AREA	HU	HUV	AREA	HU	HUV	AREA	HU	HUV	AREA	HU	AREA	HU	HUV	AREA	HU
Planning Segments																							
(Lower) Island Creek # 1	45	7.0	315	-	-	-	55	0.7	39	11	8.5	94	28	2.1	59	-	-	-	18.3	507	23.3	3.9	91
(Middle) Island Creek # 2	40	27.1	1,084	-	-	-	47	5.1	240	13	26.9	350	38	6.4	243	-	-	-	65.5	1,917	31.3	16.1	504
(Upper) Island Creek # 3	45	33.9	1,526	-	-	-	47	10.3	484	15	16.1	242	42	5.9	248	-	-	-	66.2	2,500	47.3	23.8	1,126
Copperas Mine Fork # 4	32	13.2	422	-	-	-	40	8.2	328	12	29.0	348	30	11.8	354	-	-	-	62.2	1,452	18.3	22.2	406
Mud Fork # 5	20	6.8	136	-	-	-	40	3.1	124	11	15.7	173	30	8.5	255	-	-	-	34.1	688	16.0	9.6	154
Commercial/ Housing																							
# 2	35	2.6	91	-	-	-	35	4.0	140	15	16.6	249	-	-	-	-	-	-	23.2	480	-	-	-
# 3	70	6.4	448	70	9.2	644	65	14.2	923	25	11.0	275	-	-	-	-	-	-	40.8	2,290	-	-	-
# 5	70	18.0	1,260	70	7.8	546	65	0.8	52	-	-	-	-	-	-	68	6.1	415	32.7	2,273	-	-	-
Spoil																							
Milkhouse Hollow	-	-	-	50	50.9	2,545	40	1.8	72	15	1.1	16	-	-	-	-	-	-	53.8	2,633	-	-	-
Wilkinson	-	-	-	50	55.8	2,790	47	0.7	33	13	8.3	108	-	-	-	-	-	-	64.8	2,931	-	-	-
Miller Branch	-	-	-	50	41.8	2,090	-	-	-	15	9.6	144	-	-	-	-	-	-	51.4	2,234	-	-	-
Lynn Branch	-	-	-	50	38.8	1,940	47	3.0	141	-	-	-	-	-	-	-	-	-	41.8	2,081	-	-	-
TOTALS		115.0	5,282		204.3	10,555		51.9	2,576		142.8	1,999		34.7	1,159		6.1	415	554.8	21,986		75.6	2,281

1/ Habitat Unit Values.
2/ Acres.
3/ Habitat Unit.

Table 8. Projected Habitat units in impact area of Alternative C and D, future without project. 1/

PLANNING SEGMENTS	HUV	AQUATIC AREA	AQUATIC HU	TERRESTRIAL AREA	TERRESTRIAL HU
# 1	30	3.9	117	-	-
# 2	35	16.1	564	-	-
# 3	47.3	23.8	1,126	-	-
# 4	30	22.2	666	-	-
# 5	30	9.6	288	-	-
TOTALS		75.6	2,761	554.8	17,589

1/ 20 percent degradation of terrestrial habitats assumed.

...ojected Habitat ... impact ... of Alternative C and D, future with project.

FLOODPLAIN PLANNING SEGMENTS	HABITAT T... TERRESTRIAL BOTTOMLAND HARDWOODS			UPLAND HARDWOODS			EARLY OLD FIELD			URBAN/INDUSTRIAL			TERRESTRIAL COMBINED		AQUATIC RIVERINE UPPER PERENNIAL		
	HUV 1/	AREA 2/	HU 3/	HUV	AREA	HU	HUV	AREA	HU	HUV	AREA	HU			HUV	AREA	HU
(Lower) Island Creek # 1	50	1.1	55	-	-	-	30	16.9	507	-	-	-	18.0	562	15	3.9	59
(Middle) Island Creek # 2	50	25.2	1,260	-	-	-	30	32.9	987	-	-	-	58.1	2,247	30	16.1	483
(Upper) Island Creek # 3	50	31.9	1,595	-	-	-	30	31.3	939	-	-	-	63.2	2,534	30	23.8	714
Copperas Mine Fork # 4	40	33.2	1,328	-	-	-	30	22.1	663	-	-	-	55.3	1.991	35	22.2	777
Mud Fork # 5	30	18.4	552	-	-	-	30	9.5	285	-	-	-	27.9	837	35	9.6	336
							(30	-6.0	180) 4/				(-6.0	180)			
Commercial/Housing Relocation																	
# 2	50	4.9	245	-	-	-	-	-	-	15	18.3	275	23.2	520	-	-	-
# 3	50	7.2	360	-	-	-	-	-	-	15	33.6	504	40.8	864	-	-	-
# 5	50	5.1	255	-	-	-	-	-	-	15	27.6	414	32.7	669	-	-	-
Spoil Sites																	
Milkhouse Hollow	-	-	-	50	53.8	2,690	-	-	-	-	-	-	53.8	2,690	-	-	-
Wilkinson	-	-	-	50	64.8	3,240	-	-	-	-	-	-	64.8	3,240	-	-	-
Miller Branch	-	-	-	50	51.4	2,570	-	-	-	-	-	-	51.4	2,570	-	-	-
Lynn Branch	-	-	-	50	41.8	2,090	-	-	-	-	-	-	41.8	2,090	-	-	-
TOTALS		127.0	5,540		211.8	10,590		106.7	3,201		79.5	1,193	525.0	20,634		75.6	2,369

1/ Habitat Unit Value.
2/ Acres.
3/ Habitat Units (HUV x ACRE).
4/ Minus 6.0 acres to be developed as mini-parts.

Table 10. P 'ine habitat units in impact are ' Alternative E.

SITES	BOTTOMLAND HARDWOODS			TERRESTRIAL UPLAND HARDWOODS			TERRESTRIAL OLD FIELD			HABITAT TYPES URBAN/INDUSTRIAL			RIPARIAN URBAN/INDUSTRIAL 4/			AGRICULTURE (A)			TERRESTRIAL (COMBINED)		AQUATIC RIVERINE UPPER PERENNIAL		
	HUV 1/	AREA 2/	HU 3/	HUV	AREA	HU	HUV	AREA	HU	HUV	AREA	HU	HUV	AREA	HU	HUV	AREA	HU	AREA	HU	HUV	AREA	HU
Planning Segments																							
(Lower) Island Creek # 1	45	7.0	315	-	-	-	55	0.7	39	11	8.5	94	28	2.1	59	-	-	-	18.3	507	23.3	3.9	91
(Middle) Island Creek # 2	40	28.7	1,148	-	-	-	47	5.2	244	13	35.3	459	38	6.4	243	-	-	-	75.6	2,094	31.3	16.1	504
(Upper) Island Creek # 3	45	39.2	1,764	-	-	-	47	10.6	498	15	28.8	432	42	5.9	248	-	-	-	84.5	2,942	47.3	23.8	1,126
Copperas Mine Fork # 4	32	13.2	422	-	-	-	40	8.2	328	12	29.0	348	30	11.8	354	-	-	-	62.2	1,452	18.3	22.2	406
Mud Fork # 5	20	6.8	136	-	-	-	40	3.1	124	11	15.7	173	30	8.5	255	-	-	-	34.1	688	16.0	9.6	154
Commercial/ Housing																							
# 2	35	2.6	91	-	-	-	35	4.0	140	15	16.6	249	-	-	-	-	-	-	23.2	480	-	-	-
# 3	70	6.4	448	70	9.2	644	65	14.2	923	25	11.0	275	-	-	-	-	-	-	40.8	2,290	-	-	-
# 5	70	18.0	1,260	70	7.8	546	65	0.8	52	-	-	-	-	-	-	68	6.1	415	32.7	2,273	-	-	-
Spoil Sites																							
Milkhouse Hollow	-	-	-	50	50.9	2,545	40	1.8	72	15	1.1	16	-	-	-	-	-	-	53.8	2,633	-	-	-
Wilkinson	-	-	-	50	55.8	2,790	47	0.7	33	13	8.3	108	-	-	-	-	-	-	64.8	2,931	-	-	-
TOTALS		121.9	5,584		123.7	6,525		49.3	2,453		154.3	2,154		34.7	1,159		6.1	415	490.0	18.290		75.6	2,281

1/ Habitat Unit Value.
2/ Acres.
3/ Habitat Units (HUV x AREA).
4/ Calculated on an average width.

Table 11. Projected habitat units in impact area Alternative E, future without project.

PLANNING SEGMENTS	HUV	AQUATIC AREA	HU	TERRESTRIAL AREA	HU 1/
# 1	30	3.9	117	-	-
# 2	35	16.1	564	-	-
# 3	47.3	23.8	1,126	-	-
# 4	30	22.2	666	-	-
# 5	30	9.6	288	-	-
TOTALS		75.6	2,761	490.0	14,623

1/ 20 percent degradation of terrestrial habitats assumed.

E, future with project.

HABITAT TYPES												
TERRESTRIAL ARDWOODS		EARLY OLD FIELD			URBAN/INDUSTRIAL			TERRESTRIAL (COMBINED)		AQUATIC RIVERINE UPPER PERENNIAL		
EA	HU	HUV	AREA	HU	HUV	AREA	HU	AREA	HU	HUV	AREA	HU
	-	30	16.9	507	-	-	-	18.0	562	15	3.9	59
	-	30	25.4	762	-	-	-	65.7	2,777	40	16.1	644
	-	30	23.1	693	-	-	-	78.8	3,478	50	23.8	1,190
	-	30	22.1	663	-	-	-	55.3	1,991	35	22.2	777
	-	30	9.5	285	-	-	-	27.9	837	35	9.6	336
		(30	- 6.0	180) 4/				(-6.0	180)			
	-	-	-	-	15	18.3	275	23.2	520	-	-	-
	-	-	-	-	15	33.6	504	40.8	864	-	-	-
	-	-	-	-	15	27.6	414	32.7	669	-	-	-
8	2,690	-	-	-	-	-	-	53,8	2,690	-	-	-
8	3,240	-	-	-	-	-	-	64.8	3,240	-	-	-
6	5,930		91.0	2,730		79.5	1,193	455.0	17,448		75.6	3,006

Table E-4

Table 13. Comparison of habitat units with and without project for the action alternatives. 1/

		ALTERNATIVES					
		B TERRESTRIAL	B AQUATIC	C & D TERRESTRIAL	C & D AQUATIC	E TERRESTRIAL	E AQUATIC
1	Baseline	14,996	2,272	21,986	2,281	18,290	2,281
2	Future without	11,997	2,749	17,589	2,761	14,632	2,761
		(+) 2,001	(+) 321	(+) 3,045	(-) 392	(+) 2,816	(+) 245
3	Future with	13,998	3,070	20,634	2,369	17,448	3,006

1/ Net gain or loss (3-2) (+) No compensation required based on life of project (50 years).
(-) Compensation required based on life of project (50 years).

and future with project. As we understand it, this alternative, in all likelihood, will be the selected alternative. No long-term terrestrial or aquatic compensation is required (Table 13). However, short-term construction impacts are severe and require short-term compensation. These impacts will be the same as experienced for Alternatives C and D but over a shorter period of time with a shorter recovery period.

Mitigation

The negative impacts which could result with project alternatives are (1) permanent destruction and/or severe short-term disturbance to aquatic and riparian habitats along 10.0 miles of Island Creek, (2) severe chronic siltation and resuspension of streambed pollutants in 10.0 miles of Island Creek and the Guyandotte River, (3) permanent to partial loss of approximately 118.0 acres of productive bottomland habitat (relocation sites) which is in short supply in this region of the State, and (4) temporary loss of 212.0 acres of good upland hardwood habitat from spoil disposal.

Positive impacts which could result with the project alternatives include: (1) evacuation of the flowage easement, approximately 300 acres, along 19.5 miles of stream resulting in improved bottomland and riparian habitat and improved water quality and physical stream habitat, (2) legal protection to approximately 212.0 acres of upland wildlife habitat (the spoil disposal sites). These sites also have small perennial or intermittent streams traversing them, and (3) general reorganization and improvement of sewage treatment and trash collection systems.

A number of means are available to mitigate for adverse impacts. The U.S. Fish and Wildlife Service's Mitigation Policy, as published in the Federal Register on January 23, 1981, and corrected on February 4, 1981, defines mitigation as a 5-part process to include:

> "(a) avoiding the impact altogether by not taking a certain action or parts of an action; (b) minimizing impacts by limiting the degree or magnitude of the action and its implementation; (c) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (d) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and (e) compensating for the impact by replacing or providing substitute resource or environments."

Mitigation for the project over the planning period will be viewed and discussed in keeping with the above definition. Significant Service and State input over the planning period regarding impact reduction and avoidance have, in part, resulted in significant modifications to the plan alternatives.

Avoid the Impact. Measures which avoid impact includes: elimination of channelization along Copperas Mine Fork and Mud Fork; and elimination of concrete lined channels in the project area.

Minimize Impact. Measures which minimize project impacts include: selection of the least damaging alternative; modification of stream channel work to one-sided, elevated floodway construction with no instream disturbance; control sedimentation and turbidity from stream work and spoil areas by adoption of Best Management Practices.

Rectify the Impact. Reclaim areas disturbed during construction through mulching, seeding, and selective shrub and tree planting along disturbed stream reaches and spoil areas; establish and maintain vegetative buffers to the Guyandotte River and other tributaries in the relocation areas.

Reduce or Eliminate the Impact over Time. Enforce and maintain stated uses of project lands; monitor the process; allow natural succession to occur as planned; provide for operation and maintenance of specific mitigation features for as long as needed.

Compensate for Impact. Reclaim certain stream bank or instream problems which have occurred in the past, (e.g., cribwalls, bridges, trash dumps, etc.,) which would improve fish and wildlife habitat within the flowage easement. Compensation of terrestrial impacts are not necessary for any of the plan alternatives, however, short-term aquatic compensation will be required for Alternative E and short-term and long-term aquatic compensation will be required in Alternatives C and D, e.g., construction of small impoundment in the Logan area, extension of flowage easement up Island Creek, Copperas Mine or Mud Fork, or other large tributary, abatement of chronic pollution, acid mine or sedimentation, from some of the many sources, (e.g., acid mine outfall above Monaville on Island Creek), or maintenance dredging in the upper end of Laurel Creek Lake located in Laurel Creek Public Hunting Area to return this portion of the lake back to depths suitable for sport fish habitation. We are presently coordinating with the WVDNR, Wildlife Resources Division, to identify adequate project compensation. Emphasis is being placed on the short-term impacts of the favored Alternative E.

A compensation proposal suggested by the COE, increased fish stocking in Laurel Creek Lake in the Laurel Creek Public Hunting Area, is presently undesirable to WVDNR. Streams in West Virginia which receive such fish are already fully stocked by certain criteria set by the Wildlife Resources Division.

Summary

Unlike most flood protection projects, implementation of certain alternatives, Alternative B, and to a lesser extent, Alternative E, would be beneficial to the fish and wildlife resources of the project area. All alternatives have positive terrestrial impacts with no compensation requirement, while Alternatives C and D require short-term and long-term aquatic compensation and Alternative E requires only short-term compensation.

The U.S. Fish and Wildlife Service strongly favors the non-structural Alternative B. Of the structural measures, we would not oppose Alternative E, if mitigated as described. We are opposed to Alternatives C and D since less impacting alternatives exist. In addition, any change of design or construction from what we presently understand would make it necessary to re-evaluate project alternatives.

Sincerely yours,

Glenn Kinser
Supervisor
Annapolis Field Office

APPENDIX A

AQUATIC HEP RESULTS AND JUSTIFICATION

FISH AND WILDLIFE HABITAT FIELD EVALUATION SHEETS

FORM NO. 3-1101

U.S. FISH AND WILDLIFE SERVICE
DIVISION OF ECOLOGICAL SERVICES

FISH AND WILDLIFE HABITAT FIELD EVALUATION SHEET

Page ______ of ______ pages

PROJECT NAME: Island Creek LPP

DATE: 6/25/82

HABITAT CODE:

HABITAT TYPE: Riverine upper perennial - Lower Island

ALTERNATIVE PLAN:

EVALUATION ELEMENTS

SAMPLE SITE IDENTIFICATION NUMBER	Physical	Chemical	Biological								LINE TOTAL
Reach # 1	3.5	2.0	1.5								
TOTAL EVALUATION ELEMENT VALUES	3.5	2.0	1.5								

Grand Total of All Evaluation Elements / Number of Sample Sites = ______ =

HABITAT TYPE UNIT VALUE: 23.3

MANAGEMENT POTENTIAL UNIT VALUE *(Wildlife habitat only)*:

INSTRUCTIONS

In order to evaluate the impact of the plan on the fish and wildlife habitat, it is necessary to know the value of the habitat itself. Here, each habitat type is assigned a value according to its worth for fish or wildlife. These resources are to be evaluated separately, and impacts and compensation needs are also computed separately. To determine this habitat type unit value, the evaluation team will complete a Form No. 3-1101 for each habitat type as follows:

1. Select ten representative species that are dependent to some degree on the habitat type being evaluated and which best express its diversity. These will be used in rating the sample sites. List them across the top of the chart at the left. The reasons for selecting these particular species should be noted and appended to this form. The objective is to consider the full range of animal life in assessing habitat quality. Normally ten species are selected, however the number of species used to evaluate a particular habitat type may vary. If another number is chosen, the rationale for this must be noted on the back of this form. These species, or evaluation elements, may not vary within a habitat type.
2. Select a number of sample sites agreeable to all members of the evaluation team. This number may vary with different habitat types.
3. Rate the capability of the habitat to meet the requirements of each of the evaluation elements on a scale of 1 through 10 at each sample site, the higher rating being given to the more desirable sites. All evaluation elements must be rated at each sample site.
4. The key criteria involved in making the above judgement should be recorded on the back of this form or on a separate sheet and attached.
5. Sum the values in each Evaluation Element column vertically, and write this number at the bottom of the column.
6. Sum each Sample Site line horizontally and sum the Total Evaluation Element Column. Write

SIGNATURE OF LEAD PLANNING AGENCY REPRESENTATIVE

LEAD PLANNING AGENCY: COE, Huntington District

SIGNATURE OF STATE REPRESENTATIVE

STATE AGENCY: Wildlife Resources, WVDNR

SIGNATURE OF FWS REPRESENTATIVE

ES FIELD OFFICE: Elkins Sub-office, U.S. FWS

Form No. 3-1101 (MAY 1976)

(Over)

the totals in the spaces provided. Note that if more than ten evaluation elements are used, a second Form No. 3-1101 must be used and the line totals from one sheet carried forward to the second.

7. Divide the Grand Total of All Evaluation Elements by the Number of Sample Sites. If ten evaluation elements were used, this number is the Habitat Type Unit Value for the habitat type being evaluated, and this number should be written in the box provided at the bottom of the Form No. 3-1101. If more or fewer than ten evaluation elements are used, then the number obtained by this division operation must be prorated, for example: if only five evaluation elements are used, then the quotient must be multiplied by 10/5. If twelve evaluation elements were used, then the quotient must be multiplied by 10/12. This product is the Habitat Type Unit Value in these cases and is the number that should be written down in the box at the bottom of the form.

(Additional instructions for wildlife habitat types)

8. Using professional judgement, the evaluation team no estimates the increase in wildlife habitat type unit va possible by proper management of the resources prese This is the Management Potential Unit Value. Write this number at the bottom of the form in the box provided. The sum of this number and the Habitat Type Unit Value must not exceed 100. If they do, the Management Potential Unit Value must be reduced accordingly.

9. For wildlife habitat, an interspersion value may be determined. If this is done, the evaluation continues on Form No. 3-1102.

Physical	Riparian - good overhanging mature vegetation source of shade, den sites, and food. Small area at mouth concrete lined.
	Instream - Extreme siltation.
Chemical	Sewage severe but marginal. Turbidity and suspended sediments high. High iron content.
Biological	Greatly supressed instream populations.

U.S. FISH AND WILDLIFE SERVICE
DIVISION OF ECOLOGICAL SERVICES

FISH AND WILDLIFE HABITAT FIELD EVALUATION SHEET

Page ______ of ______ pages

PROJECT NAME: Island Creek LPP

DATE: 6/23/82

HABITAT CODE:

HABITAT TYPE: Riverine, upper perennial - Lower Island

ALTERNATIVE PLAN:

SAMPLE SITE IDENTIFICATION NUMBER	EVALUATION ELEMENTS: Physical	Chemical	Biological								LINE TOTAL
Reach # 2	4.7	2.2	2.5								9.4
TOTAL EVALUATION ELEMENT VALUES	4.7	2.2	2.5								9.4

$$\frac{\text{Grand Total of All Evaluation Elements}}{\text{Number of Sample Sites}} = \frac{9.4 \times 10}{3} =$$

HABITAT TYPE UNIT VALUE: 31.3

MANAGEMENT POTENTIAL UNIT VALUE *(Wildlife habitat only)*:

INSTRUCTIONS

In order to evaluate the impact of the plan on the fish and wildlife habitat, it is necessary to know the value of the habitat itself. Here, each habitat type is assigned a value according to its worth for fish or wildlife. These resources are to be evaluated separately, and impacts and compensation needs are also computed separately. To determine this habitat type unit value, the evaluation team will complete a Form No. 3-1101 for each habitat type as follows:

1. Select ten representative species that are dependent to some degree on the habitat type being evaluated and which best express its diversity. These will be used in rating the sample sites. List them across the top of the chart at the left. The reasons for selecting these particular species should be noted and appended to this form. The objective is to consider the full range of animal life in assessing habitat quality. Normally ten species are selected, however the number of species used to evaluate a particular habitat type may vary. If another number is chosen, the rationale for this must be noted on the back of this form. These species, or evaluation elements, may not vary within a habitat type.

2. Select a number of sample sites agreeable to all members of the evaluation team. This number may vary with different habitat types.

3. Rate the capability of the habitat to meet the requirements of each of the evaluation elements on a scale of 1 through 10 at each sample site, the higher rating being given to the more desirable sites. All evaluation elements must be rated at each sample site.

4. The key criteria involved in making the above judgement should be recorded on the back of this form or on a separate sheet and attached.

5. Sum the values in each Evaluation Element column vertically, and write this number at the bottom of the column.

6. Sum each Sample Site line horizontally and sum the Total Evaluation Element Column. Write

SIGNATURE OF LEAD PLANNING AGENCY REPRESENTATIVE

LEAD PLANNING AGENCY: COE, Huntington District

SIGNATURE OF STATE REPRESENTATIVE

STATE AGENCY: Wildlife Resources, WVDNR

SIGNATURE OF FWS REPRESENTATIVE

ES FIELD OFFICE: Elkins Sub-Office, U.S.FWS

Form No. 3-1101 (MAY 1976) (Over)

the totals in the spaces provided. Note that if more than ten evaluation elements are used, a second Form No. 3-1101 must be used and the line totals from one sheet carried forward to the second.

7. Divide the Grand Total of All Evaluation Elements by the Number of Sample Sites. If ten evaluation elements were used, this number is the Habitat Type Unit Value for the habitat type being evaluated, and this number should be written in the box provided at the bottom of the Form No. 3-1101. If more or fewer than ten evaluation elements are used, then the number obtained by this division operation must be prorated, for example: if only five evaluation elements are used, then the quotient must be multiplied by 10/5. If twelve evaluation elements were used, then the quotient must be multiplied by 10/12. This product is the Habitat Type Unit Value in these cases and is the number that should be written down in the box at the bottom of the form.

(Additional instructions for wildlife habitat types)

8. Using professional judgement, the evaluation team nc estimates the increase in wildlife habitat type unit va. possible by proper management of the resources present. This is the Management Potential Unit Value. Write this number at the bottom of the form in the box provided. The sum of this number and the Habitat Type Unit Value must not exceed 100. If they do, the Management Potential Unit Value must be reduced accordingly.

9. For wildlife habitat, an interspersion value may be determined. If this is done, the evaluation continues on Form No. 3-1102.

Physical (Rated 4.7)

Riparian - Habitat ranged from fair to excellent; as the stream becomes larger people gave in somewhat greater respect, leaving the riparian area relatively undisturbed. Medium age timber completely shade the stream in most places.

Instream - Habitat was affected. Heavy siltation and shift sand substrates. Iron precipitates heavy throughout reach.

Chemical (Rated 2.2)

Acid mine waste - high iron and suspended solids.

Biological (Rated 2.5)

Poor - Same basic communities and populations as upstream, although diversity and abundance much lower. Greatly stressed system.

U.S. FISH AND WILDLIFE SERVICE
DIVISION OF ECOLOGICAL SERVICES

FISH AND WILDLIFE HABITAT FIELD EVALUATION SHEET

Page ______ of ______ pages

PROJECT NAME: Island Creek LPP

DATE: 6/22/82

HABITAT CODE:

HABITAT TYPE: Riverine upper perennial - Upper Island

ALTERNATIVE PLAN:

SAMPLE SITE IDENTIFICATION NUMBER	Physical	Chemical	Biological								LINE TOTAL
Reach # 3	5.0	4.8	4.4								14.2
TOTAL EVALUATION ELEMENT VALUES	5.0	4.8	4.4								14.2

Grand Total of All Evaluation Elements / Number of Sample Sites = $\frac{14.2 \times 10}{3}$ =

HABITAT TYPE UNIT VALUE: 47.3

MANAGEMENT POTENTIAL UNIT VALUE (Wildlife habitat only):

INSTRUCTIONS

In order to evaluate the impact of the plan on the fish and wildlife habitat, it is necessary to know the value of the habitat itself. Here, each habitat type is assigned a value according to its worth for fish or wildlife. These resources are to be evaluated separately, and impacts and compensation needs are also computed separately. To determine this habitat type unit value, the evaluation team will complete a Form No. 3-1101 for each habitat type as follows:

1. Select ten representative species that are dependent to some degree on the habitat type being evaluated and which best express its diversity. These will be used in rating the sample sites. List them across the top of the chart at the left. The reasons for selecting these particular species should be noted and appended to this form. The objective is to consider the full range of animal life in assessing habitat quality. Normally ten species are selected, however the number of species used to evaluate a particular habitat type may vary. If another number is chosen, the rationale for this must be noted on the back of this form. These species, or evaluation elements, may not vary within a habitat type.

2. Select a number of sample sites agreeable to all members of the evaluation team. This number may vary with different habitat types.

3. Rate the capability of the habitat to meet the requirements of each of the evaluation elements on a scale of 1 through 10 at each sample site, the higher rating being given to the more desirable sites. All evaluation elements must be rated at each sample site.

4. The key criteria involved in making the above judgement should be recorded on the back of this form or on a separate sheet and attached.

5. Sum the values in each Evaluation Element column vertically, and write this number at the bottom of the column.

6. Sum each Sample Site line horizontally and sum the Total Evaluation Element Column. Write

SIGNATURE OF LEAD PLANNING AGENCY REPRESENTATIVE	LEAD PLANNING AGENCY: COE, Huntington District
SIGNATURE OF STATE REPRESENTATIVE	STATE AGENCY: Wildlife Resources, WVDNR
SIGNATURE OF FWS REPRESENTATIVE	ES FIELD OFFICE: Elkins Sub-Office, U.S. FWS

Form No. 3-1101 (MAY 1976) (Over)

the totals in the spaces provided. Note that if more than ten evaluation elements are used, a second Form No. 3-1101 must be used and the line totals from one sheet carried forward to the second.

. Divide the Grand Total of All Evaluation Elements by the Number of Sample Sites. If ten evaluation elements were used, this number is the Habitat Type Unit Value for the habitat type being evaluated, and this number should be written in the box provided at the bottom of the Form No. 3-1101. If more or fewer than ten evaluation elements are used, then the number obtained by this division operation must be prorated, for example: if only five evaluation elements are used, then the quotient must be multiplied by 10/5. If twelve evaluation elements were used, then the quotient must be multiplied by 10/12. This product is the Habitat Type Unit Value in these cases and is the number that should be written down in the box at the bottom of the form.

(Additional instructions for wildlife habitat types)

8. Using professional judgement, the evaluation team now estimates the increase in wildlife habitat type unit value possible by proper management of the resources present. This is the Management Potential Unit Value. Write this number at the bottom of the form in the box provided. The sum of this number and the Habitat Type Unit Value must not exceed 100. If they do, the Management Potential Unit Value must be reduced accordingly.

9. For wildlife habitat, an interspersion value may be determined. If this is done, the evaluation continues on Form No. 3-1102.

	Parameters (Exclude aesthetics)
Physical	Riparian - Riparian area is poor to excellent. Road and bridge construction, miscellaneous encroachment in poorer areas have resulted in loss of shade, food, and cover. Instream - Substrate, pool-riffle-run, flows. Moderate to heavy siltation (some is normal). Streambed disturbance through bridge construction, gravel removal, small bridge construction, pipeline crossing. Junk and debris present. (4). Pool-riffle combination good, however, stream lacks good depth and is shallower than normal through long reaches due to sedimentation. (4). Flows because of mismanaged watershed are unusually high or low (loss of riparian cover). Critical low flow and high organic inputs are also degrading the area in most years. (3)
Chemical	Basic water quality parameters. Raw sewage, iron precipitates in lower section 1/5, high sediment and turbidity. (1.5) Good taxa count regardless. D.O. sustained.
Biological	Biomoss - good Diversity - low Species composition - lacks predators, mostly rough fish.

U.S. FISH AND WILDLIFE SERVICE
DIVISION OF ECOLOGICAL SERVICES

FISH AND WILDLIFE HABITAT FIELD EVALUATION SHEET

Page ______ of ______ pages

PROJECT NAME: Island Creek LPP

DATE: 6/23/82

HABITAT CODE:

HABITAT TYPE: Riverine upper perennial - Copperas Mine

ALTERNATIVE PLAN:

EVALUATION ELEMENTS

SAMPLE SITE IDENTIFICATION NUMBER	Physical	chemical	Biological								LINE TOTAL
Reach # 4	2.7	1.4	1.4								5.5
TOTAL EVALUATION ELEMENT VALUES	2.7	1.4	1.4								5.5

Grand Total of All Evaluation Elements / Number of Sample Sites = $\frac{5.5 \times 10}{3}$ =

HABITAT TYPE UNIT VALUE: 18.3

MANAGEMENT POTENTIAL UNIT VALUE (Wildlife habitat only):

INSTRUCTIONS

In order to evaluate the impact of the plan on the fish and wildlife habitat, it is necessary to know the value of the habitat itself. Here, each habitat type is assigned a value according to its worth for fish or wildlife. These resources are to be evaluated separately, and impacts and compensation needs are also computed separately. To determine this habitat type unit value, the evaluation team will complete a Form No. 3-1101 for each habitat type as follows:

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2. Select a number of sample sites agreeable to all members of the evaluation team. This number may vary with different habitat types.
3. Rate the capability of the habitat to meet the requirements of each of the evaluation elements on a scale of 1 through 10 at each sample site, the higher rating being given to the more desirable sites. All evaluation elements must be rated at each sample site.
4. The key criteria involved in making the above judgement should be recorded on the back of this form or on a separate sheet and attached.
5. Sum the values in each Evaluation Element column vertically, and write this number at the bottom of the column.
6. Sum each Sample Site line horizontally and sum the Total Evaluation Element Column. Write

SIGNATURE OF LEAD PLANNING AGENCY REPRESENTATIVE

LEAD PLANNING AGENCY: COE, Huntington District

SIGNATURE OF STATE REPRESENTATIVE

STATE AGENCY: Wildlife Resources, WVDNR

SIGNATURE OF FWS REPRESENTATIVE

ES FIELD OFFICE: Elkins Sub-Office, U.S. FWS

Form No. 3-1101 (MAY 1976) (Over)

the totals in the spaces provided. Note that if more than ten evaluation elements are used, a second Form No. 3-1101 must be used and the line totals from one sheet carried forward to the second.

7. Divide the Grand Total of All Evaluation Elements by the Number of Sample Sites. If ten evaluation elements were used, this number is the Habitat Type Unit Value for the habitat type being evaluated, and this number should be written in the box provided at the bottom of the Form No. 3-1101. If more or fewer than ten evaluation elements are used, then the number obtained by this division operation must be prorated, for example: if only five evaluation elements are used, then the quotient must be multiplied by 10/5. If twelve evaluation elements were used, then the quotient must be multiplied by 10/12. This product is the Habitat Type Unit Value in these cases and is the number that should be written down in the box at the bottom of the form.

(Additional instructions for wildlife habitat types)

8. Using professional judgement, the evaluation team n(estimates the increase in wildlife habitat type unit va possible by proper management of the resources present. This is the Management Potential Unit Value. Write this number at the bottom of the form in the box provided. The sum of this number and the Habitat Type Unit Value must not exceed 100. If they do, the Management Potential Unit Value must be reduced accordingly.

9. For wildlife habitat, an interspersion value may be determined. If this is done, the evaluation continues on Form No. 3-1102.

Physical	Riparian - Below average stream cover. Some good reaches, however, overall it is in the low side of average.
	Instream - Siltation severe consisting of constantly shifting and filling from sand, coal fines, and gravel. Some disturbance from channelization. Some pools one foot deep.
Chemical	Many chronic problems - everything imaginable. Low pH, high iron, sewage, siltation.
Biological	Read bad!

U.S. FISH AND WILDLIFE SERVICE
DIVISION OF ECOLOGICAL SERVICES

FISH AND WILDLIFE HABITAT FIELD EVALUATION SHEET

Page ______ of ______ pages

PROJECT NAME: Island Creek LPP

DATE: 6/23/82

ALTERNATIVE PLAN:

HABITAT CODE:

HABITAT TYPE: Riverine upper perennial - Mud Fork

SAMPLE SITE IDENTIFICATION NUMBER	Physical	Chemical	Biological								LINE TOTAL
Reach # 5	2.6	1.1	1.1								4.8
TOTAL EVALUATION ELEMENT VALUES	2.6	1.1	1.1								4.8

Grand Total of All Evaluation Elements / Number of Sample Sites = 4.8 x 10 / 3 =

HABITAT TYPE UNIT VALUE: 16

MANAGEMENT POTENTIAL UNIT VALUE (*Wildlife habitat only*):

INSTRUCTIONS

In order to evaluate the impact of the plan on the fish and wildlife habitat, it is necessary to know the value of the habitat itself. Here, each habitat type is assigned a value according to its worth for fish or wildlife. These resources are to be evaluated separately, and impacts and compensation needs are also computed separately. To determine this habitat type unit value, the evaluation team will complete a Form No. 3-1101 for each habitat type as follows:

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5. Sum the values in each Evaluation Element column vertically, and write this number at the bottom of the column.
6. Sum each Sample Site line horizontally and sum the Total Evaluation Element Column. Write

SIGNATURE OF LEAD PLANNING AGENCY REPRESENTATIVE

LEAD PLANNING AGENCY: COE, Huntington District

SIGNATURE OF STATE REPRESENTATIVE

STATE AGENCY: Wildlife Resources, WVDNR

SIGNATURE OF FWS REPRESENTATIVE

ES FIELD OFFICE: Elkins Sub-Office, U.S. FWS

Form No. 3-1101 (MAY 1976)

(Over)

the totals in the spaces provided. Note that if more than ten evaluation elements are used, a second Form No. 3-1101 must be used and the line totals from one sheet carried forward to the second.

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(Additional instructions for wildlife habitat types)

8. Using professional judgement, the evaluation team now estimates the increase in wildlife habitat type unit value possible by proper management of the resources present. This is the Management Potential Unit Value. Write this number at the bottom of the form in the box provided. The sum of this number and the Habitat Type Unit Value must not exceed 100. If they do, the Management Potential Unit Value must be reduced accordingly.

9. For wildlife habitat, an interspersion value may be determined. If this is done, the evaluation continues on Form No. 3-1102.

Physical	Riparian - Poor to fair. Encroachment and clearing.
	Instream - pool/riffle poor - fair. Cover poor to fair, siltation and shifting bottom. Flows low in summer due to small watershed and lack of depth from filling.
Chemical	Bad. Sewage, high iron, acid, siltation, and high shifting bed loading.
Biological	Essentially no life instream.

DIVISION OF NATURAL RESOURCES
Wildlife Resources Section
Capitol Complex, Building 3, Room 812
1900 Kanawha Boulevard, East
Charleston WV 25305-0664
Telephone (304) 558-2771
Fax (304) 558-3147
TDD 1-800-354-6087

Bob Wise
Governor

Ed Hamrick
Director

February 21, 2001

Mr. Larry M. Workman
Acting Chief, Environmental Analysis Section
U.S. Corps of Engineers
502 Eighth Street
Huntington, WV 25701

Dear Mr. Workman:

Thank you for the opportunity to comment on the Draft Environmental Assessment (DEA) for Island Creek Local Protection Plan, Logan County, West Virginia dated January 2000. This plan is a reduced version of both the original local protection plan that was completed in 1986 and the 1993 General Re-evaluation Study. It calls for the installation of a state-of-the-art flood warning system and for the channelization of approximately 0.7 miles of Island Creek beginning at its mouth to the Guyandotte River and proceeding upstream.

The Division of Natural Resources concurs that a need exists for flood prevention measures in this drainage. However, the continued construction and filling activities in the Island Creek flood plain, as mentioned in the DEA, causes us great concern. Severe action, such as stream channelization, should be an action of last resort. The filling activity since the initial study should be investigated and action should be taken to restore the original flood plain before any protection plan, other than a warning system, is considered.

If, after flood plain restoration, a need still exists for further action, methods other than stream channelization and widening should be considered. It is known that stream widening has a severe impact on the aquatic ecosystem. By widening the flow, you will decrease water depth and velocity. Shallow depths result in increased water temperatures and decreased oxygen levels which are harmful to aquatic life. Decreased water velocities lower the stream's ability to transport sediment loads. This will result in sediment deposition which will cover and destroy aquatic habitats, decrease the area's ability to store flood waters and cause a continuous aesthetic and maintenance problem from collected debris.

Mr. Larry M. Workman
Page 2
February 21, 2001

Although this stream has been degraded by previous activities, it has the potential to be a valuable aquatic resource to the region. Stronger mining and industrial regulation have led to dramatic improvements in water quality in the area in the last decade. This, coupled with improved wastewater treatment facilities and abandoned mine land reclamation projects, continue to improve the water quality of Island Creek.

If this plan moves forward with channelization as the preferred alternative, then efforts should be made to construct this channel using the best possible methods. These should include the use of Natural Stream Restoration Techniques for in-stream work. My staff stands ready to assist in any way possible.

Sincerely,

Bernard F. Dowler

Bernard F. Dowler, Deputy Director
Division of Natural Resources

BFD/akk

DEPARTMENT OF THE ARMY
HUNTINGTON DISTRICT, CORPS OF ENGINEERS
502 EIGHTH STREET
HUNTINGTON, WEST VIRGINIA 25701-2070

REPLY TO
ATTENTION OF:

March 7, 2001

Planning, Programs and Project Management Division
Planning Branch, Environmental Analysis Section

Mr. Bernard F. Dowler, Deputy Director
Division of Natural Resources
Wildlife Resources Section
Capitol Complex, Building 3, Room 812
1900 Kanawha Boulevard, East
Charleston, West Virginia 25305-2771

Dear Mr. Dowler,

Thank you for your comments regarding the Draft Environmental Assessment (DEA) for Island Creek Local Protection Plan, Logan County, West Virginia.

We understand your concern of the potential impacts of channelization and widening of Island Creek. However, due to the population density along Island Creek, Copperas Mine Fork and their tributaries, we feel the possible restoration of the original flood plain is unattainable. Responses from interviews with the residents and businesses in the community of Logan indicated they will welcome both the Flood Warning System (FWS) and channel expansion of Island Creek to reduce economic losses and potential loss of life incurred by recurrent flooding of this lower portion of Island Creek.

Our coordination with the U.S. Fish and Wildlife Service has continued since the 1993 report submittal. The only concern the Service had with our project included potential Indiana bat summer habitat. However, the acreage being disturbed within the project area is less than what would adversely affect the Indiana bat.

Our current mitigation, as described in the DEA, includes reseeding with deep rooting native grasses and non-woody annuals and perennials. Also, approximately 1.0 acre of native bottomland hardwood tree and shrub species would be planted along the stream. The other 1.5 acres will be mitigated on the face of the new spoil fill. The Plan, itself, has not changed since 1993 except for the spoil site location. The new spoil location site will be placed on existing fill from the construction of State Route 73 in Logan. Approximately, 1.5 acres of upland and bottomland hardwoods would be disturbed at the new spoil site compared to 7.2 acres described at the previous spoil site.

The in-stream mitigative measures include riffle pool complexes placed intermittently along the 0.7 mile of channel widening. These complexes will ensure pools for smaller aquatic life forms during lower flows and aeration of the water during normal to higher flows. We look forward to working with you throughout the design phase of this project and will consider any recommendations you may have to incorporate "Natural Stream Restoration Techniques."

If you have any further comments or questions concerning this project, please feel free to contact Ms. Ginger Mullins, of my staff, at the commercial telephone number 304-529-5712.

Sincerely,

/s/

Larry E. Workman
Acting Chief, Planning Branch

WEST VIRGINIA DIVISION OF
CULTURE AND HISTORY

April 27, 2001

Mr. Larry Workman
Chief, Environ Anlys Sect
U.S. COE
502 Eighth Street
Huntington, West Virginia 25701

RE: Draft Environmental Assessment
Island Creek Local Protection Plan
FR#: 01-443-LG-1

Dear Mr. Workman:

We have reviewed the above mentioned project to determine its effects to cultural resources. As required by Section 106 of the National Historic Preservation Act, as amended, and its implementing regulations, 36 CFR 800: "Protection of Historic Properties," we submit our comments.

Architectural Resources:
During a records search at our office and a windshield survey of the project area two architectural resources were identified. These are the Appalachian Power Company building and the CSX railroad bridge. Both of these resources are eligible for listing in the National Register of Historic Places. However, the proposed activities will have *No Adverse Effect* on these two structures.

Archaeological Resources:
The report satisfactorily addresses our concerns regarding the presence of cultural resources within the project area. Systematic testing of the project area located no previously unrecorded archaeological sites, therefore, no further archaeological investigation is recommended. We have also determined that no known archaeological sites listed on or eligible for inclusion in the National Register will be affected by this project. No further consultation is necessary.

We appreciate the opportunity to be of service. *If you have questions regarding our comments or the Section 106 process, please call Marc Holma, Senior Structural Historian for Review and Compliance or Rachel Black, Staff Archaeologist at (304) 558-0220.*

Sincerely,

Joanna Wilson

Joanna Wilson
Senior Archaeologist

mh/reb

WEST VIRGINIA DIVISION OF
CULTURE AND HISTORY

January 31, 2001

Mr. Larry Workman
Chief, Environ Anlys Sect
U.S. COE
502 Eighth Street
Huntington, WV 25701

RE: Draft Environmental Assessment
Island Creek Local Protection Plan
FR#: 01-443-LG

Dear Mr. Workman:

We have reviewed the above mentioned project to determine its effects to cultural resources. As required by Section 106 of the National Historic Preservation Act, as amended, and its implementing regulations, 36 CFR 800: "Protection of Historic Properties," we submit our comments.

Architectural Resources:
Although the Draft Environmental Assessment for the Island Creek Local Protection Project, Logan County, West Virginia, addresses archaeology it does not comment on the project's potential impact to architectural resources listed in or eligible for the National Register of Historic Places. Please provide information regarding architectural resources within the project area and the undertaking's expected effect, if any, to them.

Archaeological Resources:
Thank you for providing us with a copy of the Draft Environmental Assessment for the Island Creek Local Protection Project, Logan County, West Virginia. However, we require additional information in order to complete our review. In the aforementioned EA, it is stated that an archaeological reconnaissance was made of the proposed area in 1980 indicating that there would be no significant impact from the project to archaeological resources. Please submit a copy of this report. We will complete our review immediately upon its receipt.

We appreciate the opportunity to be of service. *If you have questions regarding our comments or the Section 106 process, please call me or Rachel Black, Staff Archaeologist at (304) 558-0220.*

Sincerely,

Joanna Wilson

Joanna Wilson
Senior Archaeologist

mh/reb

THE CULTURAL CENTER • 1900 KANAWHA BOULEVARD, EAST • CHARLESTON, WEST VIRGINIA 25305-03
TELEPHONE 304-558-0220 • FAX 304-558-2779 • TDD 304-558-3562
EEO/AA EMPLOYER

APR 1 2 2001 AKF/7445

Planning, Programs and Project Management Division
Planning Branch, Environmental Analysis Section

Ms. Nancy P. Herholdt, Director
Division of Culture and History
ATTN: Susan Pierce
1900 Kanawha Blvd.
Charleston, West Virginia 25305

RE: Island Creek Local Protection Plan
Cultural Resources Reconnaissance Report
FR# 01-443-LG

Dear Ms. Herholdt:

Please find enclosed the Cultural Resources Reconnaissance Report prepared for the Island Creek Local Protection Plan in response to your comments dated January 31, 2001.

If you have any further questions or need additional information, please feel free to contact Ms. Amy Frantz at 304-528-7445.

Sincerely,

MULLINS PM-PD-R
WORKMAN PM-PD

Larry E. Workman
Assistant Chief, Planning Branch

Enclosures

FR# 01-443-LG

Island Creek Local Protection Plan
Logan County, West Virginia
Cultural Resources Reconnaissance Report

Prepared by

Dr. Robert Maslowski and Amy Frantz, P.G.
U.S. Army Corps of Engineers
Huntington District
502 Eighth Street
Huntington, West Virginia 25701-2070
304-528-5712

April 2001

FR# 01-443-LG

TABLE OF CONTENTS

Introduction

A literature and records search was conducted for the Island Creek project on 2/15/01. The state site files showed that there were no archeological sites located in the immediate project area. Two structures with historic structure numbers were located in the immediate project area. These structures located on Maps 1 and 2, include LG169 (Appalachian Power Company Building) and LG 86 (CSX railroad bridge).

A literature search indicated that a basin wide reconnaissance had been completed in 1980 by the Corps of engineers and further studies were recommended when specific project alternatives were selected for future study.

A cultural resources reconnaissance of the Island Creek Local Protection Project was performed in Logan, West Virginia on 20 February 2001 by the staff archeologist and ecologist of the Corps of Engineers, Huntington District. The purpose of the proposed project is to reduce flooding impacts along the lower 0.7 miles of Island Creek. Channel widening would begin at the confluence of Island Creek and the Guyandotte River and continue for approximately 0.7 miles. Post and panel walls would be constructed in certain locations to avoid impacts associated with the acquisition of certain structures along the channel. The cultural resources reconnaissance of the project entailed a site walkover at the site of approximately 17 acres along the channel widening along Island Creek and approximately 6.5 acres of the fill site.

Project Description and Authority

Preauthorization studies of the water and related land resources problems and needs of the Island Creek area of Logan County, West Virginia, were undertaken as a result of the Senate Public Works Committee Resolution dated 2 June 1976. The resolution is as follows:

> ***"Resolved by the Committee on Public Works and Transportation of the United States House of Representatives****, that the Board of Engineers for Rivers and Harbors is hereby requested to review the report of the Chief of Engineers on the Ohio River, published as House Document numbered 306, Seventy-fourth Congress, and other pertinent reports, with a view to determining whether they should be modified to provide additional means of flood damage prevention and to meet other water and related land resource development needs for communities in the southern coal mining regions of West Virginia, with particular reference to flood protection for the Island Creek area of Logan County and the City of Mullens in Wyoming County."*

The Water Resources Development Act of 1986 (PL 99-662) authorized the Island Creek Local Protection Project for flood control.

A concept plan of the proposed structural and nonstructural measures to alleviate the flooding problems in the Island Creek basin began in 1985 with "Interim Report, Island Creek Basin, Guyandotte River Basin Study, West Virginia," U.S. Army Corps of Engineers, Huntington District. However, a general reevaluation of the economic feasibility of the Island Creek Local Protection Project continued until 1991, when results of that study concluded that the nonstructural alternative was too costly to be considered a measure of protection.

In the 1993 "Island Creek at Logan, West Virginia Local Protection Project, General Reevaluation Report" U.S. Army Corps of Engineers, Huntington District, several structural alternatives were addressed including variations of the authorized channel. After detailed analyses were performed, it was determined that the 80-foot wide channel is the most economically feasible.

FR# 01-443-LG

The Island Creek Local Protection Plan project area is located in the sub-basin of Island Creek and drains about 105 square miles of rugged, mountainous terrain and is composed of three major streams – Island Creek, Copperas Mine Fork and Mud Fork. The project site is located in the city of Logan, West Virginia and begins at the confluence of the Guyandotte River and Island Creek. (Figure 1). The project then continues approximately 0.7 miles upstream of the confluence and terminates at the CSX railroad bridge above the confluence of Copperas Mine Fork and Island Creek. The project area is bounded to the south by CSX railroad tracks and U.S. Route 119, to the west, Mount Gay, West Virginia and State Route 119/26 to the north. U.S. Route 119 and State Routes 10 and 44 serve the area and access to the site is provided from city streets.

The plan considered in detail entails widening Island Creek to create a trapezoidal channel using 2.5 horizontal to 1.0 vertical side slopes. Channel widening would begin at the confluence of Island Creek and the Guyandotte River and continue for approximately 0.7 miles. Post and panel walls would be constructed in certain locations to avoid impacts associated with the acquisition of certain structures along the channel. Widening would only be accomplished on one side of the channel in any area. Clearing and grubbing would be accomplished only in those areas where walls are constructed or where earthwork cuts would be made. All other areas would remain undisturbed as much as possible. Stone slope protection would be placed along the base of the wall and at the toe of the newly excavated slope to reduce the effects of erosion in the lower level flood frequencies. The remaining area between stone slope protection and the contractors working limits would be seeded.

The material removed during channel widening would be spoiled at a nearby site, School House Hollow. Excess material was spoiled at the site during the construction of U.S. Route 119 and State Route 73 in the mid-1990s. The material from the channel widening would be placed at an approximately depth of 19 feet. The final graded slopes would be properly drained and seeded and blended into the surrounding terrain. An additional 2.5 acres of the 12 acre site would be utilized by the local sponsor for future disposal of channel sediment.

A sandbar located above the railroad bridge and south of U.S. Route 119 will also be removed. The removal of the sandbar will keep higher flows from backing up behind the bridge causing flooding in the Cherry Tree area.

Environmental Setting

The terrain is of rugged mountainous terrain and is comprised largely of steep-sided mountains and narrow stream valleys. Ninety percent of all slopes in Logan County, are in excess of 25 percent. Industrial, transportation, and residential land uses and community facilities occupy much of the rather limited level or gently sloping land. Existing environment along the 0.7 mile reach of Island Creek is limited to a narrow band of bottomland along the stream. Disturbed areas have grown up in old fields adjacent to the nearly continuous string of commercial and industrial development.

The spoil disposal site at School House Hollow was utilized for construction of U.S. Route 19 and State Route 73. The site is currently accessed via a dirt road and the disposal area is vegetated with grasses and brush.

The Island Creek basin has experienced numerous damaging floods. The maximum flood of record in the basin occurred in March 1963. During March 1963 flooding event, the area's residences, and commercial and industrial establishments were flooded to a depth of up to 15 feet. Other major floods have occurred in January 1957, January 1974, April 1977, and May 1996. The flood plains along the major streams are occupied almost entirely by residential and commercial structures, highways, and railroads. As a result, almost all development within the basin is susceptible to damage by even moderate flood events.

Field Techniques

The project area was visually inspected for archeological materials beginning on the downstream left descending bank near Motel 8 (Photo 1). The area along the left descending bank which will be widened had been previously disturbed and was covered with modern debris (Photos 2 to 5).

The area most likely to have archeological sites was the field immediately downstream from the railroad bridge (Map 1) on the right descending bank. This area had several house sites which have been removed. The field is totally disturbed from the removal of the houses and the dirt has been mounded up to form a series of jumps and a trail for bikes and ATVs (Photo 6). In one area there was a deep cut down the stream bank (Photo 7). This area and all of the trails were walked and visually inspected and no prehistoric or significant historic artifacts were observed. The only artifacts observed were modern debris consisting of glass, plastic, coal, cinders and brick fragments.

The disposal area located outside of town was visually inspected from the road (Figure 8) and was fund to be a narrow valley that had been previously filled with material from the construction of U.S. Route 119 and State Route 73.

Results

The cultural resources reconnaissance of the project area and disposal area produced no evidence of archeological sites largely because the project area was totally disturbed by modern construction and the disposal area has been previously used as a disposal site for road construction. Two structures with state inventory numbers were located adjacent to the project (the Appalachian Power Company building and the CSX railroad bridge) but neither structure will be adversely affected by construction of the local protection project. The Appalachian Power Company building will actually be protected by the project. There will be visual impacts to these structures during construction but these will be temporary.

Recommendations

No further cultural resources work is recommended for the project.

Conclusions

There are no recorded archeological sites within the project area because most of the area has been extensively disturbed. The Appalachian Power Company building and the CSX railroad bridge will not be adversely affected by the project.

FR# 01-443-LG

References Cited

U. S. Army Corps of Engineers
1980 A Cultural Resources Reconnaissance of the Island Creek Basin, Logan County, West Virginia. Huntington District.

1985 Interim Report, Island Creek Basin, Guyandotte River Basin Study, West Virginia, Huntington District.

1993 Island Creek at Logan, West Virginia Local Protection Project, General Reevaluation Report. Huntington District.

2001 Draft Environmental Assessment, Island Creek Local Protection Project, Logan County, West Virginia. Huntington District.

APPENDIX 1

FR# 01-443-LG

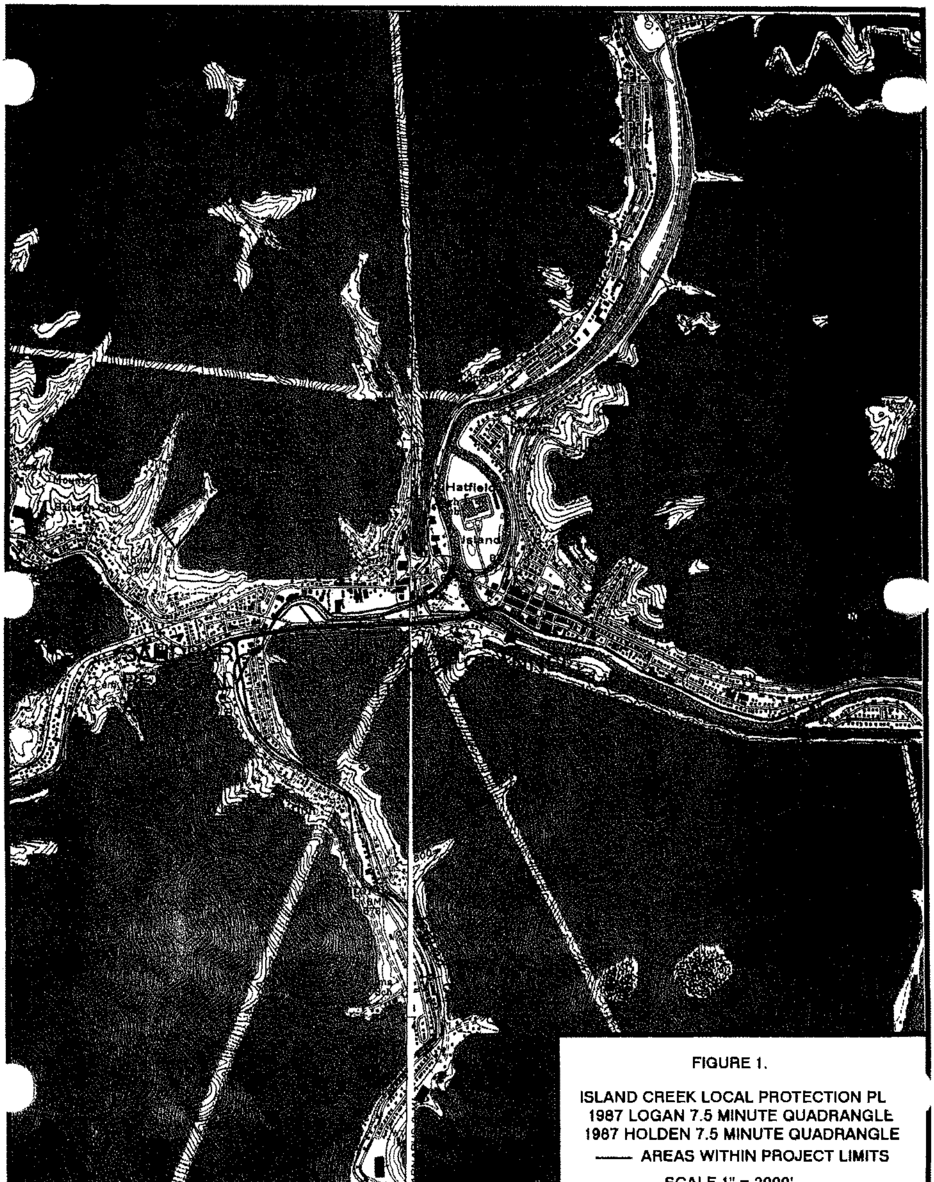


FIGURE 1.

ISLAND CREEK LOCAL PROTECTION PL
1987 LOGAN 7.5 MINUTE QUADRANGLE
1987 HOLDEN 7.5 MINUTE QUADRANGLE
—— AREAS WITHIN PROJECT LIMITS
SCALE 1" = 2000'

West Virginia
State Historic Preservation Office

Cultural Resources Files and Library
User Registration and Research Record Form

INSTRUCTIONS: Part I must be completed before you will be permitted access to the SHPO Cultural Resource Files and Library. Part II is a record of the site files, cultural resource reports. USGS topographic maps and other materials you utilize during your visit. Part III will be completed and signed by a SHPO staff member only when you have completed your research and have returned the materials to which you have been given access.

I. IDENTIFICATION

DATE: 2/15/01

Name (s) Dr Robert Maslowski
Leslie Birdwell

Organization or Company: US Army Corps of Engineers

Address: 502 8th St
Huntington WV 25701 Phone 304 / 529-5712

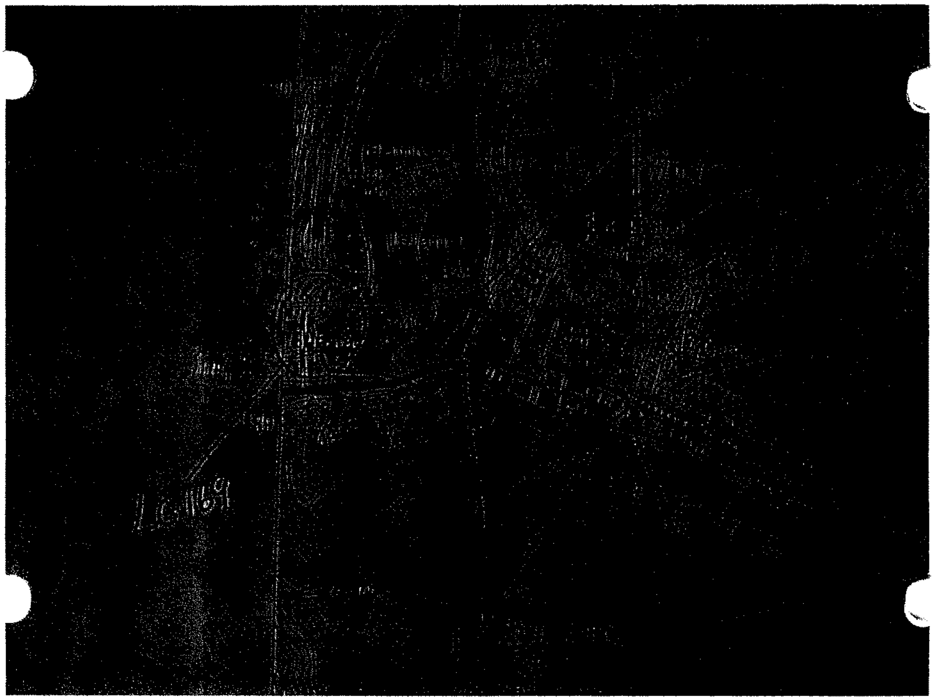
FR Number (if known) ____________________

II. MATERIALS UTILIZED

USGS Quad Maps: Welch
Logan
Holden

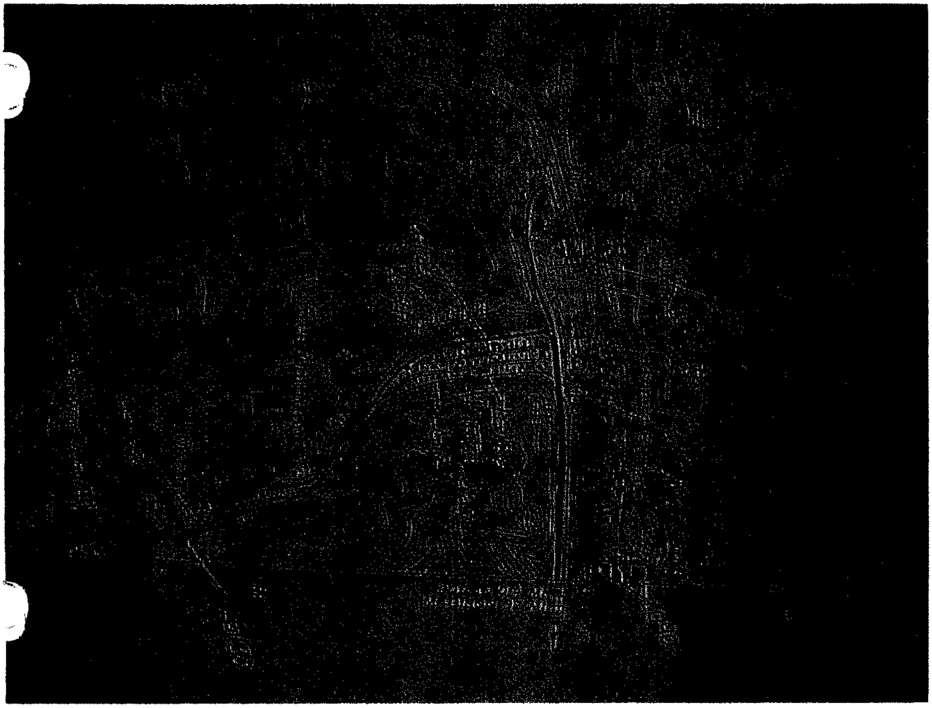
Archaeological Site Forms:

M1 Hatfield Island Map .JPG (1024x768x16M jpeg)



Map 1. Appalachian Power Company LG169

M4 Mount Gay Map.JPG (1024x768x16M jpeg)



Map 2. CSX Railroad Bridge LG68

Photo 1. North bank of Island Creek and Motel 8.

Island Creek 10.bmp (1203x758x16M bmp)

Photo 2. North bank of Island Creek behind Gaylocks.

near gaylocks.bmp (1202x768x16M bmp)

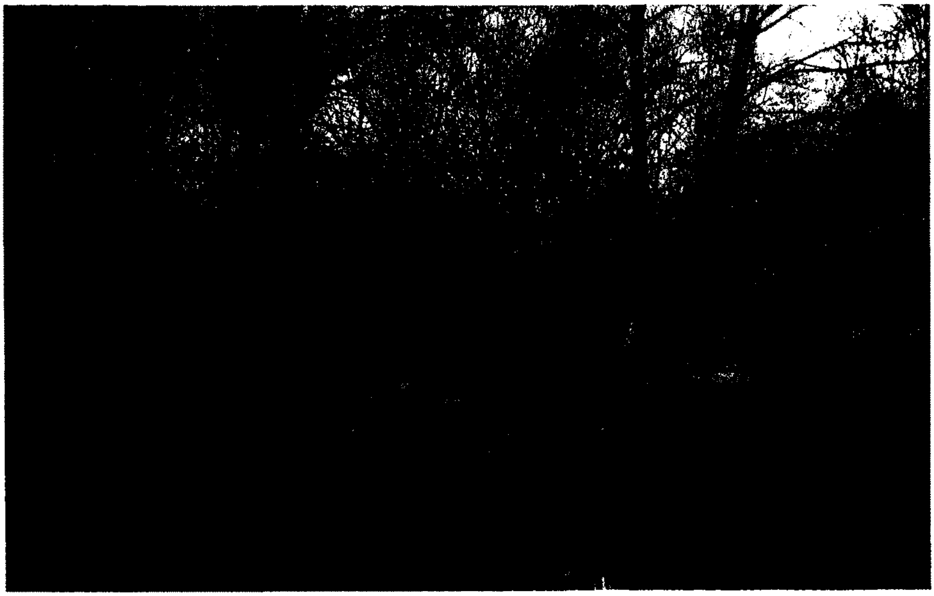


Photo 3. North bank near Logan Physical Therapy.

black bot debris.bmp (1207x762x16M bmp)

Photo 4. Looking downstream near former Honeycutt Auto.

looking downstream from rrbridge.bmp (1191x752x16M bmp)

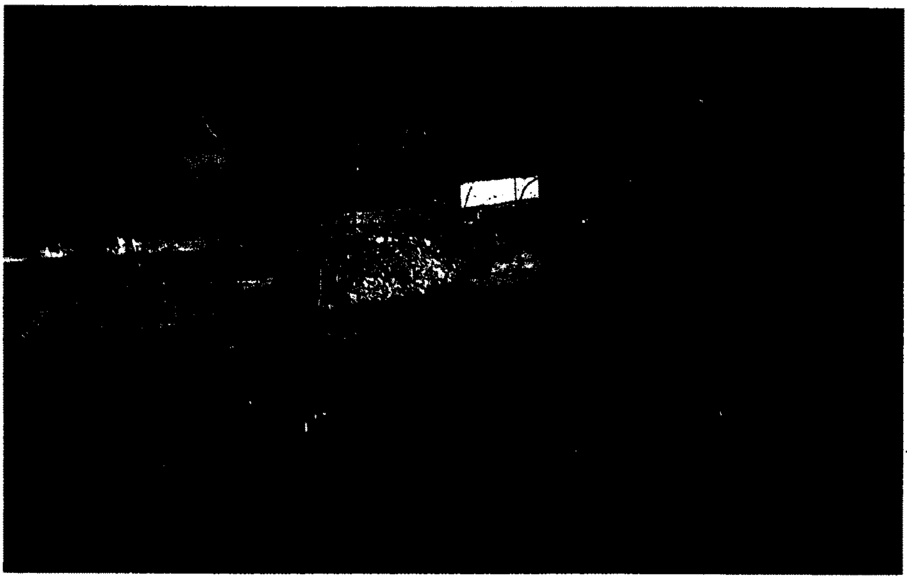


Photo 5. Looking upstream at CSX bridge.

rr bridge.bmp (1207x762x16M bmp)

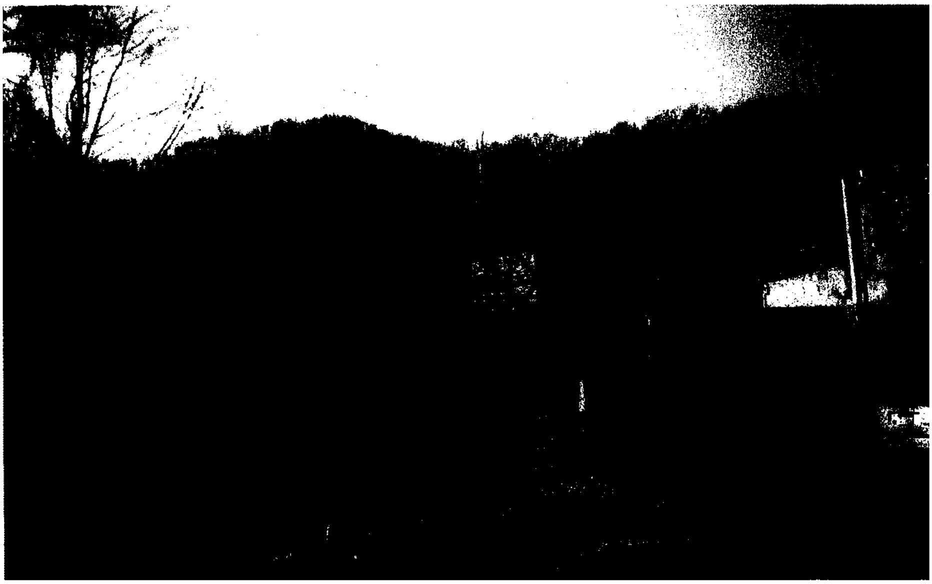


Photo 6. ATV Trail.

4wheel road near wetland.bmp (1207x752x16M bmp)

Photo 7. ATV Trail crossing Island Creek.

old bridge site.bmp (1206x758x18M bmp)

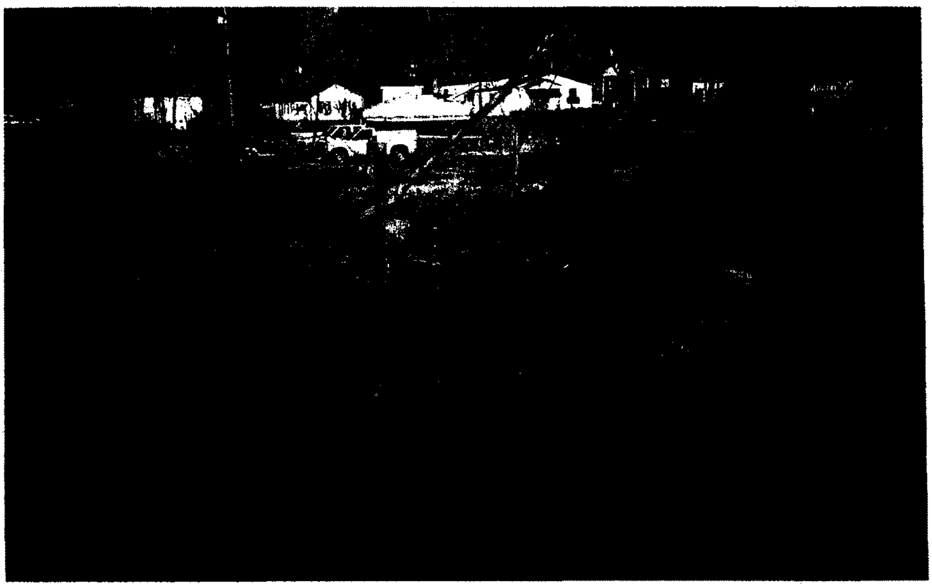
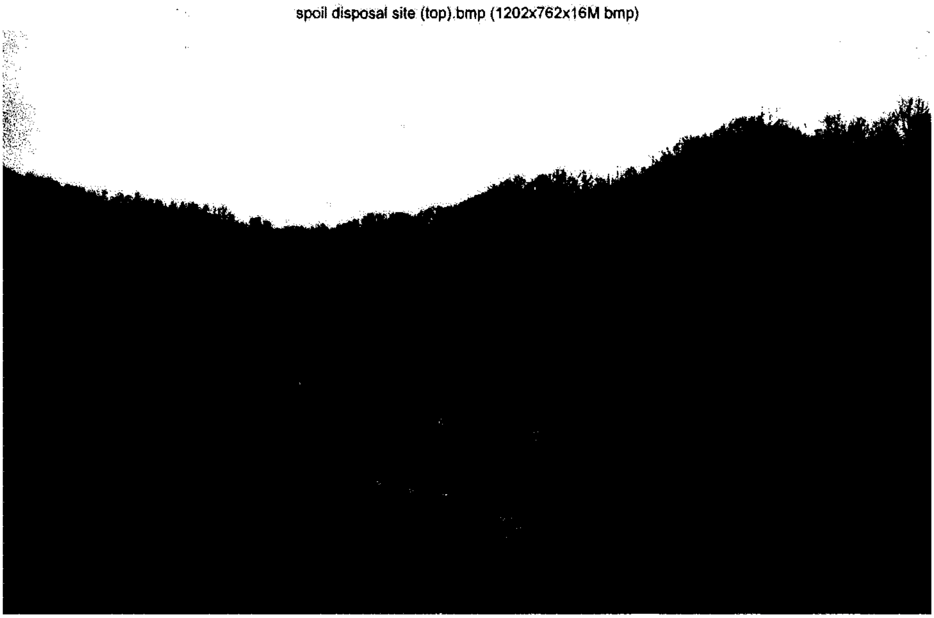


Photo 8. View of spoil disposal area.



MAILING LIST

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Logan, West Virginia 25601

Logan County Flood Zoning Administration
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Logan, West Virginia 25601

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Charleston, West Virginia 25303

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Logan County Emergency Ambulance Service
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16 Wildcat Way
Logan, WV 25601

Logan County Commission
ATTN: Julie Propst
Logan County Courthouse
300 Stratton Street
Logan, WV 25601

US Army Corps
of Engineers
Huntington District

ISLAND CREEK
LOCAL PROTECTION PROJECT
AT LOGAN, WEST VIRGINIA

GENERAL REEVALUATION REPORT

ECONOMIC APPENDIX

MARCH 2002

ISLAND CREEK AT LOGAN, WEST VIRGINIA, LOCAL PROTECTION PROJECT

GENERAL REEVALUATION STUDY

ECONOMIC APPENDIX

LIST OF TABLES

LIST OF FIGURES

ISLAND CREEK AT LOGAN, WEST VIRGINIA, LOCAL PROTECTION PROJECT

GENERAL REEVALUATION STUDY

ECONOMIC APPENDIX

I. PURPOSE

The purpose of this Economic Appendix is to: 1) reevaluate flooding and related problems with Island Creek in and around the community of Logan, West Virginia; and 2) determine the National Economic Development (NED) benefits and costs associated with potential solutions.

II. METHODOLOGY

Methodology employed for this economic analysis is in accordance with Principles and Guidelines and standard economic practices. Benefits and costs are computed at October 2001 (FY 2002) price levels. This analysis employs the currently established Federal discount rate of 6 1/8 percent. The period of analysis is 50 years, with a Base Year of 2003.

III. STUDY AREA

A. Location

Logan County, located in the southwestern portion of West Virginia, was formed in 1824 from parts of Giles, Tazewell, Cabell, and Kanawha Counties. The county seat, Logan is situated in the central portion of the county, at an elevation of 682 feet, m.s.l. The topography of the county, which measures 456 square miles, is steep and rugged, as streams have cut their channels deep through the surface rocks, making sharp V-shaped valleys. Surface elevation varies from 600 feet above sea level at Big Creek on the Guyandotte River at the Lincoln County line to 2,750 feet, m.s.l. at the corner of Logan, Boone, and Wyoming County.

The county is largely drained by the Guyandotte River. The Guyandotte, having a drainage area of 1,670 square miles, originates in Raleigh County and flows in a general northwesterly direction through Raleigh, Wyoming, Mingo, central Logan, Lincoln, and Cabell Counties to the Ohio River, near Huntington, West Virginia.

The original project study area lies within the Island Creek sub-basin of the Guyandotte. The sub-basin drains about 105 square miles of rugged, mountainous terrain and is composed of three major streams of Island Creek, Copperas Mine Fork, and Mud Fork. The original study area is about 19 miles long and consists of the developed areas within the 500-year floodplain along Island Creek from its mouth at Logan to a point upstream near Barnabus (about 10 miles); Copperas Mine Fork from its mouth to a point upstream near Davis (5.1 miles); and Mud Fork to a point upstream near Shegon (3.9 miles).

Subsequent reevaluation efforts narrowed the study area to the Island Creek sub-basin. The current evaluation focuses on the area impacted by the proposed alternatives. This area includes the 500-year floodplain along Island Creek from its confluence with the Guyandotte River to a point approximately 9,000 feet upstream. Maps depicting these areas are in the main report as Exhibits 1 and 2.

B. Study Area Development

1. Population and Housing

Population in the town of Logan and Logan County has declined since the 1980s largely as a result of the declining employment opportunities in mining and related services. The Town of Logan's population has decreased by 576 persons since 1980 resulting in 1,630 persons in 2000 or a 26 percent decrease. Logan County's population has declined from 50,511 in 1980 to 37,710 in 2000 for a loss of 25 percent. The 2000 population of West Virginia has also decreased since 1980 by 7 percent but has increased by 14,867 persons from 1970. Population data for the Town of Logan, Logan County, state of West Virginia and the U.S is provided in Table 1. Population for the town and county are expected to remain the same or slightly decline based on the county's dependence on the coal mining industry.

TABLE 1- POPULATION

	Logan Town	Logan County	West Virginia	U.S.
1980	NA	50,511	1,949,644	226,542,204
1990	2,206	43,032	1,793,477	249,439,545
2000	1,630	37,710	1,808,344	281,421,906

In 2000 there were 965 housing units in the Town of Logan, 16,807 in the County, and 844,623 in West Virginia. There were 14,880 households in Logan County with 2.5 persons per household and 736,481 households in West Virginia with 2.40 persons per household. The number of housing units has decreased only slightly since the 1980s, while the number of households has declined with the decrease in population.

2. Per Capita Income and Poverty

Per capita income in 1999 for Logan County, West Virginia, and the U.S. was $17,291, $20,921, and $28,542 respectively. Per capita income for Logan County increased 84 percent in real dollar terms from 1970-1999. While Logan County's per capita income has increased, it has been consistently lower than W.V. and U.S. totals. (BOC, 1999). Per Capita income data is shown in Table 2. In 1997, 23 percent of Logan County residents lived below the poverty line as compared with 16.8 percent in West Virginia and 13.3 percent in the U.S.

TABLE 2- PER CAPITA INCOME

	Logan County	West Virginia	U.S.
1970	$2,753	$3,117	$4,095
1980	$7,936	$8,172	$10,183
1990	$12,638	$14,579	$19,584
1999	$17,291	$20,921	$28,542

Source: U.S. Bureau of the Census

3. Education

The percentage of persons in Logan County 25 years and older who graduated from high school in 1990 was 53 percent, in West Virginia 66 percent, and the U.S. 75 percent. The percentage of persons 25 years and older with college degrees in 1990 for Logan County, West Virginia, and the U.S. was 6.3, 12.3, and 20.3 percent respectively (U.S. Bureau of the Census).

4. Employment, Labor Force, and Unemployment Rate

The economy of Logan County and the Town of Logan rely heavily on the coal industry and related services. With the decline in the coal industry as a result of less production and technological advances, the county's economy has suffered. From 1970 to 1980, mining employment in Logan County had increased 5.8 percent with 4,796 people employed in 1970, to 5,092 in 1980. In Logan County, from 1980 to 1999, mining employment decreased 77.8 percent from 5,092 in 1980 to 1,131 in 1999. From 1970 to 1980, mining employment in West Virginia increased 23 percent with 52,057 people employed in 1970 to 67,617 in 1980. From 1980 to 1999, mining employment in the state decreased 60 percent from 67,617 in 1980 to 27,082 in 1999. From 1970-1999 there was a 76.4 percent decrease in overall mining employment in Logan County compared with a 48 percent decrease in West Virginia. Mining employment in West Virginia has declined but not at as high of a rate of as Logan County. This is due to the fact that Logan County's employment base is highly specialized in the bituminous coal and lignite mining industry and mining support services. Coal mining accounted for approximately 48 percent of all jobs in Logan County in 1987. This lack of a diversified economy leaves the county and the region extremely vulnerable from fluctuations in national and international coal markets (Bureau of

Labor Statistics 1999). Statistics on employment and earning by industry are shown in Tables 3 and 4.

TABLE 3 - TOTAL FULL-TIME & PART-TIME EMPLOYMENT BY INDUSTRY
(number of jobs)

	Logan County			West Virginia			U.S.		
	Gov't.	Mining	Services	Gov't	Mining	Services	Gov't	Mining	Services
1970	2,063	4,796	1,833	110,125	52,057	108,661	16,073,000	743,900	17,029,800
1980	2,222	5,092	2,730	136,059	67,617	142,991	18,758,000	1,277,600	24,999,600
1990	2,385	2,750	3,686	137,239	41,792	190,791	21,196,000	1,044,600	38,709,600
1999	2,335	1,131	4,507	149,802	27,082	259,016	22,256,000	782,100	51,669,000
Change 1970-1999	299	-3,665	2,674	39,677	-24,975	150,355	6,183,000	38,200	34,639,200

Source: Bureau of Labor Statistics

TABLE 4 - EARNING BY INDUSTRY
(Thousand of Dollars)

	Logan County			West Virginia			U.S.		
	Gov't	Mining	Services	Gov't	Mining	Services	Gov't	Mining	Services
1970	$11,200	$54,020	$9,037	$632,354	$571,332	$524,889	$121,784,000	$6,996,000	$104,405,000
1980	$26,297	$149,733	$34,544	$1,816,532	$2,004,878	$1,553,527	$309,755,000	$36,402,000	$316,773,000
1990	$50,971	$134,506	$74,308	$3,212,577	$3,447,666	$1,779,421	$629,902,000	$36,461,000	$888,863,000
1999	$72,240	$70,150	$119,044	$5,129,149	$1,395,433	$5,985,421	$891,983,000	$47,095,000	$1,626,743,000

Source: Bureau of Labor Statistics

In 1980, Logan County's civilian labor force totaled 16,424 and West Virginia's totaled 753,096. In 2001, Logan County's civilian labor force totaled 12,054 and West Virginia's totaled 810,822. From 1980 to 2001 Logan County's civilian labor force decreased by 4,370 persons, during this same time period West Virginia's civilian labor force increased 57,726 persons (Bureau of Labor Statistics). Logan County's civilian labor force has declined since the 1980s as a result of the heavily dependent coal economy. Civilian labor force data is shown in Table 5.

TABLE 5 - CIVILIAN LABOR FORCE

	Logan County	West Virginia	U.S.
1980	16,424	753,096	140,449,819
1990	14,362	760,328	125,857,000
2001	12,054	810,822	141,822,000

The 2001 unemployment rate for Logan County, West Virginia, and the U.S. is 5.9, 4.9, and 4.8 percent respectively. One of the major contributing factors for Logan County's higher unemployment rate is the continuing decline in coal mining employment. The type of coal mined in Logan County and advancements in mining technology all have added in the county's high unemployment rate (Bureau of Labor Statistics). Unemployment rate data is shown in Table 6.

TABLE 6 - UNEMPLOYMENT PERCENTAGE RATE

	Logan County	West Virginia	U.S.
1980	8.6	12.1	6.5
1990	11.2	8.4	5.6
2001	5.9	4.9	4.8

IV. STRUCTURE VALUE AND CONTENTS

A flood damage survey was conducted for the Island Creek study area in 1977-78. The survey included a detailed inventory, mapping and assessment of all structures in the 20-mile study area located within the limits of the 500-year floodplain. Each structure included in the inventory was assigned a unique identification number and located on detailed maps; classified according to category of use (e.g. residential or non-residential); and survey to determine the first floor elevation and photographed. The non-residential category includes commercial, industrial, schools, churches, government, and utility structures. Since the original survey, values have been updated and field verifications made in subsequent study efforts during 1984 and 1990.

The study area for the current evaluation has been modified to include only the structures in the 500-year floodplain that would be impacted by the **current** proposed alternatives. This includes the floodplain area along Island Creek from its confluence with the Guyandotte River to a point approximately 9,000 feet upstream and also a short distance upstream on Copperas Mine Fork that would be affected by backwater from Island Creek. The **current** study area (500-year floodplain) as defined above includes 174 residential structures at an average value of $18,000 and 102 non-residential structures for a total of 276 structures. The number of structures in various other modeled floodplains breaks down as follows: 100-year—270; 50-year—262; 20-year—252; and 1-year—107.

The structure value information for the current evaluation has been updated to reflect values at October 2001 price levels. All residential structures were verified in the field. Those structures no longer in existence were removed from the inventory. Structure values were updated based on information from realtors in the area and professional judgment. Content value for residential structures is assumed to be 50 percent of structure value.

Non-residential structure data has also been updated to reflect October 2001 price levels. Field verification of all structures was conducted in early 2001. Those structures no longer in existence were removed from the inventory. All new structures were photographed, surveyed for first floor elevation, stage-damage values, and structure value. The structures that contained a different business than in the 1990s were resurveyed for new stage-damage values. All structures containing the same business as the 1990s were updated for structure value and their contents using the consumer price index.

V. WITHOUT PROJECT DAMAGES/COSTS

A. Structure and Content Damages

1. Methodology

Without project structure and contents damages were computed utilizing the Huntington District Flood Damage Program and HEC Flood Damage Analysis, Version 1.2. Using this method incorporates a two step process that first computes damages in the Huntington District Flood Damage Program and then uses those results in the HEC-FDA program to incorporate risk and uncertainty.

The Huntington District Flood Damage Program computes damages differently for residential and non-residential structures. For residential structures, potential damages were calculated using standardized depth-damage functions. These functions were based upon empirical studies and post-flood evaluations in the Huntington District. Damages are determined as a function of the type of construction (e.g. 1-story, 2-story, etc.), structure value, content value (50 percent of structure value), and the depth of flooding. The first floor elevations were then related to the flood frequency profile data to determine flood damages for the 1, 5, 20, 50, 100, and 500-year frequency events. For the non-residential structures, potential damages at various flood depths were estimated based primarily upon interviews with business owners/managers or other responsible personnel. This information was then used along with the flood frequency profile data to determine direct flood damages.

The HEC-FDA model computes expected annual damages based upon the following input parameters:

1) Structure and contents flood damage estimates from the Huntington District Flood Damage Program for the 1, 5, 20, 50, 100, and 500-year flood frequency events.

2) Hydrologic and Hydraulic data, including frequency/discharge and stage/discharge relationships. This data furnished by Engineering Construction Division, was developed HEC-2 Water Surface Profiles Program. Details about this data can be found in the ENGINEERING TECHNICAL APPENDIX , Tab II, Section A. The data from these output files were input into the HEC-FDA program. Data was input for base year 2003.

3) Risk and Uncertainty variables. The hydrologic engineering relationships allowed by the HEC-FDA model to fluctuate are frequency/discharge and stage/discharge. For the frequency/discharge relationship, the model computed a statistical distribution using the graphical approach, based upon data contained in the water surface profiles and equivalent record length furnished by Engineering/Construction Division. For the stage/discharge relationship, a normal distribution is assumed. The standard deviation of error was based on professional judgment and prior studies.

The HEC-FDA model computes expected annual damages using a Monte Carlo simulation process. Expected annual damages are calculated for each plan, analysis year, and stream.

2. Results

Table 7 summarizes the total damages by frequency event and the existing conditions expected annual damages of $6,866,960.

TABLE 7 - TOTAL DAMAGES BY EVENT & EXPECTED ANNUAL

Frequency	Estimated Damages
1-year	$1,906,000
5-year	$9,753,000
20-year	$15,068,000
50-year	$17,997,000
100-year	$20,058,000
500-year	$25,180,000
Expected Annual	$6,866,960

Although there are no historical damage records to verify the low frequency events, particularly the 1-year damages, an H & H review seems to validate this scenario. According to H & H data the 1-year event is approximately 4 feet above the top of bank from roughly 0.5 miles upstream of the mouth to the upstream limit of the current study area.

VI. ANALYSIS OF FINAL ARRAY OF ALTERNATIVES

A. Description of Alternatives

Three plans have been developed to address flooding problems on lower Island Creek. These include the 60-Foot, 80-Foot, and 100-Foot Channel plans. Details of each plan are outlined below.

1. 60-Foot Channel

This channel plan consists of widening the channel to 60 feet beginning at the confluence of the Guyandotte River and Island Creek and continuing 3,800 feet upstream. The trapezoidal channel would have side slopes that would be laid back on a 2.5H to 1V slope. A post and panel wall would be constructed to protect the AEP facility. The plan also includes a Flood Warning System and sandbar removal.

This plan requires the demolition of six commercial structures including the Super 8 Motel, Baisden Hardware, Baisden Hardware's outbuilding, Southern Public Utilities Warehouse, Honeycutt Auto Body, and Compton's Chevron. Generic drawings for the 60-Foot plans and their associated features can be found in the Engineering Technical Appendix as drawing numbers 80/11-14.

2. 80-Foot Channel

This channel plan is similar to the 60-foot design except for the channel width. This plan consists of widening the channel to 80 feet beginning at the confluence of the Guyandotte River and Island Creek and continuing 3,600 feet upstream. The trapezoidal channel would have side slopes that would be laid back on a 2.5H to 1V slope. Post and panel walls would be constructed at AEP facility and at Baisden Hardware. The plan also includes a Flood Warning System and sandbar removal.

This plan requires demolition of Super 8 Motel and Baisden Hardware's outbuilding. Generic drawings for the 80-Foot plans and their associated features can be found in the Engineering Technical Appendix as drawing numbers 80/11-14.

3. 100-Foot Channel

This channel plan consists of widening the channel to 100 feet beginning at the confluence of the Guyandotte River and Island Creek and continuing 3,600 feet upstream. The trapezoidal channel would have side slopes that would be laid back on a 2.5H to 1V slope. A post and panel wall would be located at the AEP facility. The plan also included a Flood Warning System and sandbar removal.

This plan requires demolition of four commercial structures including Super 8 Motel, Anderson Wholesale, Baisden Hardware's outbuilding and Baisden Hardware. Generic drawings for the 100-Foot plans and their associated features can be found in the Engineering Technical Appendix as drawing numbers 80/11-14.

B. Residual Damages and Benefits

The following tables summarize the residual damages and expected annual benefits for each alternative. The flood warning system for each alternative will be evaluated separately based on reductions to residual damages. That analysis is conducted in the following section and its benefits will be added to the flood inundation reductions benefits calculated in this section.

TABLE 8 - ISLAND CREEK RESIDUAL EXPECTED ANNUAL STRUCTURE & CONTENTS DAMAGE BY ALTERNATIVE
(in $1,000s)

Alternative	Residual Expected Annual Damage
60-Foot Channel	$3,150.7
80-Foot Channel	$2,915.3
100-Foot Channel	$2,632.6

TABLE 9 - ISLAND CREEK EXPECTED ANNUAL BENEFITS BY ALTERNATIVES
(Structure & Contents) (in $1,000s)

Alternative	Expected Annual Benefits
60-Foot Channel	$3,716.3
80-Foot Channel	$3,951.7
100-Foot Channel	$4,234.4

As shown in Table 9, the 60-Foot, 80-Foot, and 100-Foot Channel plans provide approximately $3.7, $3.9, and $4.2 million in expected annual inundation reduction benefits for structures and contents.

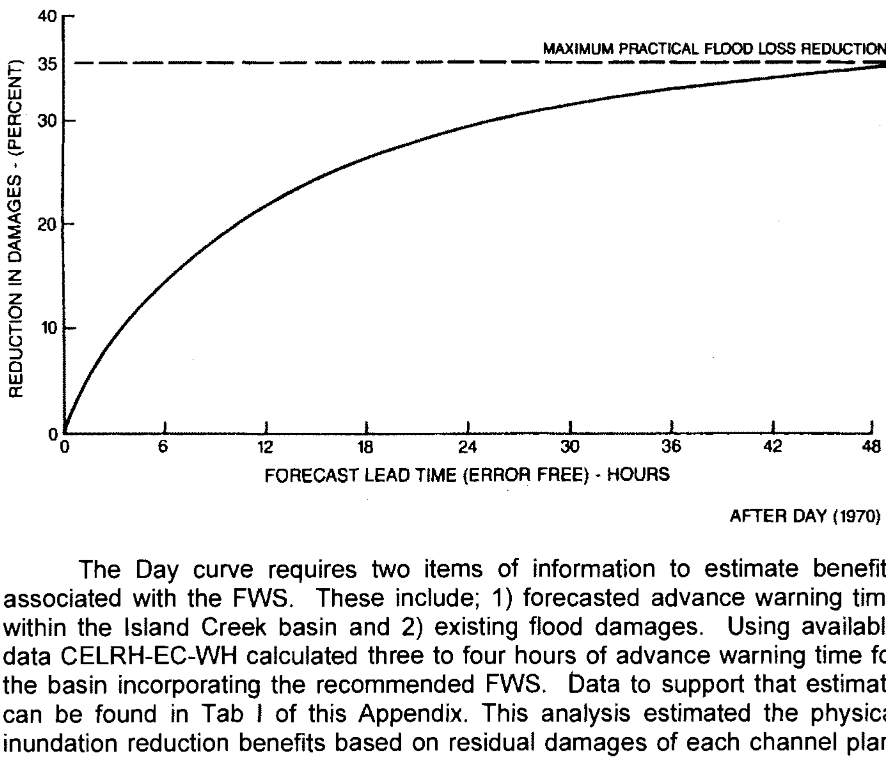
C. Flood Warning System Analysis

Flood Warning Systems (FWS) improve the community's capability for accurate and timely forecasts of damaging floods. They provide for the communications channels, information, and resources necessary for individuals to safely evacuate, and for floodplain occupants to take effective flood damage reduction actions. The recommended system for the Island Creek basin would provide advanced warning times for residents and businesses in the basin. The same system is recommended for each alternative. Details about the system can be found in the Engineering Technical Appendix, Tab II, Section B. The baseline cost for the system is $334,000 with an associated annual O&M cost of $48,600. This element of the project would be implemented as a non-structural component in conjunction with the recommended structural plan for Island Creek.

This section will provide an economic analysis of the benefits and costs of the recommended FWS associated with each alternative. Benefits were developed based on procedures in Chapter IX of the National Economic

Development Procedures Manual - Urban Flood Damage (IWR Report 88-R-2) dated March 1988. A basic tool for evaluating benefits of warning and preparedness measures is the lead time-damages prevented function. This function was developed by Harold Day and is used to determine the amount of damage that can physically be prevented within a give amount of time. The Day lead time-damages prevented curve is presented as Figure I below. Day's curve assumed a 100 percent response, which assumes that all the affected population will receive the message, know what to do, have the inclination and the capability to respond.

FIGURE I - FLOOD WARNING RESPONSE MAXIMUM PRACTICAL FLOOD LOSS REDUCTION (DAY CURVE)



The Day curve requires two items of information to estimate benefits associated with the FWS. These include; 1) forecasted advance warning time within the Island Creek basin and 2) existing flood damages. Using available data CELRH-EC-WH calculated three to four hours of advance warning time for the basin incorporating the recommended FWS. Data to support that estimate can be found in Tab I of this Appendix. This analysis estimated the physical inundation reduction benefits based on residual damages of each channel plan. The residual expected annual damages for the 60, 80, and 100 foot channel plans are $3,151,000, $2,915,000, and $2,633,000 respectively.

For this analysis, a conservative three hours of warning time is assumed. Based on the Day curve, three hours of lead time would equate to approximately nine percent reduction in damages. Since the Day curve is based on 100 percent response which is not very realistic, this analysis will assume a conservative 50 percent response and therefore a four and one-half percent reduction in residual damages. This approach yields expected annual benefits of the flood warning system with the 60-, 80-, and 100-foot channels amounting to $142,000, $131,000, and $118,000 respectively.

Average annual costs of the FWS are computed based on a 50-year period of analysis and a 6 1/8 percent interest rate. Given a project first cost of $334,000, the average annual project cost would be $21,500 plus $48,600 for O&M for a total of $70,000 (rounded). The comparison of benefits to costs for the 60-, 80-, and 100-foot Channels results in $72,000, $61,000, and $48,000 respectively of net benefits and a benefit cost ratio of 2.0, 1.9 and 1.7 to 1. Details of this analysis are shown in Table 10.

TABLE 10 - ISLAND CREEK FLOOD WARNING SYSTEM BENEFIT COST ANALYSIS

60-Foot Channel's Flood Warning System			
Project First Cost	**$334,000**		
Avg. Ann. Benefits	$142,000		
Avg. Ann. Cost	$70,000	Annual Costs	$21,500
Net Benefits	$72,000	O&M	$48,600
Benefit-Cost Ratio	2.0		
		Total Avg. Ann. Costs	$70,000
80-Foot Channel's Flood Warning System			
Project First Cost	**$334,000**		
Avg. Ann. Benefits	$131,000		
Avg. Ann. Cost	$70,000	Annual Costs	$21,500
Net Benefits	$61,000	O&M	$48,600
Benefit-Cost Ratio	1.9		
		Total Avg. Ann. Costs	$70,000
100-Foot Channel's Flood Warning System			
Project First Cost	**$334,000**		
Avg. Ann. Benefits	$118,000		
Avg. Ann. Cost	$70,000	Annual Costs	$21,500
Net Benefits	$48,000	O&M	$48,600
Benefit-Cost Ratio	1.7		
		Total Avg. Ann. Costs	$70,000

This analysis reveals that the FWS is justified based on the positive net benefits and the favorable benefit-cost ratio. Not only will this system allow the occupants of the floodplain to reduce the residual flood damages it will also protect lives. Since the average annual benefits for the FWS were based on residual damages, they will be added to the flood damage reduction benefits of each channel plan.

D. Total Expected Annual Benefits

The total expected annual benefits will include both the flood inundation reduction benefits and the residual damage reduction benefits resulting from the proposed flood warning system for each alternative. Table 11 shows the total expected annual benefits by alternative.

TABLE 11 - ISLAND CREEK TOTAL EXPECTED ANNUAL BENEFITS BY ALTERNATIVE
(in $1,000s)

Category	60-Foot Channel	80-Foot Channel	100-Foot Channel
Structure & Contents	$3,716.3	$3,951.7	$4,234.4
FWS Residual Damage Reduction	$142.0	$131.0	$118.0
Total	$3,858.3	$4,082.7	$4,352.4

E. Project Costs

Table 12 displays the baseline project costs and additional annual costs for each alternative. Detailed cost estimate information can be found in the Engineering Technical Appendix, Tab VII. The supporting data for the interest during construction calculations can be found in Tab 2 of this Economic Appendix.

TABLE 12 - ISLAND CREEK PROJECT COSTS
FY 2001 price level (in $1,000s)

Item	60-Foot Channel	80-Foot Channel	100-Foot Channel
01-Lands & Damages	$6,804.0	$4,974.0	$6,125.0
Contingency	$1,626.0	$1,146.0	$1,448.0
02-Relocations	$710.0	$710.0	$$710.0
Contingency	$322.0	$322.0	$322.0
09-Channels & Canals	$7,025.0	$7,772.0	$9,074.0
Contingency	$1,721.0	$1,908.0	$2,324.0
22-Post Feas. Studies	$2,200.0	$2,200.0	$2,200.0
Contingency	$0	$0	$0
30-PED	$1,750.0	$1,750.0	$1,750.0
Contingency	$175.0	$175.0	$175.0
31-S & A	$464.0	$514.0	$599.0
Contingency	$46.0	$51.0	$60.0
Total First Cost	**$22,843.0**	**$21,522.0**	**$24,787.0**
Less Sunk Cost	$2,200.0	$2,200.0	$2,200.0
Economic First Cost	**$20,643.0**	**$19,322.0**	**$22,587.0**
Annualized (6 1/85, 50yrs)	$1,378.7	$1,290.5	$1,508.6
Ann. Int. During Const.	$169.6	$142.5	$170.3
O & M	$67.7	$67.7	$67.7
Total Annual Cost	**$1,616.0**	**$1,500.7**	**$1,746.6**

F. Benefit/Cost Analysis

TABLE 13 - ISLAND CREEK BENEFIT/COST ANALYSIS
(in $1,000s)

	60-Foot Channel	80-Foot Channel	100-Foot Channel
Expected Annual Benefits	$3,858.3	$4,082.7	$4,352.4
Expected Annual Costs	$1,616.0	$1,500.7	$1,746.6
Net Benefits	$2,242.3	$2,581.9	$2,605.8
Benefit/Cost Ratio	2.39	2.63	2.42

As shown above, the 100-Foot Channel has slightly higher net benefits than the next-best plan—$2,605,700 versus $2,581,900 (a difference of $23,800, less than 1%). The 80-Foot Channel has the highest BCR at 2.63. The 100-Foot Channel is considered to be the NED Plan for the study area based on the greatest net benefits.

Due to the lack of historical damages for the 1-year event, it was decided to rerun the FDA program for a sensitivity analysis. Based upon H & H data and the average ground elevation along the stream, the 1-year event damages were deleted and the zero damage stage was reset at the 2-year water surface elevation. This analysis yielded the following results. Tables 14 through 17 display the economic results from the sensitivity analysis described above.

TABLE 14 – SENSITIVITY ANALYSIS RESIDUAL EXPECTED ANNUAL DAMAGE
(in $1,000s)

Alternative	Residual Expected Annual Damage
Without Project	$3,941.2
60-Foot Channel	$2,069.2
80-Foot Channel	$1,842.8
100-Foot Channel	$1,061.7

TABLE 15 – SENSITIVITY ANALYSIS EXPECTED ANNUAL BENEFITS
(in $1,000s)

Alternative	Expected Annual Benefits
Without Project	$0
60-Foot Channel	$1,872.0
80-Foot Channel	$2,098.4
100-Foot Channel	$2,348.6

*For structures and contents

TABLE 16 – SENSITIVITY ANALYSIS TOTAL EXPECTED ANNUAL BENEFITS
(in $1,000s)

Category	60-Foot Channel	80-Foot Channel	100-Foot Channel
Structure & Contents	$1,872.0	$2,098.4	$2,348.6
FWS Residual Damage Reduction	$142.0	$131.0	$118.0
Total	$2,014.0	$2,229.4	$2,466.6

TABLE 17 – SENSITIVITY ANALYSIS ISLAND CREEK BENEFIT/COST ANALYSIS
(in $1,000s)

	60-Foot Channel	80-Foot Channel	100-Foot Channel
Expected Annual Benefits	$2,014.0	$2,229.4	$2,466.6
Expected Annual Costs	$1,616.0	$1,500.7	$1,746.6
Net Benefits	$398.0	$728.7	$720.0
Benefit/Cost Ratio	1.25	1.49	1.41

Even under this modified scenario all three alternatives result in positive net benefits and BCRs greater than 1. Furthermore, the 80-Foot Channel is the NED plan under these conditions.

G. Risk and Uncertainty

Table 18 shows the results of the risk and uncertainty analysis. For sensitivity analysis purposes, this table displays a low range, high range, and most likely estimates for the damages reduced to structures and contents by each alternative.

TABLE 18 - EXPECTED VALUE & PROBABILISTIC VALUES OF EAD & EAD REDUCED
(in $1,000s)

Plan	Expected Annual Damages			Probability EAD Reduced Exceeds Indicated Values ($1,000s)		
	Without Plan	With Plan	Damage Reduced	.75	.5	.25
60-Foot	$6,866	$3,150	$3,716	$2,988	$3,730	$4,470
80-Foot	$6,866	$2,915	$3,951	$3,064	$3,394	$4,840
100-Foot	$6,866	$2,632	$4,234	$3,240	$4,214	$5,210

Table 19 displays results of the risk and uncertainty analysis generated by the HEC-FDA program based upon with project conditions.

Target Stage Expected Annual Exceedance Probability

These statistics show the expected annual probability that the capacity of the channel within these reaches will be exceeded. The Target Stage (in this case, the top of streambank elevation) represents the stage at which significant damages begin to occur. Table 19 shows that for the 60-Foot, 80-Foot, and 100-Foot Channels, there is 18%, 9%, and 5% chance that the capacity of Island Creek will be exceeded (equivalent to a 5.5-year event, 11-year event, and 20-year event, respectively). Under without project conditions, the expected annual exceedance probability was almost 100 percent (equivalent to a 1-yr event).

Long-Term Risk

Long-Term Risk represents the probability of the Target Stage being exceeded over a given time period (not a specific event, simply some type of overbank flooding). Under without project conditions, there is 100 percent chance that capacity of Island Creek will be exceeded over the 50-year period of analysis. Table 19 displays the long-term risk for 10, 20 and 50-year periods for the three alternatives. As shown on the table, the long-term risk over the 50-year period of analysis ranges from about 95 percent to about 99.9 percent for the with project conditions along Island Creek. The long-term risk over ten years for

Island Creek ranges from roughly 45 percent for the 100-Foot channel to 86 percent for the 60-Foot channel.

Conditional Non-Exceedance Probability by Event

The conditional non-exceedance probability by event represents the probability of an alternative containing the given probability event, should that event occur.

Table 19 shows that the conditional non-exceedance probability results for the 10-yr event is 7% for the 60-Foot Channel, 62% for the 80-Foot Channel, and 92% for the 100-Foot Channel.

TABLE 19 - ISLAND CREEK RISK & UNCERTAINTY RESULTS BY ALTERNAIVES

	Target Stage Exp. Annual Exceedance Probability	Long-Term Risk			Conditional Non-Exceedance Probability by Event					
		10 Yrs	25 Yrs	50 Yrs	10%	4%	2%	1.0%	0.4%	0.2%
Island Creek										
W/O Project	99.9%	100%	100%	100%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
60-Foot Channel	18%	86%	99%	99.9%	7%	0.1%	0.0%	0.0%	0.0%	0.0%
80-Foot Channel	9%	61%	90%	99%	62%	6%	1%	0.3%	0.0%	0.0%
100-Foot Channel	5%	44%	76%	94%	92%	31%	8%	2%	0.5%	0.2%

TAB 1

FLOOD WARNING AND RESPONSE SUPPORT DOCUMENTATION

FLOOD WARNING AND RESPONSE

Flood warning and preparedness systems improve a community's capability for accurate and timely forecasts of severe floods. The warning system is situated in the county to provide enough time for the local community to get personal belongings to higher ground and out of danger. At the present time, there are no stream gages located on Island Creek or any of the tributaries of Island Creek. The careful planning and placement of these gages would enable the community to reduce damages caused from severe floods.

The channel velocities indicate the travel times vary from 4.2 miles per hour to 6.10 miles per hour. These values are based on actual velocities the average values for the lower reach of Island Creek. With reaches of 10 to 15 miles in length, the flood wave would reach the downtown business district in three to four hours. The hydrology for Island Creek is based on twenty USGS gaging stations displaying similar hydrologic characteristics of the Logan County surrounding area. Only two are located within the county. The two stations are on the Guyandotte River at Logan and Man.

A quick look at the Standard Project Flood at the mouth of Island Creek reveals the time of crest is only 12 hours. The rate of rise is approximately 2 feet per hour. With banks six to 20 feet, it would take three to six hours for the water to be out of banks and somewhere between zero and 12 hours until a storm of the magnitude of the Standard Project Flood to crest.

Based on the available data, three to four hours would be reasonable to assume for advanced flood warning.

Phillip E. Anderson
Hydrology and Hydraulics

TAB 2

INTEREST DURING CONSTRUCTION SUPPORT DOCUMENTATION

Island Creek, LPP Logan, WV

Annual Costs Computation
60-Foot Channel
(Costs in $1,000's - Oct 2001 Prices)
Interest Rate - 6-1/8%

Total Capital Outlay Plus Interest During Construction

Fiscal Year	Quarter	Years Int Charged		Capital Outlay	6 1/8 Compound Rate	Total
FY 03						
	1	5.00	$	390.60	1.3461	526
	2	4.75	$	390.60	1.3263	518
	3	4.50	$	390.60	1.3067	510
	4	4.25	$	390.60	1.2874	503
FY 04						
	1	4.00	$	762.66	1.2684	967
	2	3.75	$	762.66	1.2497	953
	3	3.50	$	762.66	1.2313	939
	4	3.25	$	762.66	1.2131	925
FY05						
	1	3.00	$	735.14	1.1952	879
	2	2.75	$	735.14	1.1776	866
	3	2.50	$	735.14	1.1602	853
	4	2.25	$	735.14	1.1431	840
FY 06						
	1	2.00	$	1,628.69	1.1263	1,834
	2	1.75	$	1,628.69	1.1096	1,807
	3	1.50	$	1,628.69	1.0933	1,781
	4	1.25	$	1,628.69	1.0771	1,754
FY 07						
	1	1.00	$	1,571.47	1.0613	1,668
	2	0.75	$	1,571.47	1.0456	1,643
	3	0.50	$	1,571.47	1.0302	1,619
	4	0.25	$	1,571.47	1.0150	1,595
	Sub-Total			20,354		22,981

Total Capital Outlay	20,354
Interest During Construction	2,627
Annual IDC (note: actual $$)	169,552

Island Creek, LPP Logan, WV
Annual Costs Computation
80-Foot Channel
(Costs in $1,000's - Oct 2001 Prices)
Interest Rate - 6-1/8%

Total Capital Outlay Plus Interest During Construction

Fiscal Year	Quarter	Years Int Charged	Capital Outlay	6 1/8 Compound Rate	Total
FY 03					
	1	5.00	$ 315.64	1.3461	425
	2	4.75	$ 315.64	1.3263	419
	3	4.50	$ 315.64	1.3067	412
	4	4.25	$ 315.64	1.2874	406
FY 04					
	1	4.00	$ 568.97	1.2684	722
	2	3.75	$ 568.97	1.2497	711
	3	3.50	$ 568.97	1.2313	701
	4	3.25	$ 568.97	1.2131	690
FY05					
	1	3.00	$ 541.43	1.1952	647
	2	2.75	$ 541.43	1.1776	638
	3	2.50	$ 541.43	1.1602	628
	4	2.25	$ 541.43	1.1431	619
FY 06					
	1	2.00	$1,558.64	1.1263	1,755
	2	1.75	$1,558.64	1.1096	1,730
	3	1.50	$1,558.64	1.0933	1,704
	4	1.25	$1,558.64	1.0771	1,679
FY 07					
	1	1.00	$1,718.27	1.0613	1,824
	2	0.75	$1,718.27	1.0456	1,797
	3	0.50	$1,718.27	1.0302	1,770
	4	0.25	$1,718.27	1.0150	1,744
	Sub-Total		18,812		21,020

Total Capital Outlay	18,812
Interest During Construction	2,208
Annual IDC (note: actual $$)	142,535

Island Creek, LPP Logan, WV
Annual Costs Computation
100-Foot Channel
(Costs in $1,000's - Oct 2001 Prices)
Interest Rate - 6-1/8%

Total Capital Outlay Plus Interest During Construction

Fiscal Year	Quarter	Years Int Charged	Capital Outlay	6 1/8 Compound Rate	Total
FY 03					
	1	5.00	$ 365.39	1.3461	492
	2	4.75	$ 365.39	1.3263	485
	3	4.50	$ 365.39	1.3067	477
	4	4.25	$ 365.39	1.2874	470
FY 04					
	1	4.00	$ 696.49	1.2684	883
	2	3.75	$ 696.49	1.2497	870
	3	3.50	$ 696.49	1.2313	858
	4	3.25	$ 696.49	1.2131	845
FY05					
	1	3.00	$ 668.72	1.1952	799
	2	2.75	$ 668.72	1.1776	787
	3	2.50	$ 668.72	1.1602	776
	4	2.25	$ 668.72	1.1431	764
FY 06					
	1	2.00	$1,845.79	1.1263	2,079
	2	1.75	$1,845.79	1.1096	2,048
	3	1.50	$1,845.79	1.0933	2,018
	4	1.25	$1,845.79	1.0771	1,988
FY 07					
	1	1.00	$1,998.17	1.0613	2,121
	2	0.75	$1,998.17	1.0456	2,089
	3	0.50	$1,998.17	1.0302	2,058
	4	0.25	$1,998.17	1.0150	2,028
	Sub-Total		22,298		24,937

Total Capital Outlay	22,298
Interest During Construction	2,639
Annual IDC (note: actual $$)	170,361

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
441 G STREET NW
WASHINGTON, D.C. 20314-1000

OCT 01 2007

REPLY TO
ATTENTION OF:

CECW-LRD

MEMORANDUM FOR COMMANDER, GREAT LAKES AND OHIO RIVER DIVISION (CELRD-PDS-P)

SUBJECT: Island Creek Local Protection Project, Logan, West Virginia, General Reevaluation Report (GRR) (March 2002, updated economics June 2007)

1. PURPOSE: To reaffirm HQUSACE approval of the final General Reevaluation Report (GRR) on the subject project.

2. BACKGROUND: The Island Creek Local Protection Project, Logan, West Virginia, was authorized by Section 401 of the Water Resources Development Act of 1986 (PL 99-662). The authorized project addresses flooding adjacent to a total of about 19 miles of Island Creek (10.4 miles), Copperas Mine Fork (5.1 miles), and Mud Fork (3.9 miles). The plan includes both structural and non-structural components. The project was authorized at a cost $86 million (October 1984 Prices). At the time of the authorization, the local sponsor did not have the available funding to proceed with the project.

In 1999, the Logan County Commission, acting as non-Federal sponsor with financial support from the West Virginia Conservation Agency requested that the Corps reevaluate the authorized project. The Huntington District prepared a General Reevaluation Report to reaffirm the project justification and submitted the GRR for review and approval. The GRR only addressed the 0.7-mile long authorized structural feature and a basin-wide flood warning system (FWS). Reevaluation of other authorized non-structural features was deferred to a later date. The GRR was reviewed and approved as policy compliant by HQUSACE in September 2002 (enclosure 1). Approval authority for the GRR was HQ in 2002 and has since been delegated to Major Subordinate Commands (MSC). The GRR was submitted to ASA (CW) in October 2002 for OMB clearance.

Over the period October 2002 through June 2006, ASA (CW) raised a number of concerns on the report during its review for OMB clearance. The district prepared a supplement to the GRR in September 2003. The supplement answered questions regarding the documentation of flood events, sensitivity of the H&H data and resulting economic feasibility, and the technical adequacy of the H&H information. A second supplement was prepared in February 2005. The supplemental material included a sensitivity analysis to evaluate the effects of hydrologic assumptions on frequent flooding events on project justification. From the analysis it was evident that changing the assumed annual event to a 2-year event still resulted in a justified project with a BCR of 1.5. The sensitivity analyses indicated that the recommended plan would be economically justified regardless of the degree to which these frequent flooding events are considered in the economic analysis. In June 2006, the Office of Water Project Review reaffirmed the recommendations of the GRR and noted that the project would alleviate the frequent flood damage and substantially improve the living conditions within the community for a modest cost.

3. DISCUSSION. In June 2007, the district submitted a packet to HQUSACE that included updated project economics and certifications of policy and legal compliance (enclosure 2). The estimated cost of the project is $32.3 million at October 2006 price levels (includes $3.5 million in sunk costs). Based on a 4.875 percent discount rate and a 50-year period of economic evaluation, equivalent annual benefits are cited as $4.3 million. Equivalent annual costs are estimated as $1.9 million, including $0.07 million in equivalent annual OMRR&R costs. Indicated equivalent annual net benefits are $2.5 million. The resultant benefit-to-cost ratio is 2.3 to 1.

The district and non-Federal sponsor are poised to implement the project recommended by the GRR, which has been approved and reaffirmed as policy compliant by HQUSACE. The recommended plan is a separable element of the project authorized at Island Creek by WRDA 1986. Construction funding has been appropriated and non-Federal funding is available; therefore, the district has the ability to execute a Project Cooperation Agreement (PCA) and initiate construction. The GRR requires ASA(CW) endorsement and OMB clearance for the project's inclusion in future budget submittals. The ASA(CW) staff has recently indicated that the GRR will be approved and forwarded to OMB for budget clearance.

4. RECOMMENDATION: That the district negotiate and execute a Project Cooperation Agreement (PCA) with the Non-Federal Sponsor to initiate construction on the recommended plan. If you have any further questions, please contact Ms. Becky Moyer at 202-761-4589.

FOR THE COMMANDER:

2 Encls

MARK F. SUDOL, D. Env.
Acting Chief, Regional Integration Team
Great Lakes and Ohio River Division
Directorate of Civil Works

DEPARTMENT OF THE ARMY
HUNTINGTON DISTRICT, CORPS OF ENGINEERS
502 EIGHTH STREET
HUNTINGTON, WEST VIRGINIA 25701-2070

REPLY TO
ATTENTION OF:

CELRH-PM-PD-F

21 June 2007
CAMPBELL/pro/5825

MEMORANDUM THRU: Commander, USAED, Great Lakes and Ohio River (LRD-OR/ William Chapman,), Planning & Policy Division, 550 Main Street, Cincinnati, Ohio 45201

MEMORANDUM FOR Commander, USAED, Headquarters (CECW-LRD/Rebecca Moyer), 441 G ST NW, Washington, DC 20314

SUBJECT: Island Creek Local Protection Project at Logan, West Virginia, General Reevaluation Report, dated March 2002

1. The CELRH submission for the Island Creek General Reevaluation Report (GRR) was initially submitted for HQ review on 31 August 2001. Subsequent supplemental information has been provided to facilitate the project review, and included a field visit by ASA(CW), HQ, LRD and District staff in June 2004.

2. Although formal comments or guidance have not been received from higher authority, the District is submitting the following documentation to facilitate the GRR review, based upon communications between HQ, Division and District staff. Should more details be required regarding the enclosed information, the discussion can be found in the GRR dated March 2002.

    a. A summary comparison table and detailed explanation of the differences between the 25 April 1986 Chief's Report recommending the project, and the recommended project from the March 2002 General Reevaluation Report. (Enclosure 1)
    b. An update of project benefits. (Enclosure 2)
    c. An update of project costs. (Enclosure 3)
    d. An updated economic analysis. (Enclosure 4)
    e. An ITR, legal compliance and policy compliance documentation. (Enclosure 5)

3. The District's conclusions of the attached information are as follows.

    a. The summary comparison of the two reports of the proposed project determined that the differences between the projects recommended for implementation are minimal. Therefore, the GRR recommended project is authorized for construction by the original authorizing legislation.
    b. An update of the GRR recommended project determined the project remains policy compliant with significant net benefits, environmentally acceptable and has a benefit-cost ratio of 2.33.
    c. The information is technically correct, legally compliant and policy compliant.

CELRH-PM-PD-F
SUBJECT: Island Creek Local Protection Project at Logan, West Virginia, General Reevaluation Report, dated March 2002

4. Your expeditious review and approval is requested for two reasons. First, construction funding has been appropriated and non-Federal funding is available; therefore, the District has the ability to execute the Project Cooperation Agreement and initiate construction. Secondly, in order for the District to include the project in the FY 09 budget submission, the project report approval will be required by 1 Aug 2007.

5. The Huntington District POC for this action is Mr. S. Michael Worley. If you have any questions regarding the subject report, he may be reached at phone number (304) 399-5802.

		FRANTZ	PD-F
Encls	S. MICHAEL WORLEY		
1. Summary Comparison	Chief, Planning Branch	IARRIUSO	OC
		BORDA	PM-PD
2. Benefits Update	Project Management Division		
3. Costs Update		WORLEY	PM-PD
4. Economic Update			
5. Certification Sheet			

Enclosure 1 – Summary Comparison of Chief's Report and General Reevaluation Report

The following table describes the differences between the Chief's Report on the project in April of 1986 and the March 2002 General Reevaluation Report. It is the intent of the table that the reader will be able to easily directly compare the two submissions.

The rows and columns were selected to illustrate the similarities between the two packages. The first column is a listing of the major components of each effort, including a cost summary based up the differing years of submission, then finally brought forward to a common basis of October 2006. The next two columns are summaries of the plans with highlights of common and differing features. The last column is a description of what the differences are and an explanation of why this is so.

The table shows that there is little significant difference between the two packages. The primary component of the structural reach remains virtually identical and the nonstructural component is deferred, not deleted, at the request of the sponsor. This caused the lands for the recreation areas not being available, so that measure will also be deferred. The inclusion of a Flood Warning System is in line with Corps policy, was described in the original 1985 Feasibility Report, and is a small part of the project cost.

Enclosure 1

Island Creek Local Protection Project at Logan, West Virginia

Summary Comparison Between 1986 Chief's Report and March 2002 General Reevaluation Report

	Chief's Report Dated 25 Apr 86	General Reevaluation Report (March 2002)	Detailed Discussion
Structural	• 3,700 feet of channel improvement • 100 feet wide • 1st 1,000 feet concrete lined • 3 significant businesses to be acquired • reduces 100 year event to 2-11 year event	• 3,700 feet of channel improvement • 80 feet wide • No concrete lining • 1 significant business to be acquired • reduces 100 year event to 6-11 year event	The channel width was revised downward from 100 feet to 80 feet as it was less environmentally intrusive, reduced the number of business that have to be acquired and provided nearly the same amount of hydraulic carrying capacity, so it had nearly the same amount of flood damage reduction. The 80-Foot Channel Plan is also the preferred plan of the non-Federal sponsor. Although it is not technically the NED plan, the difference in net benefits between the 80-Foot and 100-Foot plans are essentially the same ($2.6 Million). Therefore, the 80-Foot Channel Plan is considered to "reasonably" maximize NED benefits and was selected in the GRR. Frequency reduction is dependent upon location along channel modification. Net benefits are essentially the same and neither report selected the pure NED plan.
46-759 **Nonstructural**	• 146 Residential Acquisitions • 116 Commercial Acquisitions • 1126 Residential Floodproofing • 77 Commercial Floodproofing • 149 Mobile Home Relocations	Component not implemented at this time	The nonstructural component was deferred as the Logan County Commission has stated that it is financially unable at this time to meet the cost sharing requirements for the additional nonstructural components of the authorized plan. Therefore, it is further concluded that reevaluation of the nonstructural component of the authorized plan should be deferred until such time as a willing and capable nonfederal sponsor expresses interest in the implementation of such measures. The Huntington District's extensive experience in nonstructural flood protection as part of our Section 202 Authority has taught us that this type of effort, while currently relatively expensive, is still effective in reducing flood damages and should be retained for future consideration.
Flood Warning System	Not identified as a specific separable element in Chief's report, however, presented as an essential feature in the 1986 feasibility report	FWS Included as part of recommendation - installation of supplemental gages and equipment for an effective system	The Flood Warning System was added as a nonstructural measure as it is now Corps policy for inclusion on all projects (CE-ETL-1110-2-540, dated 30 Sep 96). It was assumed in the feasibility report that a complete IFLOWS system would be installed and available for use as a flood warning system and is incrementally justified. To date, a fully functioning system has not been developed in the project area.
Recreational Areas	8 Day Use Recreation Areas to be constructed within nonstructural project area	Deferred until implementation of nonstructural component	The deference of the nonstructural effort resulted in lands not being made available for recreation, so that measure was not included at this time.
Cost Oct 1985 (FY 86) Price Level	$86.0 Million	N/A	This reflects the original fully funded project cost.
Cost Oct 2001 (FY02) Price Level	N/A	$23.8 Million	This reflects the fully funded cost of the March 2002 submission at the time it was submitted.

Enclosure 2 – Project Benefit Update

To facilitate updating the project flood damage reduction and flood warning system benefits, USACE personnel visited the project area on 24 May 2007. Since the majority of the benefits for the proposed project are from commercial development, the focus of the trip was on the documentation of any changes related to the commercial structure inventory. During the visit, each commercial structure was located and photographed with the goal of verifying the continued existence of the structure and the type of business contained within. The physical condition of the structure was also noted to support the structure value estimate. Based upon the findings of the field personnel, it has been determined that while there were some changes to the complete commercial structure inventory, there are no appreciable differences overall. It should also be noted that each residential structure was not looked at individually because the inventory also did not appear to be significantly changed.

Therefore, it is deemed appropriate to use a cost index factor to update the project benefits used in this analysis from FY02 (1 October 2001) to FY07 (1 October 2006) price level. The results are shown in Enclosure 4 – Economic Analysis Update.

Enclosure 3 – Project Cost Update

The project costs were updated from 1 October 2001 (FY02) to a 1 October 2006 (FY07) price level. The summary estimates for non-fully funded and fully funded project costs follow.

Enclosure 3

Island Creek LPP at Logan, WV
Total Project Cost Summaries (Fully Funded and Non-Fully Funded)

	FEATURE ACCOUNT	1 Oct 2006 Price Level	PRIOR EXPENDITURES THRU FY 07	FY08	FY09	FY10	FY11	FY12	FY13	TOTAL PROJECT COST
Non-Fully Funded	01	6,403,399	7,136	2,114,467	2,143,835	2,137,961	-	-	-	6,403,399
	02	1,024,960	-	-	-	-	614,976	409,984	-	1,024,960
	09	17,682,648	-	429,717	-	-	10,609,589	6,643,342	-	17,682,648
	22	1,209,527	1,209,527	-	-	-	-	-	-	1,209,527
	30	4,569,676	2,259,676	385,879	384,824	384,824	384,824	385,879	383,770	4,569,676
	31	1,399,728	-	-	-	-	839,837	559,891	-	1,399,728
Non-Fully Funded Total		$32,289,939	$3,476,340	$2,930,063	$2,528,659	$2,522,785	$12,449,226	$7,999,096	$383,770	$32,289,939

	FEATURE ACCOUNT	1 Oct 2006 Price Level	PRIOR EXPENDITURES THRU FY 07	FY08	FY09	FY10	FY11	FY12	FY13	TOTAL PROJECT COST
Fully Funded	01	6,403,399	7,136	2,225,048	2,367,846	2,413,309	-	-	-	7,013,339
	02	1,024,960	-	-	-	-	689,644	468,958	-	1,158,602
	09	17,682,648	-	439,995	-	-	11,897,735	7,598,931	-	19,936,662
	22	1,209,527	1,209,527	-	-	-	-	-	-	1,209,527
	30	4,569,676	2,259,676	398,999	426,638	458,629	461,056	480,668	496,936	4,982,600
	31	1,399,728	-	-	-	-	996,393	690,625	-	1,687,018
Fully Funded Total		$32,289,939	$3,476,340	$3,064,042	$2,794,484	$2,871,938	$14,044,828	$9,239,182	$496,936	$35,987,749

Enclosure 4 – Project Economic Analysis Update

The resulting project economic analysis based upon updated benefits and project costs is shown in the following table.

Enclosure 4

Island Creek Local Protection Project at Logan, West Virginia
Project Benefit and Cost Comparison
1 October 2006 (FY07) Price Level

Fully Funded Total Project Cost	$ 35,987,749
Non-Fully Funded Total Project Cost	$ 32,289,939
Less Sunk Cost (Prior Expenditures)	$ 3,476,193
Economic Project Cost	**$ 28,813,746**
Expected Annual Flood Damage Reduction Benefits	$ 4,138,922
FWS Reduction of Residual Damages	$ 148,764
Total Expected Average Annual Project Benefits	**$ 4,287,686**
Annual Project Costs	$ 1,547,940
Interest During Construction	$ 221,104
Operations & Maintenance	$ 67,700
Total Expected Average Annual Project Costs	**$ 1,836,744**
Total Expected Average Annual Project Benefits	$ 4,287,686
Total Expected Average Annual Project Costs	$ 1,836,744
Net Benefits	**$ 2,450,942**
Benefit to Cost Ratio	**2.33**

Enclosure 5

STATEMENT OF DOCUMENT CERTIFICATION

Island Creek Local Protection Project at Logan, West Virginia

This is to certify that the undersigned, as members of the Project Delivery Team, have reviewed and approved the attached document package for this project and our signature below indicates that the proposed project as outlined herein is technically correct and consistent with policy.

Sherry L Adams

Sherry Adams
Project Manager
PM-PP-P

Clyde R Campbell

Clyde Campbell
Civil Engineer
PM-PD-F

Natalie McKinley

Natalie McKinley
Economist
PM-PD-F

Russell Craddock (Acting)

(for) Mary Ann Rowe
Cost Engineer
EC-TC

Jeffrey D. Yost

Jeff Yost
Lead Engineer
EC-DC

QUALITY REVIEW

My signature below indicates that submission is correct and consistent with policy.

Amy K Frantz

AMY K. FRANTZ
Chief, Plan Formulation Section

LEGAL REVIEW

My signature below indicates that submission is consistent with applicable statutes and concur with the analysis concluding the proposed GRR project is consistent with the 1986 Chief's Report and is authorized under current legislation.

Kimberly P. Perry

KIMBERLY P. PERRY
Assistant District Counsel

Enclosure 5

Island Creek Local Protection Project at Logan, West Virginia

ITR CERTIFICATION

My signature below indicates that the submission is technically correct and consistent with policy.

Roger Dale Setters

ROGER D. SETTERS, P.E.
Chief, CELRD FDR Tech Center

PROGRAM & POLICY COMPLIANCE CERTIFICATION

My signature below indicates my certification of policy for the subject submission.

G. Michael Worley

G. MICHAEL WORLEY, P.E.
Chief, Planning Branch

CECW-PC 20 June 2006

MEMORANDUM FOR LRD-RIT (Ms. Patricia Mutschler)

SUBJECT: Policy Review Assessment- Supplemental Materials for Island Creek Local Protection Project at Logan, West Virginia, June 2006.

1. BACKGROUND. The Island Creek at Logan, West Virginia local protection project was authorized for construction in Section 401 of the Water Resources Development Act of 1986. At that time the local sponsor did not have the available funding to proceed with the project. In 1999 the Logan County Commission, acting as non-Federal sponsor with financial support from the West Virginia Conservation Agency requested that the Corps reevaluate the authorized project. The Huntington District prepared a General Reevaluation Report to reaffirm the project justification and submitted the GRR for review and approval. The GRR was submitted to ASA (CW) in October 2002. ASA (CW) comments on the report were provided through HQUSACE on 30 April 2003. Responses were provided to HQUSACE and ASA (CW) on 25 July 2003, however questions still remained. The district then prepared a supplement to the GRR and submitted it on 11 September 2003. The supplement answered questions regarding the documentation of flood events, sensitivity of the H&H data and resulting economic feasibility, and the technical adequacy of the H&H information. However, questions still remained regarding the estimated damages from the 1-year, 2-year, and 5-year frequency floods. In an effort to resolve the concerns, the district hosted a field trip to the Island Creek basin on 29 June 2004 to allow the review team to meet with the residents and business owners in the project area. This was documented in an MFR dated January 2005.

ASA (CW) provided further clarification of the review concerns on 22 July 2004. Specifically, the concerns related to the following:

- Lack of documentation for the annual and 2-year flooding presented in the report.
- The local residents and businesses in the economically depressed community seem incapable of having the disposable income to repair and replace the damaged property to the extent claimed in the report.
- Project justification is sensitive to the amount of average annual damages projected from the very frequent events, with about 70% of the benefits being attributable to the 1-year through 5-year events.

In response, the district provided further supplemental information on 1 February 2005. The response did not directly address the ASA (CW) concerns point by point, although it contained some information that was responsive. HQ developed a draft policy review assessment of the supplemental materials and provided a draft memorandum to the LRD-RIT on 17 August 2005. The draft assessment was coordinated with ASA (CW) and it was concluded that additional information was needed to support the damage analysis. The LRD-RIT and ASA (CW) coordinated to provide the district with the format for a table in October 2005, to detail the very frequent flooding-related costs from the 1-year and 2-year, as a means of helping to substantiate the reasonability of the damage analysis and resolving the ASA (CW) concerns.

The supplemental tables and materials were submitted in April 2006 along with ITR documentation. The submittal did not include a narrative to explain how the material addressed ASA (CW) concerns, but the various tables included clarifying notes on the key assumptions and coordination undertaken. The additional analyses included no additional damage surveys. Existing data sources and limited coordination were used to estimate costs associated with the flood events and to help substantiate the information in the report.

2. ASSESSMENT OF CELRH RESPONSES TO ASA (CW) POLICY REVIEW CONCERNS. The following sections explain the review team's views on how supplemental analyses have addressed each of the ASA (CW) concerns.

a. Documentation of the Annual and 2-year Flooding Presented in the Report. The supplemental material provided by the district included a significant amount of material that documented the occurrence of numerous historic flood events- newspaper articles, video, photos of damaged property and high water marks, and discussions of damages and temporary evacuation measures that could be reduced with a project. However, this information related to individual properties and was not presented in manner that helped to verify or calibrate the economic model by comparing historic damages to those predicted for hypothetical floods in the range of the 1-year to 5-year frequency events. The district's February 2005 supplement suggested that the damages shown in the GRR for frequent events had actually been understated. Several damage categories were left out in the original analysis including the costs of flood preparation, false alarm responses, lack of flood insurance, incremental damages from repetitive flooding, auto damages, and compensation to employees while businesses are closed. Some of these categories qualify as NED benefits. However, without knowing how the economic model calculated damages and whether they might have been overstated, the discussions of potential additional benefit categories that were not quantified did not help the review team clarify whether the project was economically justified.

The basis for the policy concern is paragraph 3-3.c.(5)(f), which indicates that the determination of existing damages should be based on losses actually sustained in historic floods supplemented by appraisals, application of depth-damage curves and an inventory of capital investment within the floodplain. The review team understood and concurred that this area experiences significant frequent flooding, however the February 2005 supplemental information, as presented, had limited utility for reaching concurrence in the damage function for frequent events, which were critical to the project justification. In an effort to better understand the information provided, the review team reviewed information contained in the March 2002 GRR and May 2001 in relation to the supplemental information provided in June 2004 and February 2005.

The attached tables summarize information gleaned from review of the GRR and supplemental materials provided to date. Attachment 1 lists and characterizes the historic events in the project area and Attachment 2 summarizes historic flood damage sustained at those properties where interview information was provided.

The HQ review in 2005 led to several observations that related to the correlation of the damage model to frequent historic flooding events.

(1) Frequency of First Floor Flooding. Several businesses and rental properties were shown in Table 1 of the February 2005 submittal to have first floor elevations within the 1-year flood event (Janet's Restaurant, Stereo Video Unlimited, Logan Physical Therapy, Logan Auto Machine Shop, Logan Rental, Atkins Safe/ Charlene's Hair Salon and Atkins Security, AvMAC, and various Sam Tiller rental properties), however the interviews focused primarily on damage and flooding from the more damaging May 2004 and May 1996 events at these properties. It is not surprising that interviewees might focus on their most severe flooding rather than the more frequent lesser events, because the damage would sound more devastating. But if the flood stage-damage-frequency relationship was reasonably correct, many of these businesses would be experiencing significant first floor flooding annually or multiple times in a year. Some interviews referenced annual flooding, but damage estimates and details were sparse.

HQ attempted to evaluate the elevation of structures relative to the flood profiles, topography, and channel cross sections (bank elevations) to check for consistency of the information and zero damage points. Comparing the first floor elevations to the stationing shown in Figure 1 of the February 2005 supplement and profile data on Exhibit A-II-5 of the GRR it appeared that some structures had first floor elevations as much as 4 feet below the 1-year flood profile. The supplemental documentation noted that several businesses undertake evacuation measures or experience flood damages annually, but little or no damage or cost data was provided. The economic appendix of the report contained no damage information on individual structures, breakdown by categories or reaches- just total damages for selected frequency events from the 1-year to 500-year floods. HQ concluded that the community suffers from a frequent flooding problem that has devastating effects, and the documentation provided supports that conclusion. The frequent flood damages/costs predicted by the economic model appeared to be high, but could not be correlated to those experienced historically in order to draw conclusions on the reasonability of the results for the 1-year and 2-year events.

For example, one of the lowest structures appears to be the Stereo Video Unlimited with a first floor elevation of 659.0 (Table 1, February 2005 Supplement). This appeared to be located along Island Creek at about station 35+00 (Figure 1) where the 1-year flood profile would have an elevation of about 663.1 (Exhibit A-II-5), roughly 4 feet above the store's first floor. The supplement indicates that the store incurs damages from annual flooding, however, the documentation focused on 9.5' of flooding in May 2004. The September 2003 supplemental documentation reported that the building incurred damage from 9 feet of flooding in May 1996, and about 3 feet of flooding in a September 2003 event. The 1996 and 2004 floods appear to be about 10-year events based on the historic flooding depths and flood profiles (Exhibit A-II-5). The 2003 flood appears to be less than a 1-year frequency event, although its frequency is not estimated in the supplement. In addition, a news article on the October 1989 flood event showed that this business was prepared to move its contents with a rental truck in anticipation of flooding, but it was not necessary because waters receded. No historic damage/cost values were offered for a typical annual flood or the 1989, 2003 or 1996 floods, however the backup provided does show that at least four events occurred during that 15-year period. Other interviews and sources show that as many as ten or eleven events may have occurred during that period. Although no conclusions could be drawn on the correlation of predicted damages to historic damages- it was concluded that the business likely incurred flooding from numerous events including those below a 1-year frequency and the report of annual flooding was reasonable.

The Keefer Kawasaki shop was shown to have a first floor elevation of 667.3' (2-year floodplain), however the only interior flooding reported for the building was for the 1996 and May 2004 events. The business reported moving inventory twice in 2002 and it is likely that actions were also taken for other events such as those in 2003. More frequent first floor flooding might be expected for a structure that is in the 2-year floodplain, however it is reasonable to expect that the economic model should show some damages or costs are incurred during 1-year to 5-year events.

Another group of structures (Atkins Safe/Atkins Security/ Hair Salon) in the 1-year floodplain had annual flooding of 1-2 feet reported in the interviews. These structures incurred 4-6 feet of flooding in 1996 and 2004. Multiple floods were shown to have flooded the interior to a 2-foot depth. The structures have first floor elevations of 663.4 to 665.9, however there may be some confusion as to which elevations apply to each business. The 1-year profile has an elevation of about 667 at that location, so reports of 1-2 feet of flooding annually appear to correlate well with that profile. The 4'-6' of flooding during 1996 and 2004 appear to be in the range of the 2-year to 5-year frequency profiles, depending on what depth and first floor elevations apply to each business.

In conclusion, for the businesses discussed above it seemed reasonable that damages and costs were incurred from floods in the range of 5-year to 1-year events or less. Although historic damage values were not reported during interviews, the district's economic model likely reflects reasonable flooding levels that have occurred historically. Several other businesses reported a significant number of flooding events. Baisden Hardware reported getting flooded 9 times ('57, '63, '67, '72, '77, '84, '93, '96, and '04) and although the first floor (673.5) was shown as being within the 75-year floodplain, HQ believes the first floor elevation should have been reported as the basement floor, which might be 8-10 feet lower, similar to other structures. The topographic mapping showed a spot elevation near the structure (662.9), which appeared to lie between the 1-year and 2-year profiles. Valley Market reported being flooded 17 times in 33 years, with 3'-5' every two years. These reports seem reasonable in relation to the frequency flood profiles and are likely typical of the flood history for other structures. Other floodplain properties may have experienced changes in ownership that limit knowledge of the long term flood history or owners may have just focused on the most severe events when interviewed, not knowing that the frequent, less damaging events might be more critical in estimating the benefits of a project. The issue is whether the damage estimated for these frequent events based on depth-damage curves is reasonable.

(2) **Zero Damage/Multiple Annual Flooding Events.** It is not clear how the economic analysis has addressed the flood levels at which damages begin. No discussion has been provided in the report regarding zero damage elevations on flood prone structures or for damage reaches due to over bank flow- the available information included only first floor elevations at selected structures, which appeared to represent the lowest/basement floor in most cases and may also be the zero damage elevation. The damage–frequency information on page 9 of the Economic Appendix showed damages of $1,906,000 for a 1-year event. It was not evident how that value was calculated or how the analysis might have addressed the effects of multiple annual events as reported by the businesses. The economics appendix did not provide a breakdown of damages by category (structure, content, residential, commercial, public, clean up, emergency costs), reaches, or source of flooding for the frequency events used in calculating the average annual damages. HQ understands that residential damages were modeled using standardized depth-damage curves developed by the district from empirical and post-flood evaluations for residential structures. Structure values were assigned based on coordination with local realtors and professional judgment, and content values were assumed to be 50% of the structural values. Non-residential depth-damage relationships were estimated based on interviews. The model then used predicted flood levels for the various frequency floods to estimate the damage to each property using the appropriate depth-damage curve.

A more detailed description of the model results and a breakdown of the damages predicted for the 1-year, 2-year, 5-year events would have been helpful in establishing the reasonability of the damages for these frequent events. The economic appendix indicated there are 107 structures in the 1-year floodplain of the study area. However, the supplemental data provided information on only a limited number of them in the immediate project area. It would have been helpful to see information in the report that explained the number and type of structures damaged for these frequent events, and where they were located within analytical reaches used to model Island Creek and its tributaries. The breakdown of residential, public, and commercial structure and content damages should have been provided, as well as information on any emergency and cleanup costs incurred by the community. The district should have also described the zero damage points for the project area and how multiple annual flooding events were evaluated in the analysis. To some degree the supplemental information provided in April 2006 addresses the concern by providing information on residential versus commercial damages and estimates of cost associated with emergency efforts and preparedness actions..

(3) **Model Calibration Using a Reference Flood.** The supplemental documentation dated January 2005 characterized the May 2004 event as about a 10-year frequency. This appeared reasonable based on some of the HWM data shown at the Logan Auto Machine Shop (+7' ref. FF) and the DEP building (+2' ref. FF). However, it wasn't clear that the HWM data for that event at other locations was consistent with that frequency. Further

upstream at Atkins Security, Atkins Safe, and Charlene's Hair Salon, the flood depths were reported to be in the range of 4-6 feet, which seemed to correlate to a lower frequency flood event (2-year to 5-year). HQ did not see a discussion of how the flood stage–damage-frequency model was calibrated based on the use of historic high water marks and damages for a reference flood, although there were sensitivity analyses conducted on "n" factors and debris blockage. Given the multiple sources of flooding (Guyandotte River, Island Creek, Copperas Mine Fork) that could contribute to flooding in the area, and the nature of the historic flooding (backup/ fluvial/ debris blockage effects) some discussion on the model calibration to a reference flood would have been helpful in understanding the economic analysis, but the hydraulic analysis seemed reasonable relative to the 2004 event.

Data provided on page 9 of the Economic Appendix showed the following damages for the more frequent events: 1-year event- $1,906,000
5-year event- $9,753,000
20-year event-$15,068,000

Based on this information, HQ would expect a 10-year event (similar to the May 2004 flood) to result in damages on the order of $12-13 million. The damage estimates provided during supplemental coordination appeared to total about $1.5 million. Those interviews represented only a portion of the properties historically flooded, however it would have been helpful to see information on the damage predicted by the economic model for those properties, as a means of correlating the predicted damages to historic event damages during a reference flood for the project area as a whole.

(4) <u>Characterization of the May 1996 Flood.</u> The ASA (CW) memo of 22 July 2004 noted that the district has characterized the May1996 flood as about a 100-year event. This characterization did not seem appropriate, since the interviews and HWMs generally described the 1996 event as being somewhat lower or about the same magnitude as the 2004 (10-year) event. The 100-year profiles in Exhibit A-II-5 of the May 2001 GRR showed that the 100-year profile should be about 5' to 7.5' higher than a 10-year event in the area between US 119 and the Chessie RR. At Keefer's Kawasaki, the 1996 flood depth of 3 feet appeared to correspond to about a 5-year event. In addition, the event is not described as being within the highest twelve floods experienced. This provides more support for the economic analysis than considering the May 1996 as a 100-year event.

(5) <u>Characterization of the February 2003 Flood.</u> A few interviewees noted a flood in February 2003 that appeared to be less than a 1-year magnitude, however no estimated frequency or damage estimates were provided for that event. This type of flooding should have been documented to the maximum extent since its frequent nature contributes significantly to the average annual damages and benefits. The data indicated that Stereo Video Unlimited and Napier's Exxon were closed for about one month and Janet's Restaurant closed for 16 days following this event, however no damage estimates were provided. Those reports appear to substantiate that significant damages occurred at varied locations throughout the floodplain for an event that appears to be less than a 1-year flood.

b. <u>Ability of Residences and Businesses to Repair and Replace Damaged Property.</u> The February 2005 supplemental materials indicated that property owners in this economically depressed area have suffered tremendous damages from flooding events, yet are financially incapable of purchasing flood insurance in many cases. This does not appear to be rational behavior if flood insurance is available. However, several interviewees also reported that flood insurance coverage was cancelled due to the substantial claims that had been filed. HQ believes that having floodplain businesses that incur significant flood damages would contribute to a situation where the occupants would have low disposable income. Several of the businesses are located on the lowest level of the structure and the owner resides in the upper floors. It is understandable that the occupants might continue to stay in flood prone properties, if they cannot sell their properties or cannot afford to relocate to a less flood prone locations. Some interviewees also noted that they had taken loans for repairs.

This seems to be an issue that will be difficult to resolve definitively based on the judgment involved and the various factors affecting disposable income (flood losses, payments to employees), limited options for relocating, the connection between housing and businesses (living quarters above stores), and financing. The town's businesses largely provide services to this mining community. It would be difficult for the district to provide additional information that can substantiate that property owners have the ability to pay for the level of damages predicted by the economic model. No study funds are available to accomplish the effort, and there is reluctance to contact floodplain occupants yet again, since they are frustrated with the inability to obtain flood protection despite the history of significant, frequent flooding and they have cooperated repeatedly in the past in attempts to substantiate the damage information used in this analysis.

<u>c. Sensitivity of Project Justification to Frequent Flooding Events.</u> The February 2005 supplemental material explained that a sensitivity analysis was conducted to evaluate the effects of hydrologic assumptions on frequent flooding events on project justification. From the analysis it was evident that changing the assumed annual event to a 2-year event still resulted in a justified project with a BCR of 1.5. Changing the annual event to a 5-year event would affect the justification, however this seemed to be an unreasonable adjustment from a hydrologic standpoint.

HQ believes the hydrologic and hydraulic analyses of this ungaged creek are not so much an issue as the predicted damages for the frequent flooding events. Since theoretical probability is more appropriate to extreme events and gage data is more applicable with frequent events, the hydrologic analysis considered gage data for a similar stream in developing the discharge-frequency relationship for Island Creek, which is an appropriate methodology where no gage records exist.

The supplemental material provided by the district in April 2006 provided additional information on the anticipated damages for the 1-year and two-year events, including costs for landscaping damages and evacuation costs; municipal costs for emergency management and police/fire/EMT services; and flood preparedness costs including lost wages and costs for moving damageable property. This additional information on frequent damages was developed based on available data sources, reasonable assumptions, and a limited amount of supplemental coordination.

HQ completed an additional sensitivity analysis using the April 2006 information, to evaluate the sensitivity of project justification to the very frequent flooding events. The damage information shown in the GRR for a 1-year event was shifted to the 3-year frequency, keeping damages for the 5-year and 10-year similar to those shown in the report, since the damage estimates are better supported at those frequencies. The April 2006 supplemental damage information was then used to estimate the damages from the 1-year and 2-year events as $100,000 and $200,000, respectively. The results are shown in the calculations below:

	Frequency		Damages		AAD
1 Year	0.99		100,000		
		0.49		200,000	98,000.00
2-Year	0.50		200,000		
		0.17		1,053,000	179,010.00
3-Year	0.33		1,906,000		
		0.13		5,829,500	757,835.00
5-Year	0.20		9,753,000		
		0.10		11,376,500	1,137,650.00
10-Year	0.10		13,000,000		
					2,172,495.00

The report concluded that the recommended plan would eliminate all damages from the 10-year event and lesser floods. Using the value above as a conservative estimate of project benefits (there would likely be some benefits from events above a 10-year also) the project would still be justified with a BCR of over 1.4 (average annual costs are about $1.5M). Based on statistical probability there is a 13 percent chance in any given year of having a 3-year to 5-year flood event, a 10 percent chance of having a flood in the 5-year to 10-year range, and a 10 percent chance of having floods greater than a 10-year event. It would be reasonable to expect that three to five floods might occur per decade in these circumstances. For the Island Creek area two flood events occurred in the 1960's, three in the 1970's, three in the 1980's, four in the 1990's, and four since 2000. So the frequency of historic flooding seems reasonable in comparison to the assumptions in this sensitivity analysis.

For further comparison, the damages were truncated at the 3-year event as shown below, resulting in annual benefits of $2.057, which are about $115,000 less. Use of these very conservative values would still result in an economically justified project with a BCR over 1.3.

	Frequency		Damages		AAD
1 Year	0.99		-		
		0.49		-	-
2-Year	0.50		-		
		0.17		953,000	162,010.00
3-Year	0.33		1,906,000		
		0.13		5,829,500	757,835.00
5-Year	0.20		9,753,000		
		0.10		11,376,500	1,137,650.00
10-Year	0.10		13,000,000		
					2,057,495.00

3. CONCLUSIONS. Although the GRR submitted by the district lacked detailed economic data in the Economic Appendix with which to review and verify calibration of the damage model to historic flood events, it is apparent that the damage center is subject to repeated significant flood damages that devastate the community. The damages resulting from 1-year and 2-year events may be overstated to some degree in the economic analysis, however, the sensitivity analyses completed by the policy review team indicate that the recommended plan would be economically justified regardless of the degree to which these frequent flooding events are considered in the economic analysis. The district has no funds with which to refine the economic analysis any further. The project would alleviate the frequent flood damage and substantially improve the living conditions within this community for a modest cost. Therefore, the Office of Water Project Review recommends that the report be processed for project authorization.

/s/
C. Lee Ware
Review Manager

Historic Flood Event	Interview Data	Estimated Freq.	Pictures	Video	Newspaper Articles	Notes
July 1875						Guyandotte crest stage 27.3 at Logan, 7th highest
Jan.1918						Guyandotte crest stage 26.3 at Logan, 9th highest
Jun.1957						Guyandotte crest stage 28.2 at Logan, 5th highest reported by Baisden Hardware
May. 1963					Yes (2)	Guyandotte crest stage 34.9 at Logan, highest reported by Baisden Hardware, US 119 washed out
1967						reported by Baisden Hardware
1972						reported by Baisden Hardware flooding 4 times in 1 yr during 70's reported by Valley Market
Jan.1974					Yes (2)	Guyandotte crest stage 31.1 at Logan, 3rd highest
April. 1977					Yes	reported crest stage of 31 in paper, 4th highest reported by Baisden Hardware
Sept. 1982				Yes		Paper reported May 1984 as first flood since1977
May. 1984				Yes	Yes (3)	Guyandotte crest stage 23.3 atLogan, 12th highest reported by Baisden Hardware
Oct. 1989					Yes	Stereo Video prepared to move stock, water receded
May. 1991						
1993						reported by Baisden Hardware
May. 1996	Extensive	Reported as 100-yr, but is nearer to 10-yr.	Yes	Yes		reported by Baisden Hardware and others
Mar. 1997				Yes		video upstream
2002						Keefer Kawaskai moved inventory twice
Feb. 2003	Several	Less than 1-yr.	Yes		Yes	reported by Jane's Rest , Exxon, Stereo Video Chirico's, Chevron
Sept. 2003	Two		Yes			parking lot flooding reported by Stereo Video water in Valley Market
May. 2004	Most Extensive	10-year per rpt.				reported by Baisden Hardware and others

Attachment 1

Interviewee	FF Elev.	May 2004 Damages, Depth	Feb. 2003 Damages, Depth	1996 Damages, Depth	Notes
Big Eagle Gun & Pawn				$? 4-4.5' ref. FF	Freq. Flooding in parking lot
Stereo Video Unlimited	659	$? 9.5' ref. FF	Closed 1 mo. 3 ' ref FF	Contents destroyed 9' ref. FF over ceiling	Have Flood Ins. Premiums increase after floods
Chevron			1-2.5'ref FF	To pump canopy 10'?	Structure floods twice annually
Valley Market				$400K 5-5.5' ref. FF	17 floods in 33 years, have Ins. 3-5 ' every two years, 4X in 1 yr, during 70's Water in bldg. Sept 2003
Keefer's Kawasaki	667.3	$277.5K moved inventory closed 2 weeks	about 1-1.5' on bldg.	about 2.5-3' ref. FF	moved inventory twice in 2002 water reaches wall annually, inventory moved
DEP Building	670.2	$250-300K, 2' ref. FF		Similar $ to 04, 1.5' ref.FF 3.5' above ground	
Atkins Safe & Alarm	663.4	No estimate yet		$60K 6' ref. Basement	Floods 1-2' annually, multiple HWMs at 2'
Charlene's Hair	663.4	$4K Salon			
AtkinsSecurity	665.9	$15K Security, 6' in basement			
Logan Hydraulics	671	$250-300K for all properties (owns DEP Bldg)		Similar to 2004, within 1' of FF	storage bldgs. flooded every 2-3 years
Chirico's Ristorante			FF and parking lot flooded	7' ref. FF	
Logan Auto Parts/ Machine Shop	670.6 661.8	$35K 7' moved inventory		$150K 6.5' lost all inventory	
Braisden Hardware	673.5	$200K saved $275K moving inventory			flooded in '57,63,67,72,77,84,93,96,04
Logan Rental	660.8	$25K structure			
Logan Physical Therapy	661.9	$342 contents $180 structure		Similar to 2004 closed 3 months	have flood insurance
Janet's Restaurant	664.4	$100K	closed 16 days	$60K	has flood insurance
Napier's Exxon		$46K	closed 1 month		flooding in 76, 96, 03, 04.

Attachment 2

Enclosure 4

Island Creek Local Protection Project at Logan, West Virginia
Project Benefit and Cost Comparison
1 October 2006 (FY07) Price Level

Fully Funded Total Project Cost	$ 35,987,749
Non-Fully Funded Total Project Cost	$ 32,289,939
Less Sunk Cost (Prior Expenditures)	$ 3,476,340
Economic Project Cost	**$ 28,813,599**
Expected Annual Flood Damage Reduction Benefits	$ 4,138,922
FWS Reduction of Residual Damages	$ 148,764
Total Expected Average Annual Project Benefits	**$ 4,287,686**
Annual Project Costs	$ 1,547,932
Interest During Construction	$ 221,104
Operations & Maintenance	$ 67,700
Total Expected Average Annual Project Costs	**$ 1,836,736**
Total Expected Average Annual Project Benefits	$ 4,287,686
Total Expected Average Annual Project Costs	$ 1,836,736
Net Benefits	**$ 2,450,950**
Benefit to Cost Ratio	**2.33**

Response: 17 Feb 2006

Independent Technical Review Comments
Island Creek Logan, West Virginia
Table Detailing Frequent Flood Costs

These are consolidated comments of Roger Setters and Mitchell Laird, CELRL-PM-P, 22 December 2005.

1. General comment: it is assumed that estimated data used in the GRR is sufficient and that ASA(CW)'s office did not intend for the district to gather empirical data for the table.
   RESPONSE: *Concur. Per division's instructions, we believe this to be true. Our impression is that we were to use best available information. Limited information was gathered through interviews with county and state officials, but no new surveys were conducted.*

   Clarification: The District decided to remain consistent with the results presented in the GRR as we completed this spreadsheet. The economic benefits contained in the GRR were calculated using the LRH flood damage program. The damages were then used as input into HEC-FDA to incorporate the required risk component. Due to this, the "standard HEC-FDA output" is not available to use to complete categories in the spreadsheet as several of the comments suggest.

2. The price level of monetary values of the table should be stated.
   RESPONSE: *Concur. All values calculated for the table (see the* RIT-ASA *worksheet in the workbook) are now expressed in $2002 to coincide with the price level used in the GRR.*

3. A rough estimate of 1% of total residential damage was made for residential landscaping damage. The note for total residential damage indicates that landscaping is included in these. However, if the generic residential damage functions provided in EGM 04-01 were used, landscaping is not included and should not be subtracted from total residential damage but estimated separately.
   RESPONSE: *Concur. It was determined that landscaping damages were not included in the total damages reported in the GRR. The landscape damages provided in the table (see the worksheet* Landscaping-costs *for specifics) are based upon information provided by a staff landscape architect.*

4. Estimates of "road closures" were not made. The suggested algorithm in the original ASA table essentially gives the method for estimating the traffic delay portion of traffic diversion costs. Additional traffic operating costs should be estimated along with the delay costs. The methodology for these estimates is provided in chapter VII of IWR report 88-R-2, National Economic Development Procedures Manual – Urban Flood Damage.

RESPONSE: *Clarification. An attempt was made to estimate road closure costs; however, there was insufficient information available upon which to base an estimate. SR44 is the only highway that is blocked by flooding of Island Creek, so efforts to estimate road closure costs focused on this highway. In response to our request for vehicle flow data, the WV Department of Transportation provided traffic counts at five locations on SR 44(see* Alt-route-map *worksheet).*

State route 44 follows Island Creek for approximately 17 miles from SR44's junction with old US119 on the north to US52 on the south. Between these two junctions, SR44 does not intersect with any US highways, state routes or secondary highways owing to the terrain's severe relief on either side of Island Creek. During the one and two year flood events, Island Creek floods the project area, prohibiting residents from leaving their homes or using their automobiles to travel anywhere. Flooding also obstructs the road along significant stretches of SR44 south of the project area, blocking residents there from traveling. So residents along SR44 cannot avail themselves of an alternate route.

It is likely that there is vehicle traffic that uses SR44 as a through route; however, at-a-point traffic counts were not sufficient for determining current origin-destination vehicle transit patterns, making the identification of alternate routes impossible with the available information. Without the identification of alternate routes and flows, it was not possible to estimate traffic delay and diversion costs with any degree of confidence.

5. Both residential and commercial structure and content damage for each event should not need to be estimated based on the analyst's judgment, but should be obtained from HEC-FDA output. The original ASA table indicated the number of structures and average damage per structure should be provided.
RESPONSE: *Concur. Based upon the clarification in response to Comment #1, we did not have "standard HEC-FDA output" to provide the answer as suggested. We have developed more scientific estimates using different methods for residential and commercial structures.*

For residential structures (since we had structure values), a test run was performed in HEC-FDA using generic depth damage functions. We used the totals for structural and contents to calculate the percentage of each type of damage. We then applied those estimated percentages to the damages reported in the GRR and populated those cells in the spreadsheet with our results. An average per structure is also stated in the notes column.

For commercial structures, we did not have the structure value available and used the method described in the Commercial-damages *worksheet to estimate the amount of total damages attributed to structures and their contents.*

6. As stated in the note made for repair costs, these are already inherent in the damage estimates. Damage functions normally include costs to clean, repair or remove, and

reset damaged features of a structure. Because of this, it is assumed that the intent for this category is that empirical repair cost data from the study area be provided, if possible. There are also commercial estimation services, such as MyEstimator.com, that could be used to break out repair costs. An arbitrary 10% is probably a low estimate for repair costs. Additionally, the repair_costs tab in the Excel file shows the repair cost estimate to be per structure, when it is actually for the study area.
RESPONSE: *Concur. As the reviewer states, repair costs do not represent an additional damage category, but are the primary cost basis for the structural damage estimate. The assumption is that damages sustained will be repaired. Additional empirical data could not be readily obtained. In complying with division's instructions, no new empirical data was compiled. Also concur that the repair cost estimates provided were much too low. The revised estimate assumes that repairs constitute 90 percent of structural damage costs for each structure. The per structure repair estimate is $4,705.*

7. The original ASA table indicates that Evacuation Costs should be based on the number of people evacuated and the cost of evacuation. The district's table states these costs are reflected in the Emergency Management costs. However, the worksheet for the Emergency Management cost estimate does not include any evacuation costs. These should be provided separately in the evacuation costs row of the table as the original table shows.
RESPONSE: *Concur. A worksheet has been created to estimate evacuation costs on a per house basis (see* Evacuation_costs*). The evacuation costs are now provided in a separate row per the original table.*

8. Fire/Police/EMT costs were calculated as a four man-month effort, expressed on a per capita basis for the county, applied to the population of the West Logan study area and weighted by the frequency of major floods in the study area. Estimating this on a per capita basis assumes that the number of such personnel that would respond during a flood does not exceed the ratio of the population of West Logan to that of Logan County. A more reasonable assumption is that many of the county's personnel would be deployed for assistance. The methodology given in the original ASA table of the estimate reflecting the cost of estimated above normal time for fire, police, and emergency medical technicians responding to 1-year and 2-year flood events should be used.
RESPONSE: *Concur. The Fire-police-costs worksheet has been modified to reflect a more appropriate response from the county's fire and police personnel. The Emergency Management costs (calculated in* EMS-costs *worksheet) were similarly modified in response to this comment.*

9. It appears that the intent of the original table for "emergency management costs" was to express above normal time of disaster and emergency services and other personnel that would man a command center to organize flood warning dissemination and emergency response. The provided estimate was based on the response costs, which should be included under Municipal Costs in an additional category. An estimate of personnel time for a command center should be made.

RESPONSE: *Clarification. The costs estimated are intended to capture "the extra costs of an emergency" as instructed in the original table for the row Emergency management costs. These do not specifically include the cost of establishing a command center, as 1-year and 2-year frequency floods occur with little warning and water recedes relatively quickly, leaving no time for establishment of a command center. The costs provided in the table (see the worksheet* EMS-costs *for specifics) are based upon information provided by the county's Emergency Services authority and reflect additional emergency services that are provided during and after the flood.*

10. The EMT_costs worksheet is referenced for emergency management costs. A more appropriate label for this sheet would be "Emergency Response Costs" instead of EMT or EMS costs. Similar to Fire/Police/EMT costs, emergency response costs for the county for one major flood event were prorated to the study area on a per capita basis and then multiplied by a lower-rounded probability of major floods. More appropriate data for this estimate would be that of response during some of the eight floods that have occurred in the last ten years.
    RESPONSE: *Concur. The row Emergency management cost should be renamed Emergency response cost. Concur that the use of per capita weighting is inappropriate. The* EMS_costs *worksheet has been modified to reflect costs per day rather than per capita.*

11. The comment for "Materials" states these are "not stockpiled by local EMS or businesses". The question is not if they are stockpiled but if they are used and, if so, what their costs are. It may be that there is not sufficient warning time to construct temporary floodproofing around structures. If so, this should be stated.
    RESPONSE: *Concur. There is insufficient warning time during these one and two year events to place sandbags or any type of temporary flood proofing around structures. Even if temporary materials could be placed, velocities are too high for them to be effective. For these reasons, it was judged that these costs would be insignificant.*

ISLAND CREEK SUPPLEMENTAL INFORMATION TO THE GENERAL RE-EVALUATION REPORT

9 September 2003

I. GENERAL DISCUSSION

In response to comments on the Island Creek General Re-evaluation Report (GRR), provided by ASA (CW) through HQUSACE on 30 April 2003, LRH reviewed the data and analysis contained in the report related to the hydrology & hydraulics (H&H) and economic components. Efforts were made by the District to confirm the previously provided data and analysis by reviewing the H&H information, researching the history of flooding on Island Creek and doing a sensitivity analysis on the economic component. A memorandum containing the responses was forwarded to HQUSACE on 25 July 2003. However, upon receipt of the additional information by ASA (CW) and HQUSACE, the concerns remained. With the District recognizing and understanding the concerns regarding the use of generalized frequency H&H data and analysis (since, currently no stream nor rain gages exist on Island Creek to produce discharge records), further clarification was needed to support the report recommendations. Therefore, the District undertook efforts to include:

A. Documentation of the flood events through photographs, videos, newspaper articles and face-to-face interviews
B. Additional sensitivity analysis relative to H&H data (discharges, frequencies and profiles) and the resulting economic feasibility of the project based upon the analysis of synthetic H&H data.
C. Review of the technical adequacy of the H&H information.

A. Documentation

Documentation of flood events by others was not necessarily obtained in support of this proposed project; therefore, some information is being provided that is located outside of the project area. The project area consists of areas along Island Creek from its confluence of the Guyandotte River to a point approximately 9,000 feet upstream. The project area includes local communities i.e., Ellis Addition, Cherry Tree, Mount Gay, and Whites Addition. Although all the information may not be directly related to the specific project area, it is relevant by indicating the frequency and severity of flooding in a location in the immediate vicinity of the project area. Some information gathered is upstream of the project area on mainstem Island Creek and also on its tributaries; however, the information presented here is indicative within that basin. Every effort has been made to assure all supplemental information is defined as being within or outside of the project area.

Attached as Enclosure 1 are newspaper articles and dates from the *Logan Banner* documenting flood events on Island Creek and vicinity. These newspaper articles dated 1963, 1974, 1977, 1984, 1989, 2003 are indicative of the chronic flood events on Island Creek and its tributaries. Enclosure 2 is a summary of nine face-to-face interviews of residents within the Island Creek project area. This documentation includes a photo of the structure within the project area that is the subject of the interview and a summary of the interview. The interviewers document how residences and businesses are impacted by the frequent flooding, actions taken during and subsequent to flood events, and recording of flood depths for specific events. Enclosure 3 is a CD containing: (1) a videotape of actual flood events, covering the time period of 1982 through 1997, (2) a digitized computer flyover of the project area depicting the baseline condition of flooding and the reductions attributable to the 80-foot modified channel, (3) a PowerPoint presentation showing photographs of structures impacted by two recent floods (1996 & 2003), with appropriate high water marks shown on the structures and/or their interiors; and, (4) newspaper articles and photos of high water events from 1963-2003. The culmination of this information on the CD reflects actual flood experiences and performance of the proposed project for higher frequency events.

In summary documentation is being provided to support the H&H and economic information contained in the GRR analyses. Frequent flooding is a common occurrence in the Island Creek basin and thus a way of life familiar to the residents along Island Creek. The face-to-face interviews, video and numerous newspaper articles support that frequent and significant flooding does occur. Damages continue to be incurred without relief, except for minimal FIA and FEMA assistance.

B. <u>H&H and Economic Sensitivity Analysis</u>

Since Island Creek does not have gages to record stream discharges, generalized frequency data was generated for use in the H&H analysis. The natural discharge-frequency relationships used in the study were developed on a regional basis in accordance with the methods outlined in "Statistical Methods in Hydrology" by Leo R. Beard, dated January 1962, and Bulletin 17b published by the United States Water Resource Council, dated 1976, and entitled "Guidelines for Determining Flood Flow Frequency." This method was developed by the Hydrologic Engineering Center located in Davis, California. The mean, standard deviation, and the skew are computed for each station located within the Guyandotte River basin. These variables are plotted against the drainage area. From these relationships, representative values for various drainage areas can be interpolated and used to calculate flow frequency for ungaged areas located in the same basin. The District understands the concerns regarding the use of synthetic data; however, "hard" H&H data is not available. Therefore, the District efforts in this report were focused on the validation of the baseline data and its analytical use.

The District's H&H technical staff reviewed historical records of drainage basins with similar topography within the Huntington District and a range of drainage areas that have stream gages operating and recording flood events. Table 1 lists the drainage areas and associated computed discharges for a 1-year event. The data from Table 1 is shown graphically in Figure 1. These will be compared to results later in this section to determine the accuracy of the synthetic flows in this analysis. Island Creek flows through Logan County which is located in the Upper Guyandotte River basin. The drainage area at the mouth of Island Creek is 104 square miles.

Table 1
Huntington District Drainage Areas
With Gaged Stations
and Calculated 1-Year Discharges

City, State	Drainage	Frequency	City, State	Drainage	Frequency
Location	Area	Discharges	Location	Area	Discharges
	Square Miles	1-Year		Square Miles	1-Year
Panther Creek Nr. Panther, WV	30.8	1240	Cherry River Nr. Fenwick, WV	150	7000
Camp Cr., Nr. Camp Cr., WV	32	1060	Steer Creek, Grantsville, WV	166	5500
East Fork Twelvepole, WV	38.2	1470	West Fork @ Rockdale, WV	205	8200
Bluestone River, Bluefield, WV	39.8	1320	Pound River Nr. Haysi, VA	212	7800
Peter Creek Nr. Lockwood, WV	40.9	1950	Little Kanawha @ Sissonville, WV	238	6400
Johns Creek Nr. Meta, KY	56.3	2550	Tygarts Creek Nr. Greenup, KY	242	6500
Tygarts Creek @ Olive Hill, KY	59.6	4470	Mud River Nr. Milton, WV	256	5800
Cranes Nest Nr. Clinton, VA	66.5	2930	Little Coal River @ Danville, WV	270	8100
Paint Creek at Staffordsville, KY	103	5100	Russell Fork @ Haysi, VA	286	11600
Little Kanawha River, Wildcat, WV	112	4300	Guyandotte River, Baileysville, WV	306	7300
William Creek Nr. Dyer, WV	128	6600	Big Coal River@ Ashford, WV	391	8800
Greenbrier River, Durbin, WV	134	4200			

A curve was plotted in Figure 1A based upon these gaged streams to determine if the discharge used for the proposed project is representative. As can be seen from this curve, the graph reflects a discharge of 4800 c.f.s. for a drainage basin of 104 square miles.

Figure 1
Huntington District Drainage Areas of Gaged Stations and Calculated 1-Year Discharges

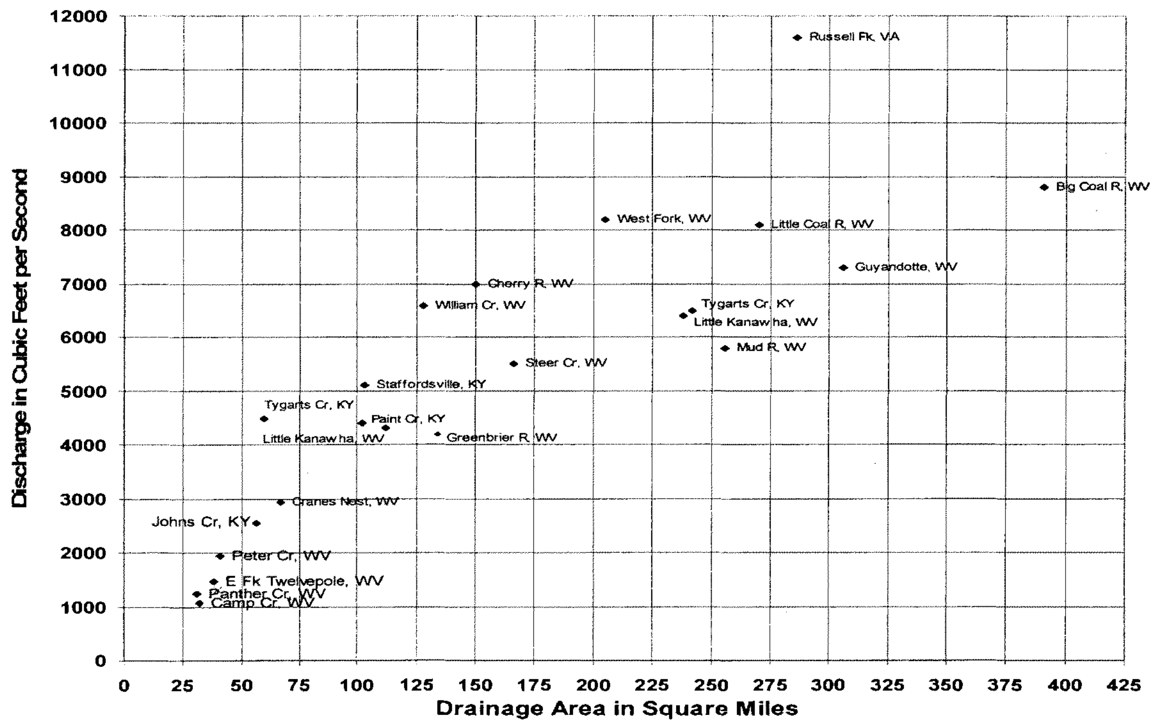
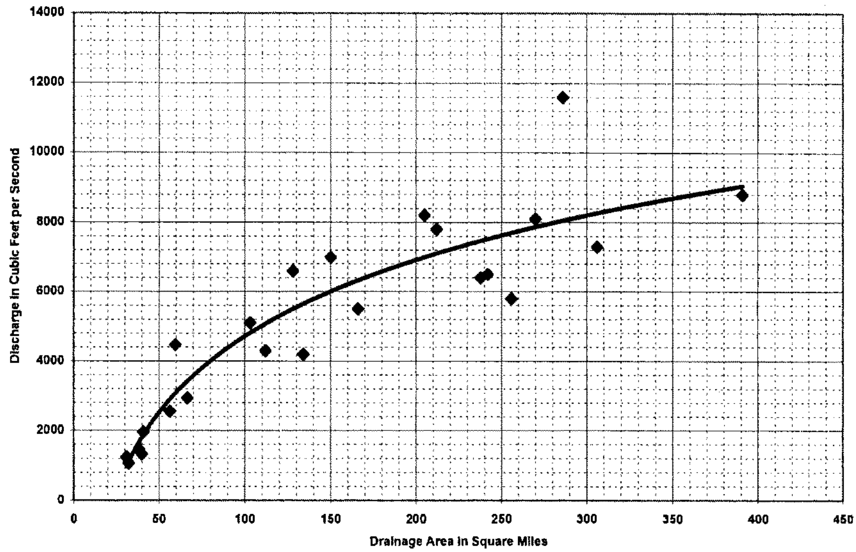


Figure 1A
Huntington District Drainage Areas
With Gaged Stations
and Calculated 1-Year Discharges



To better assess the impacts of using different discharges and frequencies for Island Creek in the H&H analysis, the frequencies associated with the baseline profiles were artificially altered. Three different scenarios were developed and analyzed to test the sensitivity of the synthetic data. Although the District has data for similar basins in the Appalachian region that have gaged streams (shown in Table 1 and Figure 1), the 1-year discharge for Island Creek was altered to be equal to the 2-year and 5-year frequencies. From this sensitivity, it can be determined how significant an error has to be made in calculating the appropriate discharge against the economic data for the project to become infeasible. Table 2 illustrates the alterations of the data used to calculate the two revised computed water surface profiles (CWSP).

Table 2
Discharge Data Used in Island Creek H&H Sensitivity Analysis

Island Cr @ Mouth D.A.=104 sq mi	Scenario 1	Scenario 2	Scenario 3	Scenario 2	Scenario 3
	CWSP=GRR	2yr CWSP = baseline 1yr	5yr CWSP = baseline 1yr	% Change	% Change
	Discharge cfs	Discharge cfs	Discharge cfs		
1-Year (.99)	6600	4000	2000	-39.4	-69.7
2-Year (.50)	9000	6600	3400	-26.7	-62.2
5-Year (.20)	12600	11200	6600	-11.1	-47.6
10-Year (.1)	15700	15000	11000	-4.5	-29.9
20-Year (.05)	19200	18500	15500	-3.6	-19.3
50-Year(.02)	23900	23500	22200	-1.7	-7.1
100-Year (.01)	27700	27700	27700	0.0	0.0
500-Year (.002)	37100	37100	37100	0.0	0.0

The first scenario presented in this analysis represents the CWSP used in the GRR and will be referred to as the baseline. Data from these scenarios were used to calculate the project economics that include expected annual benefits, expected annual costs, net benefits, and the benefit-cost ratio as presented in Table 3.

It should be noted that these figures are slightly different than those presented in the GRR due to a change in the software used. The original calculations in the GRR used the Huntington District Flood Damage Program and HEC Flood Damage Analysis (FDA), Version 1.2. Using this method incorporates a two step process that first computes damages in the Huntington District Flood Damage Program and then uses those results in the HEC-FDA program to incorporate risk and uncertainty. The revised data presented in Table 3 is based on output from HEC-FDA where flood damage reduction benefits were calculated exclusively within the program. Also, the benefits for the Flood Warning System (FWS) were estimated for each scenario using the same methodology presented in the GRR.

Table 3
Island Creek Project Economics for H&H Sensitivity Analysis

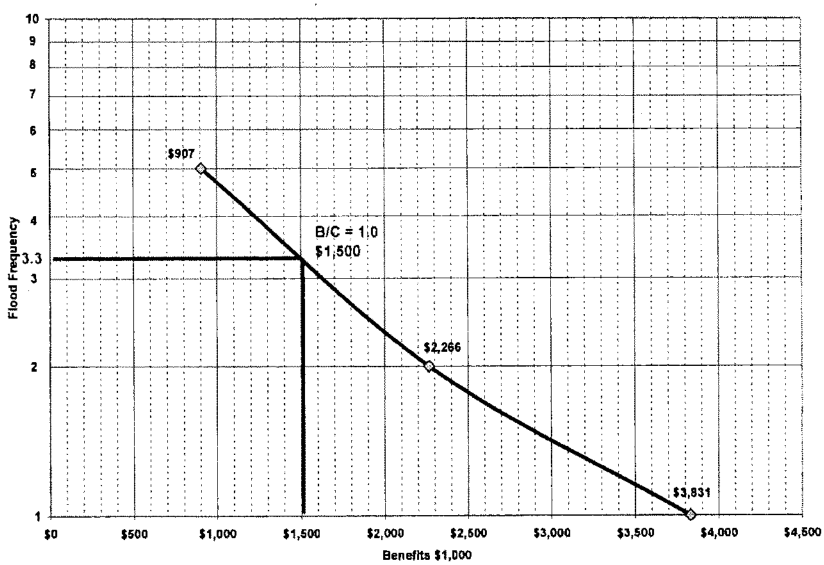
	Scenario 1	Scenario 2	Scenario 3
H&H Database	CWSP = GRR	2yr CWSP = baseline 1yr	5yr CWSP = baseline 1yr
EAB - Channel	$ 3731.55	$ 2196.97	$ 872.91
EAB - FWS	$ 99.03	$ 69.20	$ 33.65
Total EAB	$ 3830.58	$ 2266.17	$ 906.56
EAC	$ 1500.70	$ 1500.70	$ 1500.70
Net Benefits	$ 2329.88	$ 765.47	$ (594.14)
Benefit-Cost Ratio	**2.55**	**1.51**	**0.60**

EAB = Expected Annual Benefits EAC = Expected Annual Cost

The second scenario is based upon the CWSP being adjusted to have the baseline 1-year discharge now equal to the 2-year discharge. With Scenario 2 the expected annual benefits, net benefits and a B/C ratio were calculated using the same baseline cost transformed to expected annual costs. The results of Scenario 2's economic analysis are contained in Table 3. Under Scenario 3, the 5-year discharge was adjusted to the baseline 1-year discharge. The resulting project economics are contained in Table 3.

This analysis indicates that the break-even point for economic feasibility would be an adjustment of the baseline 1-year discharge to somewhere between the 2-year and 5-year frequency. The following analysis will determine that frequency and develop a discharge related to that frequency.

Figure 2
Island Creek Economic Break-even Point with Associated Frequency



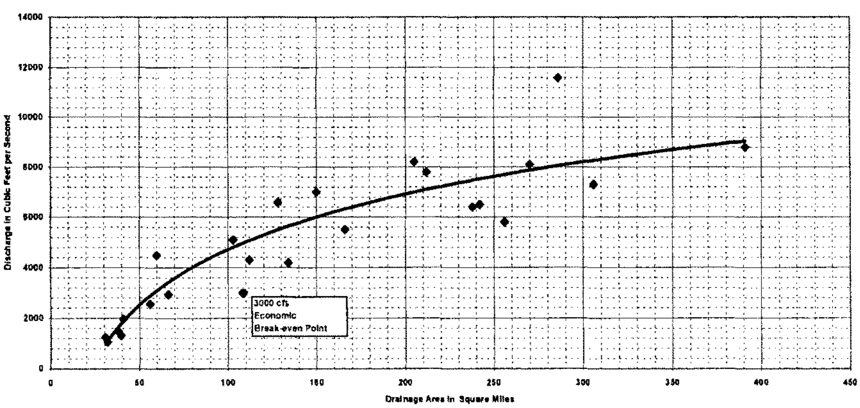
An economic sensitivity analysis was accomplished as suggested. Based on data for the three scenarios and the economic results from Table 3 we did further analysis to determine the frequency associated with 6600 c.f.s. that would be the break-even point for economic feasibility. Figure 2 illustrates that the break-even point for economic feasibility is where the expected annual benefits are equal to $1.5 million. The frequency associated with that point is approximately 3.3. With that frequency established, a new 1-year frequency discharge has been recalculated to be 3000 c.f.s. Table 4 shows the discharges associated with the break-even point along with the discharges for the scenarios used for the sensitivity analysis. The 1-year recalculated flow of 3000 c.f.s. is plotted on Figure 3 the historical frequency plot shown earlier in Figure 1.

Table 4
Island Creek Sensitivity Discharge Frequencies

	Scenario 1	Scenario 2	Break-even Point Scenario	Scenario 3
	CWSP=GRR	2yr CWSP = baseline 1yr		5yr CWSP = baseline 1yr
	Discharge cfs	Discharge cfs	Discharge cfs	Discharge cfs
1-Year (.99)	6600	4000	3000	2000
2-Year (.50)	9000	6600	4600	3400
5-Year (.20)	12600	11200	8150	6600
10-Year (.1)	15700	15000	12000	11000
20-Year (.05)	19200	18500	16100	15500
50-Year(.02)	23900	23500	22500	22200
100-Year (.01)	27700	27700	27700	27700
500-Year (.002)	37100	37100	37100	37100

The graph in Figure 3 indicates that based on historical records from similar size drainage basins (104 sq. miles) that a discharge of at least 4800 c.f.s. for a 1-year event would be reasonable for Island Creek basin. The project economics for Scenario 2 (1-year = 4000) equates to a benefit cost ratio of 1.51. The economic break-even point

Figure 3
Island Creek Economic Break-even Point Discharge Plotted with Huntington District Drainage Area with Gaged Streams and Calculated 1-Year Discharges



analysis determined that the frequency flow of a 1-year event would be about 3000 c.f.s. (from Figure 2) which is substantially lower than what actual data shows should be used (4050), based upon the generalized graph in Figure 3. Therefore, based on the sensitivity analysis of both H&H and economic data, the results determine that the project remains feasible relative to other basins with actually measured flows. In order to reach the point where the project would not remain feasible would require the flow data to be unreasonably be adjusted downward.

C. H&H Technical Adequacy

To help address the technical adequacy of the H&H information presented in the GRR, the District feels it is appropriate to reveal to the H&H reviewers the credentials of those participating. Table 5 below presents a list of the participants including their area of expertise in the field of H&H as well as the number of years of experience and their current position. Each technical specialist's relevant credentials are also provided following Table 5.

Table 5
Island Creek H & H Technical Expertise

Technical Specialist	Expertise	Years Experience	Current Position
Jerry Webb, PE	Hydrology	27	Chief, H&H, HQUSACE
Coy Miller, PE	Hydraulics	25	DDE(PM), CELRH
Phillip Anderson	Hydraulics	34	Hydraulic Engr, CELRH-EC-H
Kenneth Halstead	Hydraulics	26	Hydraulic Engr, CELRH-EC-H
Americo Sebastiani	Hydraulics	36	Retired
Tom Walker	Hydraulics	37	Deceased
Steve Stout	Hydraulics	25	Hydraulic Engr, CELRH-EC-H

Mr. Jerry Webb MS,CE, PE has had a distinguished career with the U.S. Army Corps of Engineers starting in the Memphis District. He came to the Huntington District as Chief of the Hydrology Section in the Water Resources Engineering Branch. After a short tour in that position he served as Chief of the Water Resources Engineering Branch in the Huntington District. Currently, Mr. Webb serves as Chief of H&H in HQUSACE. He was involved in the Internal Technical Review and helped formulate the Island Creek project at the District. He was responsible for the configuration of the starting water surface elevations for the profiles presented in the GRR.

Mr. Coy W. Miller MS, CE, PE began his career in the Huntington District in the Water Resources Engineering Branch. In a distinguished 25 years of service he has been a hydraulic engineer, served as Chief of Hydraulics Section for 5 years, served as the Chief of Design Branch for 2 years, and most recently, selected as the Deputy District Engineer for Planning, Programs and Project Management in the Huntington District in February 2003. He contributed significantly to the development of the computed water surface profiles presented in the GRR for Island Creek.

Mr. Phillip E. Anderson BS,CE began his career with the Huntington District in the Water Resources Engineering Branch some 34 year ago and is currently serving as the Chief of Hydrology and Hydraulics Section in that Branch. He is responsible for the re-formatting the HEC-2 data to HEC-RAS to provide output in the FDA format for

Planning to calculate benefits. Mr. Anderson is also responsible for the Island Creek profiles published the Logan County Flood Insurance Study.

Mr. Kenneth C. Halstead MS, CE, PE has been with the Huntington District for 26 years in various positions within the Water Resources Engineering Branch and is currently serving as Chief of the Water Control Section in the Water Resources Engineering Branch. He worked closely with Mr. Coy Miller in the development of backwater models for the Island Creek Basin.

Mr. Americo Sebastiani BS, CE began his career with the Jacksonville District and moved to the Huntington District, spending the majority of his distinguished career in the Water Resources Engineering Branch computing Frequency data for all basins within the Huntington District. He is responsible for the original frequency computation for the Island Creek Basin and the tributaries located in Logan County.

Mr. Thomas Walker BS, Mathematics began his career in the Nashville District, and spent the majority of his career developing hydrology for various projects within the Huntington District for over 35 years. He has worked closely with co-workers to develop frequency data for ungaged areas in Logan County and throughout the District.

Mr. Stephen R. Stout BS, CE began his career with the mining industry in the state of West Virginia and moved to the Huntington District some 25 years ago. He is currently developing data to revolutionize flood forecasting methods within the Corps of Engineers on a National Level. He has worked closely with hydrologists to develop flow frequency data for numerous projects within the Huntington District, including the Island Creek Project.

The H&H staff has an exceptional reputation within the water resources community as being experts within their fields. Other organizations, such as WES, have consulted with the previously mentioned District staff regarding other projects and H&H issues. This staff's credentials are impeccable.

II. SUMMARY AND CONCLUSIONS

In summary, the District recognized the concerns of HQUSACE and ASA (CW) regarding the use of generalized frequency H&H data and analysis in the Island Creek GRR. We have undertaken extensive efforts to validate the H&H and economic data contained in the GRR that support the report's recommendations. This supplemental information along with the enclosures provides documentation of that validation process.

First, we gathered documentation of frequent devastating flooding in the Island Creek basin. This is illustrated through the numerous newspaper articles, home video, photographs and face-to-face interview summaries. These clearly document the economic impacts of frequent flooding for the area as well as the human and emotional toll to the basin's residents. Through the photographs and digitized computer flyover, we have also provided the reader and viewer a virtual tour of the Island Creek basin.

Next, we completed a thorough sensitivity analysis of the H&H and economic data. The H&H discharge data for Island Creek was compared to similar gaged basins. Then a sensitivity analysis was prepared using CWSP with adjusted discharges as suggested by HQUSACE. Project economics were then calculated for the sensitivity scenarios. The results determined that the GRR recommended project remains feasible under actually measured flows. For the project not to be feasible, the flow data would have to be unreasonably adjusted downward. In summary, the sensitivity analysis validates the project recommendation contained in the GRR.

Finally, we have provided a summary of the technical expertise of those participating in developing and updating the H&H data for the Island Creek basin. The sum total of experience is 210 years. These individuals are highly regarded in their field and often called upon to provide technical expertise throughout the Corps. Appropriately qualified technical experts, who are respected by their peers, prepared the technical H&H analysis for the GRR and this supplemental information to the GRR.

Therefore, based on the sensitivity analysis of both the H&H and economics further supported by newspaper articles, personal interviews, and flood video the material presented in the GRR which indicated frequent inundation of the project area is adequate. Using conservative assumptions of the H&H data, the project would remain feasible. The District supports the original project recommendation contained in the GRR.

ENCLOSURE 1

NECWSPAPER ARTICLES

1. March 12, 1963
2. March 16, 1963
3. January 11, 1974
4. January 15, 1974
5. April 5, 1977
6. May 8, 1984
7. May 9, 1984
8. October 18, 1989
9. February 17, 2003

RECORD GUYANDOTTE FLOOD SWEEPS VALLEY

There's no way of knowing how effective the Justice Reservoir would have been in handling the Guyandotte River on its latest tear. But residents all along the valley wish today that it had the chance to prove its worth.

At 10 o'clock this morning, the river reached a stage in Logan of 31.7 feet, the highest on record and probably the highest in history. It could be that the crest will be even greater before the stream starts its recession.

Tributaries above and below Logan also went on a rampage and thousands of people were forced to leave their homes before daylight. It was impossible to get an accurate check from the emergency relief stations which were set up quickly in Logan, Man and Chapmanville. But the number of homeless surpasses by far the number of refugees who needed help in previous inundations, including the 28.1-foot crest of Jan. 30, 1957.

All schools in the county were closed and the City of Logan's biennial primary election was postponed. According to the Chesapeake and Ohio Railway Co. office at Peach Creek, only two mines in the county were attempting to operate today—Island Creek Coal Co. mines Nos. 1 and 4 in the Guyan Division on Buffalo Creek.

For the first time since its development back in the early 20s, the city's exclusive residential section, Midelburg Addition, was isolated. The bridge from the boulevard was covered by at least two feet of water and there was still fear late this morning that the raging river might wash the span away.

The four-lane boulevard was covered—not even the guard rail posts were visible early this morning—from its eastern terminus to the Dingess St. intersection. Holland Lane was covered and the overflow barely turned the corner and dribbled into Stratton St. The water boiled up through a storm sewer at City Hall but was not enough to hinder traffic, which was running both ways for a change on Stratton St. from Dingess St. to just above Dead Man's Curve, which was as far as eastbound traffic could make it.

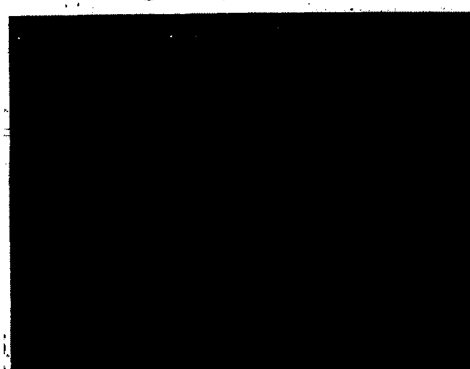
Read Daily by More Than 35,000 of the World's Best People

THE LOGAN BANNER

Now in Its 75th Year of Service to the People of Logan County

Established March 7, 1888 LOGAN, WEST VIRGINA, TUESDAY, MARCH 12, 1963 Daily Except Sunday—5 Cents

Area Ravaged By Record Guyandotte River Flood Crest

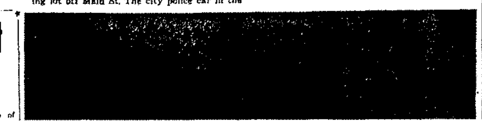


LOGAN'S four-lane boulevard was covered by several feet of water at the Holland Lane intersection this morning. The photograph was made from a window of an apartment in The Banner building.

THIS IS A view of the boulevard looking upriver from the Ashland Refining Co. parking lot off Main St. The city police car in the background is in the edge of the surging river.

State's New $155.3 Million Budget Includes Increase for Education

CHARLESTON (AP) — The ... The act will mean $7.2 million ... teachers will take $3.4 million of



About half of the City Parking Lot on Holland Lane was covered and the City Police Department had to evacuate its headquarters and the southwest corner of the lot. The parking area on Midelburg Park also was about half covered and the river was lapping against the bridges to the island and across the river from Water St. to the Triangle area.

There was no way in or out of Logan except by railroad. Highways which were not blocked by high water were covered in many places by slides and transportation in the county was at a virtual standstill. Moderate supplies of milk and bakery goods were on hand at most stores which were in business today, but some effects of the shortage could be felt before the highways are open again for travel.

Most business places in downtown Logan were closed because employers and employees were blocked by water. Basements of several establishments also were flooded and employes who could get to the stores helped to move merchandise out of danger.

Officials of the Chesapeake and Potomac Telephone Co. still were trying to determine at noon today just how many telephones in the county were knocked out by the high water. A house floating down the river knocked down a line at Chapmanville; 100 pairs of cables at Man were soaked and out of order; phones on upper Stratton St. and at Stollings were out and most stations in Deakins Addition, Cherry Tree and Mount Gay were not working.

However, the exchanges at Omar and Holden were reported in working order.

Slides began giving State Road Commission workers trouble even before the river and its tributaries started leaving their banks. A slide at Christian was reported to be about 300 feet long and at least 10 feet deep. Three other slides were reported between Logan and Man, but traffic was moving before the highway was blocked by water.

Downstream, state route 10 was covered in several spots, including the A and P Supermarket area, West Logan, Justice Addition and Mitchell Heights. The White Tower Inn and a large residence located nearby were washed away and torn apart when they struck the bridge leading to old Henlawson.

Several homes in Mitchell Heights were flooded and the families forced to move.

Emergency restrictions put on communications made it almost impossible to contact the outlying areas concerning damage and the number of families forced to leave their homes. But there was no doubt on the part of any local agency that today's crisis is the worst the people of the Guyandotte Valley ever have faced.

Man Stricken Helping Neighbors

A well-known Peach Creek man, Walter Kendall, died en route to a local hospital last night, apparently the victim of a heart attack suffered while helping neighbors move their household goods out of the reach of flood waters.

Kendall was brought to Logan by a Chesapeake and Ohio Railway Co. and caboose, but was pronounced dead on arrival at the hospital.

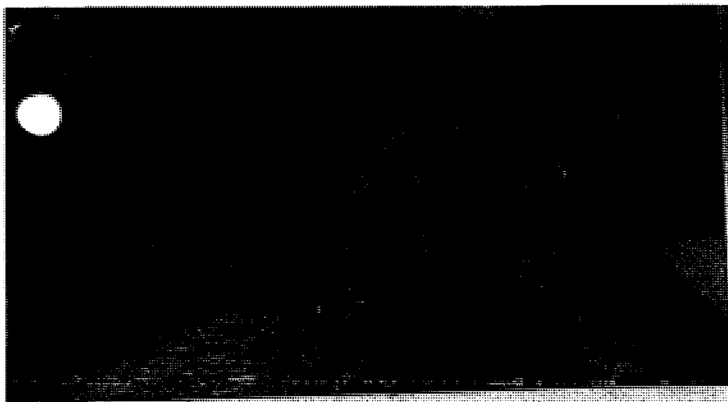
A Boy Scout leader, Kendall was employed ... Hardware and Supply Co. His body is at ... Home.

Survivors include ...

Byrd, Hechler Plead For Quick U.S. Aid

Members of West Virginia's congressional delegation made appeals to President Kennedy and federal government agencies to speed aid to Logan County and other flood-stricken areas of southern West Virginia.

Sen. Robert C. Byrd, responding to a call earlier this morning by Charlie Hylton, managing editor of The Banner, said he had asked the president to organize all government agencies into one effort for disaster re-



EMERGENCY supplies [illegible] clothing were brought [illegible] Quartermaster Charge [illegible] of the [illegible] crew [illegible] in flood rehabilitation [illegible] relief task force.

March 12, 1963

[illegible]ERAL inches of slimey mud was de[illegible] [illegible] on route 10 in front of the West Vir[illegible] [illegible] Super Markets store at West Logan. The cars shown in the picture were almost completely covered.

A LARGE section of U.S. 119 [illegible] [illegible] was washed out [illegible] Creek west [illegible] on a [illegible] Monday night. A temporary [illegible] road is being constructed around the area.

THL LOGAN B.ANNER

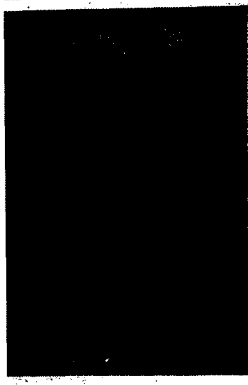
Now in Its 78th Year of Service to the People of Logan County

4-Page Television Guide

LOGAN, WEST VIRGINIA, SATURDAY, MARCH 16, 1963

Daily Except Sunday — 5 Cents

Repairs Rushed On Flooded Schools; Some Buildings Are Heavily Damaged



...e youngsters gathered to tell stories ...e keeping a watchful eye on the two tots ...ng an afternoon nap.

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LOAN INFORMATION IS AVAILABLE HERE

Information about loans from the Small Business Administration for flood victims may be obtained from the Logan County Chamber of Commerce office in The National Bank of Logan building.

Managing Director C. H. (Pat) Murphey said the SBA probably would open a local office within the next few days. Meanwhile, application forms and information and instruction pamphlets may be picked up at the chamber office, Murphey said.

In cases of extreme emergency, property owners seeking disaster loans may contact the SBA office in the New Federal Building, Charleston, or call the Charleston office, whose telephone number is 343-6181.

Logan Junior High, Mt. Gay Hit Hardest

Logan County school officials have expressed hope that classes can resume by Monday in most schools, while others are still not in condition to reopen.

Ralph Willis, assistant superintendent in charge of secondary schools, said that maintenance and repair men have been on the job almost constantly since the record flood began receding last Tuesday.

Logan Junior High School at East End is believed to be the most extensively damaged and Willis expressed doubt that it would be in condition to resume classes by the early part of next week.

The basement of the three-story structure was completely filled with water and the first floor of the main building and McDade Hall were soaked by about six feet of water.

Willis said that an annex behind the main building was washed off its foundation. Included in the flooded part of the building were the gymnasium and cafeteria.

Mt. Gay Grade School, located in one of the hardest-hit areas of the county, had water in every classroom on the first floor and also in a frame annex.

"The water ruined the cafeteria and all of the cooking equipment," Willis said. He estimated that damage to the Mt. Gay school would run almost as high as at the junior high school.

Big Creek Grade School was completely covered with water, but the loss of the small frame building was not as great as at other schools.

Chapmanville District had two other schools damaged by the high waters. They were Chapmanville High and the old Chapmanville

Guild Chiefs Approve Pact

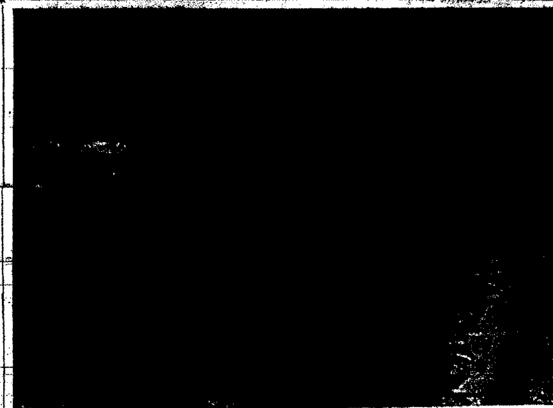
NEW YORK (AP)—Leaders of the nonstriking Newspaper Guild have decided by a one-vote margin to recommend to their membership a publishers' proposal aimed at ending the 99-day newspaper blackout.

The 9-to-8 vote Friday favored a $4.13 a week wage bonus to be added to guild wage scales, starting Oct. 31, 1964, and to extend their contract so its termination date would coincide with that of other newspaper unions.

Individual AFL-CIO guild units will vote Sunday and Monday on the proposed terms.

Local 6 of the AFL-CIO International Typographical Union, which struck Dec. 8 against four dailies —with the other five shutting down voluntarily—votes Sunday on a separate settlement plan.

Negotiations with seven other newspaper unions still are incomplete. But a guild membership acceptance of a common contract expiration date, plus the wage bonus, was seen as the key to resumption of publication next week



SHOES, CLOTHING and food are being distributed to needy flood victims at the First Christian Church of Logan under the supervision of the Rev. Robert Parrish and volunteer workers. Mrs. John Hale, center, a volunteer worker, is shown assisting one of the many flood victims who visited the church yesterday.

Disabled Navy Plane Lands Safely

BRAZIL GETS WARNING

Solons Would Halt Aid Until Reds Are Chased

THE LOGAN BANNER

› March 7, 1888

Now In Its 85th Year of Service To The People Of Logan County
LOGAN, WEST VIRGINIA, FRIDAY, JANUARY 11, 1974

ONE SECTION—14 PAGES

Fifteen Cents

uyandotte, Tributaries Surge Out Of Their Banks

ES—Favorite targets of the and its tributaries were y and today as the river rose several feet above flood stage of 23 feet during the night. At left is the Peach Creek underpass, which had several feet of water on it yesterday afternoon. Somewhere under the center picture is U.S. 119 at Wilkinson, which was covered by flooded Island Creek yesterday and again this morning. The automobiles at right were left parked on a used car lot at Monitor Junction and were nearly covered by water from Island Creek and Trace and Mud Forks. The river was continuing to rise slowly at press time and was expected to crest sometime this afternoon at around 30 feet (Banner photos by Emery Jeffreys III)

ver At 29.19 Feet At Noon, Still Rising

IBERT
e Banner
n mounted
g residents

to alert federal disaster agencies.

Acting Chief Deputy Kenneth (Cope) Spencer said this

Disaster Administration Agency, the Office of Civil Defense and the U.S. Army Corps of Engineers about the

taper off at 8 p.m. yesterday when the National Weather Service gauge near the

use at that time.

On Feb. 25, 1972, the Guyandotte crested at 28.21

Department of Highways said U.S. 119 was blocked at 9:30 a.m. today at Wilkinson and

Slides at Lyburn and Chapmanville were reported by the SDH but they were cleaned up

crossroads in Chapmanville and business people were busy cleaning out their stores.

High

County Superintendent of Schools Tom Orr announced

THE LOGAN BANNER

Now In Its 85th Year of Service To The People Of Logan County
LOGAN, WEST VIRGINIA, TUESDAY, JANUARY 15, 1974

STABLISHED March 7, 1888

ONE SECTION—TEN PAGES

Fifteen Cen

Government Applies Fuel Austerity Progran

★ ★ ★ ★ ★

Gasoline and Fuel Oil Supplies Curbed

By STAN BENJAMIN
Associated Press Writer

VASHINGTON (AP) — The leral government began ap- ing today a program of soline austerity and fuel oil ioning, including less home ating for the nation.

While no ration stamps ... olved, Federal Energy Of- e officials have described the roleum allocation system as coupon rationing for all jor products except retail soline.

The new regulations, which ok effect one minute before dnight Monday, permit ex- ceptions for hardship cases.

Normally, however, thermostats in homes and other residential buildings must be set six degrees lower than in the same month of 1972, and in other buildings ten degrees lower. Many people have already done ... the regulations will not require a further reduction on their part.

Service stations will get less gasoline than before. Just how much less was uncertain, but an FEO official guessed it might be 15 to 20 per cent less than the public otherwise would use in 1974.

The administration has asked motorists to limit themselves voluntarily to ten gallons of gasoline per week, but so far there is no formal limit to their individual gasoline use.

Airlines will get five per cent less aviation fuel than in 1972 and they have already started reducing flight schedules.

Electric power plants are to get as much residual fuel oil as the FEO says they can have, depending how much there is.

But essential services and military activities will get just about all the petroleum they need, holding top priorities in the new nationwide petroleum allocation system.

In allowing for "hardship" exceptions to their specific limits, the regulations provide plenty of room for deciding what a hardship is — apparently it could include an exceptionally cold house or a business that's hurting from too little fuel.

"Hardship", the regulations say, "means a situation involving or potentially involving substantial discomfort or danger and-or economic dislocation."

In effect, the system rations major petroleum products right down to the final consumer, with one major exception: gasoline.

The Nixon administration has ordered creation of a standby gasoline-rationing system but has not yet decided whether to use it.

As when they were first proposed, the final regulations, which took effect just before midnight, were accompanied by a flip-flop of FEO interpretation.

Late Monday, FEO spokesmen said — mistakenly, as it developed — that service stations would be allocated as much gasoline as in 1972.

Still later, however, the agency reversed itself and assistant director John Hill said service stations would get whatever was left after higher-priority bulk purchasers were supplied, just as proposed earlier.

Hill said the flip-flop in explanations made little real difference since most gasoline goes to service stations anyway and the priority demands "off the top" would make little pact.

More significant was regulation to tip refinery puts a little away from gas and toward other products.

The final regulations incl no specific figure for a re tion in refinery gasoline yi that number is to be establi periodically by the FEO.

Hill said the cutback co ered earlier — to 95 per ce 1972 levels — was being viewed and might be eas fuel oil stocks continued to up through a winter whicl

See Story No. 1 on Page 1

HECK REIN PUT ON LOBBYISTS

State Senate Rewrites Rules

By ROBERT C. WELLING
Associated Press Writer

CHARLESTON, W. Va. (AP) Close scrutiny of Senate lob- ists during the current and ture legislative sessions has en mandated by passage of w rules governing the upper amber.

After more than three hours debate Monday on 15 pro- sed amendments to the Senate rules, the body unanimously passed by voice vote the first major rewrite of the rules since 1967.

Most of those taking part in the debate praised the new rules as "progressive" and "a giant step forward," but the younger members were pressing for still further reforms.

The House of Delegates had at passage stage today the first bill to come to a vote in the five-day old session. The measure sets the dates for issuance of workmen's compensation checks to those temporarily and permanently disabled.

Both chambers met at noon.

The new Senate rules call for all committee meetings to be open, except for the powerful rules committee and that executive committee sessions can be called only by a vote of the majority. The Senate also would no longer meet behind closed doors in considering nominations by Gov. Arch A. Moore Jr.

An attempt to prevent a log jam of bills in the closing days of the session also is included in the rules, with a deadline of the 40th day of the 60-day session for introducing new legislation and a requirement that Senate committees must report out by the 50th day all Senate bills.

The rules committee became the target for further "opening up" of the legislative process in the numerous amendments offered. Younger members, unhappy over the secrecy employed by the 10-member committee which controls the flow of legislation in the final days, were behind the effort. The veteran members were those defending the present rules.

Senate President William T. Brotherton, D-Kanawha, even left the chair at one point to speak from the floor to urge defeat of a proposed change that would have allowed any senator to sit in on rules committee meetings.

Also defeated were attempts to open the rules committee meetings to the public and to at least make public key votes taken on legislation in that committee.

The only minor rules amendment that was adopted inserts

TODAY

Israelis Said 'Warm'

Jan 11th Flood
Jan 15 74

ne in Logan was in charge of ıngements.
ıbo died Friday in Logan eral Hospital.
e was born June 24, 1912, in ımbus, Ohio, a son of the Steve Sabo Sr. and Katie kas Sabo.
e was a retired employe of Powellton Coal Co. at lory and a member of the ted Mine Workers of ɜrica. He was an Army ɜran of World War II.
ırvivors include a sister, . Margaret Hayes of Silver ings, Md., and three herˢ Jimmie of Stollings, oᶠ ıgo, Ill., and John of ·o ch.

ꞩT. WILLIAM J. BROWN

ıneral services for Sgt. iam J. Brown, 38, of ertown, N.Y., formerly of ·ples, were to be held at m. today at the Monclo ɜwill Baptist Church by the ·ayne. Burial was to the Brown family ıe... at Clothier with full tary graveside services.
ımes Funeral Home at coma was in charge of ıngements.
ːown was dead on arrival rsday at the House of Good ıaritan Hospital in

BACKWATER from the Guyandotte River got into several Logan County schools, including Logan Junior High in the East End of Logan. School officials said 25 inches of water got into the building, which was closed today. Cleanup crews hope to have the school ready for occupancy tomorrow but a definite decision wasn't expected to be reached until sometime this afternoon. (Banner photo by Jim McDonald)

—3—

at Stollings Grade was opened yesterday for a shelter, but not many victims used the facility.

Officials said all schools in the Chapmanville area were closed today because of the cleanup operations by home owners and business establishment operators.

About $35,000 worth of damage reportedly was caused to 13 schools in the county by the flooding.

Superintendent of Schools Tom Orr announced just before noon today that all schools in the county will be open tomorrow with the exception of Big Creek and East Chap-

flood. As a result, 258 customers in that area are without service.

Crews, however, are in the process of restoring service in that area now.

Congressman Ken Hechler has joined in a request for declaring Logan and adjacent counties a disaster area and has urged the waiver of the 15-day period on flood insurance coverage.

In a telegram, to Secretary James Lynn of the Department of Housing and Urban Development, Rep. Hechler urged that immediate steps be taken in declaring the counties disaster areas.

"There are innocent victims

Hosp

GUYAN VALLEY

Admitted

Kathy Gore of Blair, Pauline White of Zogan, Fred Hurley of Mt. Gay, Roxie Mack of Mt. Gay, Percy Banks of Logan, Eva Berry of Logan, Willie Williams of Logan, Clarence Daniels of Logan, Nancy Combs of Harts, Bessie Star of Logan, Sharon Burton of Chapmanville, Audrey Mitchem of Monaville and Garnet Smith of Lyburn, medical care.

Discharged

Paul Dumont of Logan, Lena Whitt of Logan, James Ward of Logan, Josephine Cook of Logan, Sarah Stone of Logan, Ida Booth of Pecks Mill, Kathy Conley of Ethel, Roger Starr of Stollings, Beatrice Vance of Dingess, Leo McNeely of Holden, Dora Rouse of Logan, Pamela Faine of Peach Creek, Burgess Ooten of Myrtle, Howard Adams of Mt. Gay, Grant Toney of Ferrellsburg, Letha Bias of Logan, Harm Hall of Dingess and James Morris of Crown.

LOGAN GENERAL

Admitted

Edward Hager of Earling, Nina White of Earling, Johnson Cline of Ethel, Billy Hayes of Lake, Donna Lambert of Logan, Norma Lukacs of Holden, Barbara Meade of Verdunville, Alka Justice of Monaville, Alice Queen of Holden, Ruth Fortner of Stollings, Carrie Belcher of Chapmanville, Georgia Adams of Holden, Walter Flemming of Chapmanville, Ollie Akers of Lake, Star Rakes of Lake, David Samson of Logan, Randy Scott Jones of Logan, Lucetta Ferrell of Henlawson, William Enyart of Logan, Gladolia Motto of Logan, Thomas Browning of Peach Creek, Joe Rhodes of Yolyn, Samuel Queen of Omar, James White of Oceana, Lucille Tharin of Logan, Rhoda Nichols of

ears Old oubted

-efully examined in detail, ne says.

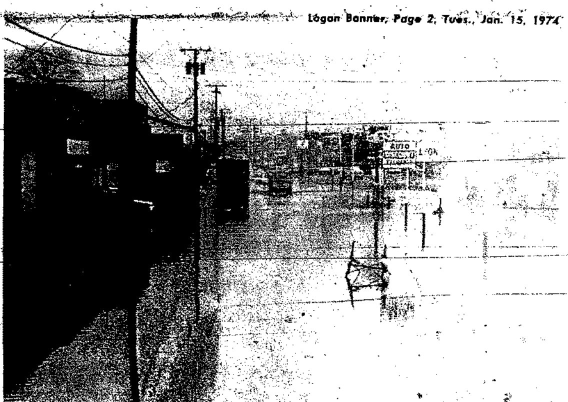
The film shows an upright ature — small for a Sasitch, about seven feet tall — ich walks across the field of w, turns to look toward the nera, and continues on out of ht," the article says.

studio specializing in anition 'd that the sub- t w tl, not a man in ur s

Inne , that the film t examined frame-by-frame Dr. Donald W. Grieve, an tomist specializing in the man gait at the Royal Free pital School of Medicine in idon.

rieve wrote that his impres- s "oscillated between total eptance of the Sasquatch to tional rejection based on tional response to the possi- ty that the Sasquatch actual- xists."

Inne says Byrne is the best e of getting an answer be- se — unlike those who hunt quatch on weekends and t to kill it and cut off a por- — he carries a tranquilizer to immobilize the creature g enough for scientists to ex- ine and photograph it.



FRIDAY'S FLOOD was the same old story as far as Deskins Addition was concerned. Water from Island Creek and the Guyandotte River blocked alternate U.S. 119 and flooded many business places. Automobile dealers in Deskins and Ellis Addition moved their cars out Thursday in advance of the river's crest of 30.81 feet, which was reached at about 6 p.m. Friday. (Banner photo by Emery Jeffreys III)

Home Heating Oil Prices Take Sharp Rise in Last Month

By LOUISE COOK
Associated Press Writer

Last Dec. 1, an independent dealer in the Chicago area was selling home heating oil at 28½ cents a gallon. Today, the same dealer is charging 35 cents a gallon.

That's an increase of almost 23 per cent in six weeks. It reflects the situation throughout the country, according to a spot check of trade associations. Home heating oil prices have risen sharply in the last month, and industry spokesmen say they'll probably rise some more in the future.

In fact, some spokesmen say it may cost you twice as much to heat your home this winter as it did last year. In dollars and cents, the increases can boost your yearly heating bill by $100 or more, depending on how much oil you use and who your supplier is.

If you were lucky enough to have a supplier who is getting domestic oil, you may not be hit too hard. If, however, your dealer depends on imported oil, you'd better be prepared for a real wallop.

The increases will more than offset any monetary savings you might get from turning down your thermostat six degrees in accordance with federal energy regulations that take effect today.

Annual imports of heating oil refined abroad have risen sharply from a negligible amount five years ago to an estimated 150 million barrels in 1973. That's more than 10 per cent of last year's total supply according to the National Oil Institute.

Institute figures show that imported heating oil at the wholesale level cost about four times as much in December as it did in June 1973. There have been similar price increases in heating oil refined in the United

Ann Landers Sa

Dear Ann Landers: I have read with amusement the letters in your column from women who seem to be in perpetual search for sexual ecstasy. Take it from an old lady who is past 60—it's all in the head.

Recently I was involved in a minor accident. While the insurance adjuster, a handsome young man in his 30s, was writing out the claim, I felt a sudden surge of passion. (I had a hysterectomy 10 years ago!) Had I been 30 years younger I'm sure I'd have made a pass at the young man. So you see, Ann, where sex is concerned, there's a very thin line between reality and fantasy.—Gutted But Not Dead

Dear Not Dead: There's a great deal of fantasy connected with sexual desire, in fact, lust is loaded with it! This doesn't mean you were imagining those feelings. A woman in her 60s can be far from sexually dead—"gutted" or not—and your experience proved it!

Dear Ann Landers: Why do people have such dirty minds? I refer to that mealy-mouthed gossip who noticed that a certain girl in the office always wears the same outfit on Thursday that she wore on Wednesday. The cat observed: "Her dress is usually pretty wrinkled—and her hair is a mess." She concluded that the girl has a steady arrangement and doesn't sleep home on Wednesday night.

That letter made me furious because last Wednesday night I went directly from work to a friend's house following a frantic phone call. Her husband is overseas and her labor pains had started. The poor kid has no relatives in town and I am her only close friend. When I arrived, the taxi had already been called to take her to the hospital. She was ... me with instructions ... do for the ... schoolers.

Her two-year-ol... terrible cold. I slep... couch and held that ... arms all night. The ... morning the woman ... took the kids and I we... looking like I had lost ... match with two goril...

Sorry I couldn't ha... up looking fresh as ... order to prot... reputation, but these ... facts, Ma'm.—Nuts ... Gossips

Dear N.T.G.: Let's ... a Good Samarit... wrinkled clothes and ... hair. Thanks for writ...

Dear Ann Land... advised mothers to t... daughters to sew ... hems and make beds ... went on to suggest th... teach their sons to b... of whatever might br... house.

Where have you b... last ten years, Annie? ... know that His and H... are things of the p... should know how to ... cook and make beds a... should be able to fi... repair appliances, ... tires and repair ... breaks.

Assigning certain ... certain sexes ... fair, unpleasant a... practical. We share th... our house. But how mu... it would be for both ... when we attended scho... Ec. and Woodshop h... compulsory subjec... everyone.—Over 30

Dear Over: Rig... are. Odd jobs know no... These past several ye... seen a blurring ... sexes. Today, preciou... things are exclusively ... Hers. In fact, we have ... labeling He and She. Th... writing.

What ...king of ... goes with today's ... life styles? ... anything go? Ann ... ders completely nev... Bride's Guide" tells ... right for today's weddi... a copy, send a dollar bil... long, self-addressed, s... envelope (16 cents post... Ann Landers, P.O. ... 3346, Chicago, Ill. 60654.

FLOOD WATERS LEAVIN_ ROADWAYS

Guyandotte River Crests At 31 Feet

By EARL LAMBERT
Managing Editor of The Banner

Tension began mounting yesterday afternoon when the Guyandotte River and its tributaries began leaving their banks because of heavy rains throughout the southern part of West Virginia

While the Guyandotte and the tributaries continued to rise during the night, persons living in low-lying areas began moving out their personal items and seeking shelter elsewhere.

But things began taking on a new look this morning when the river began rescinding and backwater in the lower areas began falling. The river crested at about 3 a.m. today at 31 feet. Skies were clear early this morning but rain was still in the forecast from the National Weather Service.

The NWS said that showers are likely statewide because of a cold front moving through the state.

Roads leading in and out of the City of Logan were blocked late last night and early today. But the water began leaving the roadways in some parts of the county as the river began reaching lower levels.

Officials of the West Virginia Department of Highways reported slides in the county as a result of yesterday's heavy rainfall, which, along with the flood waters, closed all schools in Logan County and neighboring counties.

Superintendent of Schools Jack Garrett announced late last night that all schools in the county would be closed today. Garrett dismissed schools early yesterday so that buses could get students home before the roadways became blocked.

The Guyandotte River began rising at a rapid speed at about 2:30 p.m. yesterday. The NWS gauge near the Midelburg Addition bridge showed that the river was standing at 13.84 feet by 2:30 p.m. One hour later, the river had reached a depth of 15.58 feet

Within a three-hour period the river had increased its depth by six feet to 21.32 feet at 6:30 p.m. At about midnight, the river began rising a little slower and at 1:30 a.m. today, it had reached a depth of 30.70 feet.

While hundreds of residents of the low-lying areas were moving out of their homes and seeking shelter--emergency relief shelters were set up by the Logan County chapter of the American Red Cross at Logan and Chapmanville High Schools--thousands of other county residents were left without power service as a result of the heavy rains and flood waters.

Appalachian Power Co. officials said flood waters forced personnel to make switching changes during the night. The high waters kept APC crews from getting to the troubled areas.

An APC official said this morning that power service will be restored as soon as the water begins rescinding.

In Triadelphia District, a bridge crossing Buffalo Creek near Kistler was torn apart by the high waters. However, residents said the creek had dropped three to four feet by today.

STALLED--Several vehicles were stalled in the high water near Rum Junction yesterday afternoon.--Banner photos by Emery Jeffreys

EVACUATION--Residents of Cherry Tree and Mount Gay began leaving their homes yesterday as the water from the Kopperas Fork of Main Island Creek left its banks.--Banner photo by Emery Jeffreys

THE LOGAN BANNER

Now In Its 89th Year Of Service To The People Of Southwestern West Virginia

Established March 7, 1888 — LOGAN, WEST VIRGINIA, TUESDAY, APRIL 5, 1977 — ONE SECTION—14 PAGES 20 · Cents — 20 · Cents

Flood Preparations Nothing New For Area Citizens

By EMERY JEFFREYS
Banner Regional Reporter

The haggered, wet residents stood in groups of two or three, glancing first at the sky and the falling rain, then at the river and the rapidly rising waters.

It was all the same to them -- they had seen Logan County floods before

In the Deskins Addition -- Mount Gay -- Cherry Tree area, yesterday's activity increased as the water got higher.

Most merchants along Island Creek were prepared for a rapid move. Car dealers began moving automobiles to the Logan Boulevard and every other available space of dry ground.

By 6:30 p.m. yesterday the murky waters of the Kopperas Fork of Main Island Creek was lapping at the iron bridge near the Kroger Store.

The Sidebottom family and their workers and friends began moving the [illegible] cleaning their businesses and moving back -- all wondering when the task will begin again.

Shortly after dusk, it was easy for any veteran flood watcher to see that the small community of Logan would soon be isolated from every where.

At the Logan detachment of the West Virginia State Police, the scene was the same. As three troopers sat in the lobby, they couldn't get to their own

The advice was the same to each questioner.

"Friend, you can either go to a motel or find the Red Cross Shelter," Trooper First Class F. R. Lavender intoned. "All the roads are blocked or soon will be."

For a town that was isolated from the remainder of the state, traffic was heavy early in the evening. If it wasn't a merchant moving his goods to safety,

that 54 persons were housed at the emergency shelters at Logan and Chapmanville High Schools.

Lila Hinchman, executive director of the local chapter said that plans are being made to open a temporary disaster assistance headquarters.

Tension increased as the water rose through the night. And as it increased, officials of Appalachian Power Co. announced that electrical service to

"We monitored the dam periodically through the night for signs of failure or weakness and found none," Capt. Jim Baldridge said. "We weathered the storm."

Baldridge said that during the 18-hour period beginning at 7:30 a.m. yesterday, the level of the lake increased 100 feet.

"We are well above the level for [illegible]

5 APR

Ra[illegible]s Threaten [illegible]ajor Flooding, Small Streams Close Some Roads

Registration Deadline Set For 9 P.M. Today

the Logan Banner

600 Attend See Rally, Dinne[illegible]

News At A Glance

Good Afternoon

Clinic Set At MARH

Water, Water, Water Everywhere

HEAVY rains brought small streams out of their banks in Logan County yesterday and today, causing flooding in the Mt. Gay-Cherry Tree area. Water blocked the road in the vicinity of K-City Discount Store and entered several businesses in the low-lying area. The water went down late yesterday, but was on the increase again today after three inches of rain fell.—Photos courtesy of Tarrell Webb and Johnson's Of Logan

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the Logan Banner

Tuesday
MAY 8, 1984

NOW IN ITS 96TH YEAR OF SERVICE TO THE PEOPLE OF SOUTHWESTERN WEST VIRGINIA

Established March 7, 1888 (USPS 317-620) ONE SECTION 25 Cents

Good Afternoon

Up With People Seeks Housing

The "Up With People" cast will arrive in the area Friday night and 25 more beds are needed.

Persons interested in housing the members are urged to contact the Logan Memorial Fieldhouse or Don Elkins' residence.

Parade ...nned

... wishing to participate in ...ROTC Parade slated for Monday, May 14 in Logan should contact Barbara Porter at 752-1656 no later than tomorrow, Mrs. Porter said.

The parade will be part of the festivities planned for Logan County ROTC Week which begins May 13.

Al-Anon, Alateen To Meet Tonight

Al-Anon and Alateen will meet at 7:30 p.m. today at the Nighbert Memorial United Methodist Church in Logan.

Cloudy Days

By UPI And The Banner

Partly cloudy tonight. Lows in the mid 30s to mid 40s. Mostly cloudy in the north and partly cloudy in the south and continued cool Wednesday. Highs mid 50s to near 60.

The high and low in Logan at 7 a. m. today were 78 and 60. Yesterday's temperatures at that time were 75 and 54.

There has been .30 of an inch of precipitation recorded for the 24-hour period and the barometer reads 29.00 and falling. The Guyandotte River registered at 10.91 feet and falling.

Extended Forecast Thursday through Saturday — Partly cloudy Thursday and Friday. Increasing cloudiness late Saturday. Cool Thursday with highs in the upper 50s to mid 60s, warming into the upper 60s to mid 70s by Saturday. Morning lows in th... Thursday, in the mid 30s to ... Friday and in the 40s

Inside Today

FLOOD waters left some shocking pictures for county residents to remember yesterday, as The Banner's cameras were at work recording the devastation of a flood and its effect on the people of the area. Top photo, flood waters all but cover a gasoline station at Mt. Gay; above, rescue and recovery efforts included the use of canoes and other small craft as this one navigates through the Deskins Addition section of Logan; below, sufferers from the flooding take a brief moment of respite, waiting for the water to go down and counting their losses; at bottom, the Guyandotte crests in early afternoon just below piers of Logan General Hospital.—Banner photos by Johnsons of Logan, Raamie Barker, Dwight Williamson, Jeff Baughan and Teddy Paynter

FLOOD WATERS RECEDE

Thank God For The Dam; Lack Of Rain

By RAAMIE BARKER

The thing on most Logan County minds this morning was "thank God for the dam" and "thank God the rains didn't come."

There is little question that the R.D. Bailey Dam at Justice and divine providence saved Logan and neighboring counties from a major disaster, even though the Guyandotte River slipped above flood stage for the first time in years yesterday, cresting at just over the magic figure of 23 feet.

Without the dam and lack of predicted rainfall yesterday afternoon, the situation could have been much worse today.

US Army Corps of Engineers spokesman Conrad Ripley said the dam is in excellent shape and has another 50 foot capacity before it reaches its emergency spillway.

Ripley said the dam set a new record of 71 feet for water storage and containment, further underlying the importance of the dam in averting a major disaster along the Guyandotte River Basin.

Dam officials said they would use the extra 50 foot capacity "if we have to."

After weeks of spring rains which saturated the ground, Logan County received about three and a half inches of rain Sunday and Sunday night, causing streams to rapidly rise. Water was already high in some areas, causing flooding.

While most of the county escaped disaster, those in low-lying sections around Logan didn't. Water had already flooded parts of Mt. Gay and at the mouth of Mud Fork, with rains driving those falling levels back up yesterday.

For those affected by the high water in the Mt. Gay area, the flooding was as bad as it has ever been in a county where flooding has marked the good years from the bad ones.

County residents seem to mark their private histories with years containing great or lesser floods.

In neighboring Mingo County and in Williamson, the situation is much worse. Even though they didn't get much additional rainfall either, there is no flood control protection on

See Story No. 1 on Page 12A

Slides Cause Evacuation From Logan Hillside

Recent heavy rains are causing another potentially dangerous problem for Logan residents.

Several Logan-Pine Street residents were evacuated today fearing a threat posed from a landslide on a hill overlooking the city.

A spokesman for the Chief of Police's office in Logan said evacuations were conducted when a slip occurred at Mountain Lake Park.

Another problem in the vicinity developed late yesterday when a retention wall collapsed blocking Cassick Street for a while. Normal traffic has resumed while crews attempt to clean up the mess.

Mayor Gary Hylton said he is attempting to get some professional advice on the potential danger to residents from the land slide.

Officials said they do not know the degree of danger to other residents living on the hillside posed from the slip.

A distressed woman caller late this morning said dirt was coming from under her porch which was breaking away from her house. She said she feared her house would collapse as well.

She reported seven families were evacuated because of the land slides yesterday.

Williamson, Mingo Not As Fortunate

By United Press International

Memories of the 1977 disaster have been revived in Williamson, under siege once again by the rampaging waters of the Big Sandy River.

Spring rains annually jangle the nerves of people who live there, and the rains were sustained long enough to swell the Tug Fork of the Big Sandy to the breaking point Monday

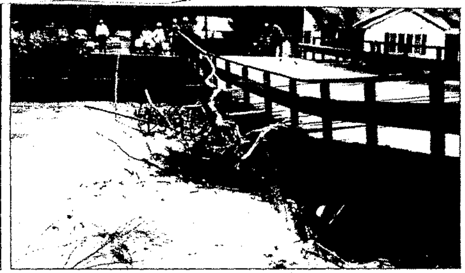
take a double amputee to a hospital for oxygen.

Three hours after the town was covered with water, the flood warning had been downgraded to a watch and National Weather Service officials said the river had begun going down.

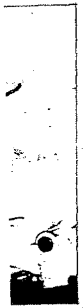
Throughout southern West Virginia, the picture was much the

The Logan Banner, Tues., May 8, 1984 Page 3A

Flood Entered Buildings, Drew Crowds Of Spectators



FLOOD waters from Island Creek, Huff Creek and the Guyandotte River yesterday caused a lot of problems, entering businesses and houses and provided some with a chance just to stop and watch it all. Top left, a man sits waiting for flood waters to fall in the Mt. Gay area top right, water threatens to destroy an already poor bridge in the Davin area, lower left, debris piles up behind a bridge at Mt. Gay, suggesting the weight limit for trash may be three tons and at lower right, some youngsters do their best to salvage a picnic table from the rising waters on Island Creek.—All Banner flood photos were made by Johnsons of Logan, Dwight Williamson, Teddy Paynter, Raamie Barker, Jeff Baughan and Terrell Webb for which The Banner extends its thanks.



STORY NO. 2

Continued From Page 2A

commanding increasing attention

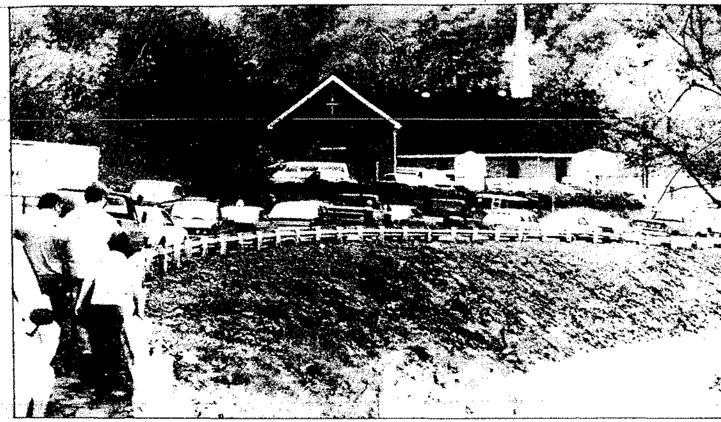
Why not call Patrick's WaterCare ...day for a free water analysis. Ron ...d his staff can answer any ...estions you may have concerning ...ater problems.

Patrick's WaterCare at ...

(2). Automatic rental — provides customers the option to buy water softener with iron filter.

(3). GaridanCare — owner plan to purchase with in the home bank financing possible.

The Logan Banner, Tues., May 8, 1984 – Page 9A



HUNDREDS of vehicles stand idle on the west end of Logan Boulevard yesterday waiting for flood waters to drop in the Mt. Gay interchange area just outside Logan. Flood waters blocked US 119 closing it to traffic for several hours. Additionally, some motorists used the unusual situation to become spectators of the flood, further compounding traffic problems in the area. – Banner photo by Dwight Williamson

South Hit Hard By Flooding

Three days of torrential rains spread floods across the South and threatened to put 5 feet of water from the mighty Tennessee River into Chattanooga, Tenn., today. Tornadoes injured dozens of people.

Thunderstorms pounded the South from Louisiana to the Carolinas and flash flood watches covered most of the southern quarter of the nation. Rain extended across Virginia, Maryland and Pennsylvania.

Rivers across Tennessee rose rapidly. Chattanooga officials began moving people from low-lying homes at midnight.

"Our estimates show the flood will cause between $20 million and $35 million worth of damage to buildings along the river," spokesman Carl Vines of the Tennessee Valley Authority said Monday night. "TVA has tamed the Tennessee River, but we just can't tame the storm clouds that come roaring through this area sometimes."

The National Weather Service said 23 tornadoes hit the South between 6 a.m. and midnight Monday night, including 10 in Tennessee, four each in Arkansas and Mississippi, two in Alabama, and one each in Kentucky, Texas and Louisiana. Tennessee claimed 23 separate touchdowns, some of them apparently by the same tornadoes.

Health

Lawrence E. Lamb, M.D.

DEAR DR. LAMB — I'm 46 and had a hysterectomy four years ago. The doctor removed everything. I developed hot flashes six weeks after the operation, but the doctor said I didn't need any hormones.

My sexual desire has slowly diminished to nothing. I've been reading a lot about women during menopause who need estrogen. How does a woman know if she needs it? Would it help me sexually?

I've also read about the disease women have that causes the bones to get thin and break easily. One article said women need calcium and experience significant changes.

There's considerable truth to the idea that glands affect personality and behavior. I can't say whether estrogen will improve your sex life, but it's certainly worth considering.

Your symptoms are one indicator of whether you need estrogen. The doctor should be able to tell in his examination. Cells from the vagina can be studied under a microscope and blood and urine tests should be done.

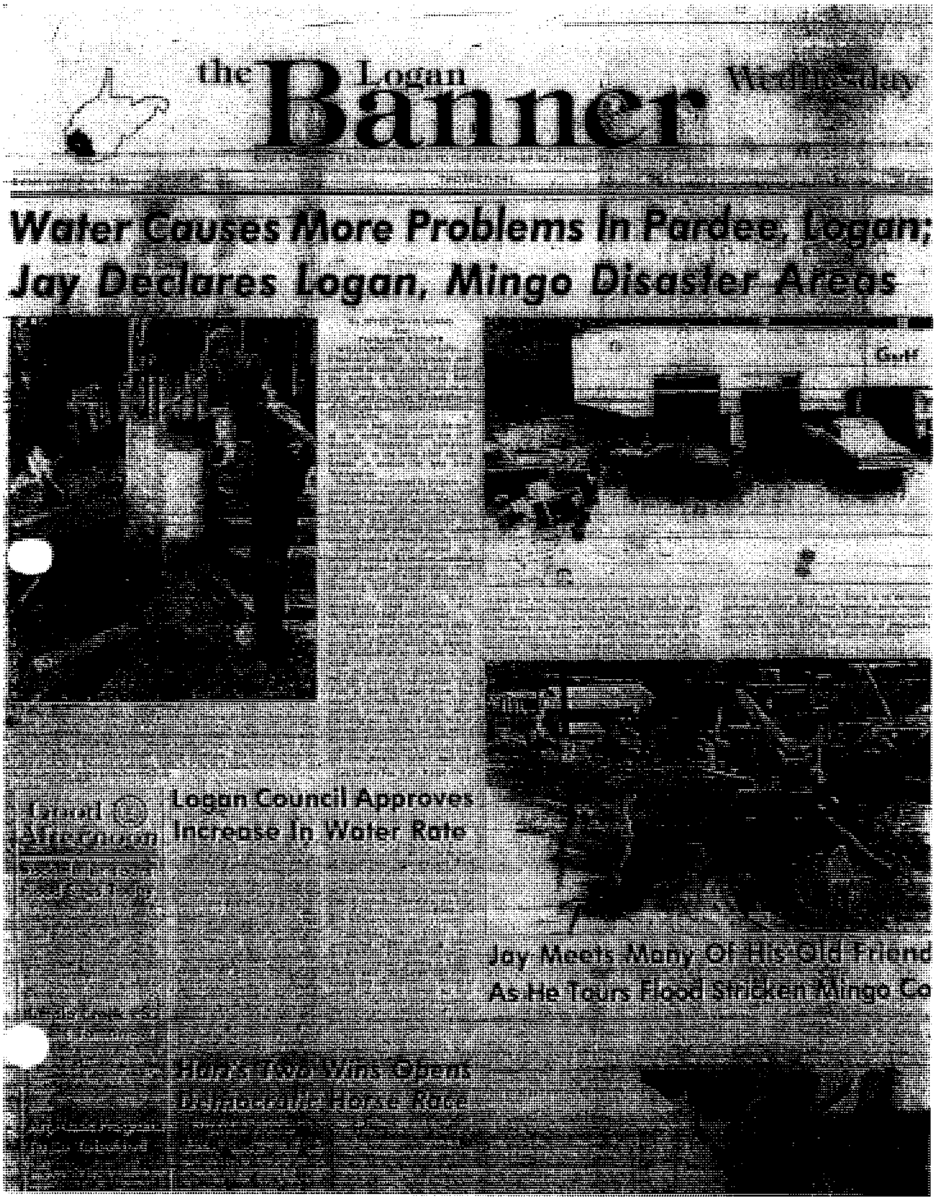
With the latest reports on how

Jeter Bows Out Of State Race

CHARLESTON, W.Va. (UPI) — Faced with "so many personal things to do," Lewisburg lawyer James Jeter is bowing out of the attorney general's race, leaving fellow Republican John McCuskey unopposed for the party's nomination in the June 5 primary.

"I no longer am going to be a candidate," Jeter said Monday. "The main consideration is that I have so many personal things to do.

"Like this weekend, I had my son's graduation and I missed the meeting of the West Virginia State Bar. I have another graduation in two weeks and the 25-year reunion of my law school is next week."



the Logan Banner

Wednesday

Water Causes More Problems In Pardee, Logan; Jay Declares Logan, Mingo Disaster Areas

Good Afternoon

Logan Council Approves Increase In Water Rate

Jay Meets Many Of His Old Friend
As He Tours Flood Stricken Mingo Co

Hurt's Two Wins Opens Democratic Horse Race

...sinesses To be Inspected

Jaycees To Meet, Discuss Plans

Danville Water Disrupted Monday

NO. 1 IN LOGAN COUNTY WITH OVER 30,000 ... DERS DAILY SUNDAY THROUGH FRIDAY

EIGHTEEN PAGES — TWO SECTIONS USPS 317-620 LOGAN, W.VA. Vol. 101 Number 190 WEDNESDAY, OCT. 18, 1989

Governor assessing flood-stricken area

By TEDDY PAYNTER
News Editor

Governor Gaston Caperton paid a visit to Logan County earlier today to get a first-hand look at flood-riddled Triadelphia District, less than 24 hours after heavy rains chased streams along Huff Creek and Buffalo Creek out of their banks.

The Guyandotte River crested above flood stage in Man Tuesday afternoon, but the Army Corps of Engineers shut off the floodgates at R.D. Bailey Dam and the river began to recede.

A spokesman for the National Weather Service said the Guyandotte crested at all locations from Logan upstream and was below flood level Tuesday evening. The NWS said the crest would reach Branchland in Lincoln County sometime today at nearly 23 feet, or seven feet below flood stage.

Communities along Huff Creek were hardest hit by the floodwaters as rains across Southern West Virginia ranged from two to four inches as the remnants of Hurricane Jerry moved through.

Residents living at Green Valley, Mallory, Davin, Claypool and Combs Addition began restoring damaged property yesterday afternoon as homes and yards were filled with mud and debris.

Logan County School officials announced that Mallory Grade School will be closed for the next two days because of the high waters. Assistant Superintendent Jack Garrett said mud and debris covered every classroom in the building.

"It was the hardest hit area. Students at Mallory Grade were the first dismissed yesterday. I'm sure the clean-up work will take at least two days and then the Health Department will inspect the building as well," Garrett noted.

Several bridges along Huff Creek were blocked by high waters in three different locations. Also, at least one small bridge was destroyed and another heavily damaged near the Mallory Church of God.

State Trooper Ric Robinson said high waters washed a two-room house off its foundation at Rita around 2 p.m. Robinson said the house floated

Related Photos
On Pages 6 & 7A

downriver to Three Mile Curve, striking a bridge and breaking up. He said no one was in the home when it was swept away.

By dark, the waters had begun retreating into their banks and evacuees started returning home.

Several homes and yards along the small Buffalo Creek stream received severe damage in low-lying areas.

Roger Bryant, Deputy Director of Emergency Services in Logan County, said a flood plan was put into effect yesterday afternoon to receive those needing assistance at Man High School. Bryant said the center was shut down last night.

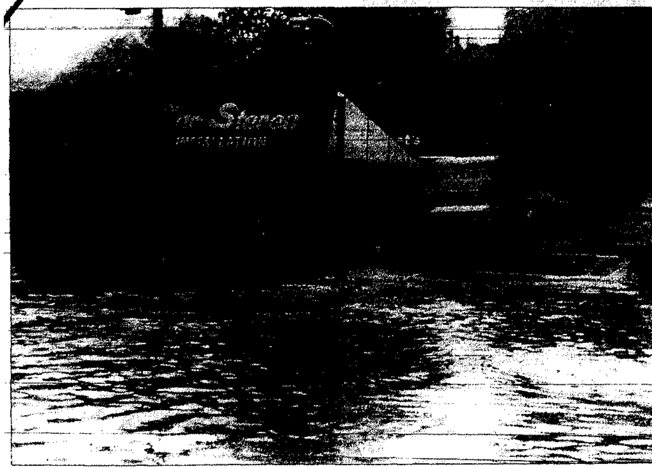
An additional flood relief center was on hold at Logan Grade School.

Bryant is scheduled to return to Man today along with Jim Singleton, Director of Emergency Services, to evaluate property damages.

In Mingo County, waters raged through the Town of Gilbert and flooded many of the outlying areas. A busload of junior high and high school students from Gilbert were left stranded at the Gilbert Volunteer Fire Department while workers cleared away a mudslide near the entrance to Gilbert Creek.

State Police Lt. Paul Rogers from the Office of Emergency Services in Charleston said a few small bridges in outlying pockets of Mingo County were swept away, and an unknown number of basements were flooded out in various communities, including Gilbert.

See GOVERNOR On Page 10A



READY TO MOVE—Jesse Queen, owner of Stereo Video Unlimited, along with employees and volunteers were prepared yesterday to move his merchandise with a Ryder truck from the store's location in Mt. Gay. The intersection is a common flood site and yesterday's heavy rains was no exception. However, floodwaters receded and the move wasn't necessary.—Banner photo by Chuck Carter

Dispute with non-union operation

BRIEFS

Gunshot claims businessman

Monday
February 17, 2003

Serving Logan, Boone, Mingo, Lincoln and Wyoming Counties of West Virginia Since 1888

50¢

THE LOGAN BANNER

USPS 317-620
E SECTION — 12 PAGES
LOGAN, W.VA. Vol. 115 No. 293

The Inside Story

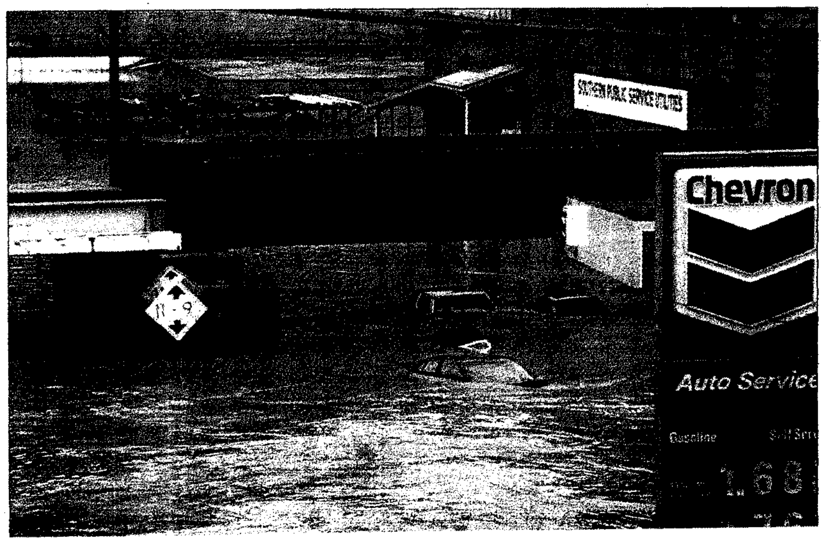
...ow causes ...stponements

...eral games were postponed due to heavy rains ... icey conditions. The ...ther isn't supposed to ...rove much. For more ... the postponements, see ...es 6A and 7A.

...ty of Logan ...t under boil ...ater advisory

...pite coal sludge entering ... Guyandotte River at ...ert, Willard Adkins, ...eral manager and chief ...rator of the Water ...rd, City of Logan, the ...er has never been off for ...an customers. "We have ...ood supply of water," ...ins said this morning. ...ere is not a boil water ...isory. It's just another ...cal day for us."

State of emergency



Several automobiles were submerged under flood waters at Mount Gay Sunday afternoon. A winter storm dumped rain and ice on the area, causing flooding and bad road conditions. The bad weather conditions closed roads in many areas and schools in many of the coalfield counties, including, Logan, Mingo, Lincoln and Boone.

n County Board of
n has set up a
nber to call in case
ent weather. The
: 752-3201.

eather

Today

rain or sleet likely changing to e afternoon. Minor mulation. Continwith highs 32 to east winds around Chance of precipipercent.

onight

A chance of snow owers early...Then of snow showers evening on. Lows upper 20s. West o 10 mph. Chance tation 30 percent.

uesday

udy. Highs in the ;. West winds 5 to

day night

ear. Lows near 30.

ndex

ituaries

ing obituary listings are t to you, courtesy of

Logan Banner
loganbanner.com
on Street, Logan, WV
752-6950

Sheets, 90; Lena , 87; James E. , 32; Randy Ray nson, 51; Grace man Turner, 93; ice Workman ner, 93; Oley wis Cook, 29

Banner photo by Michael Browning

For only the second time in the flood wall's existence, the city of Williamson was forced to close the flood gates due to flooding from the Tug Fork River. The gates were closed on the Vinson Street road sealing the city within the wall. Shown is the wall from the South Williamson, Ky., side of the Tug Fork.

■ Rising wat-- power outages and ice hit area hard

By J.D. CHARLES
Staff Writer

HOLDEN, W.Va. — A combination of floods and a freak ice storm left thousands of people in Logan and Mingo Counties out in the cold this weekend as downed powerlines and floods drove people from their homes.

In the Mount Gay area many vehicles and homes were flooded by rising waters and the road itself was blocked at the mouth of the bridge near Krogers and Valley Market.

According to the West Virginia State Police Logan Detachment the roads were blocked at Stollings, Rum Creek, Mount Gay, Madison, Holden, Cainey Branch and other areas and had crumbled in some places.

According to a spokesperson for the power company thousands of people in Logan and Mingo Counties were left without power because of downed power lines caused by trees knocking over power lines.

The flooding appears to have done the most damage.

According to AEP, many people will remain without power until late Monday evening.

According to reports, areas of Harts Creek, Stone Branch and Chapmanville were also without power and could remain so until Wednesday.

While other churches canceled services Sunday evening the West Virginia Dream Center was open for people who needed help in the aftermath of the storms with left so many out in the cold.

"Right now we are going after two people, a lady and her daughter," said Rev. Mike Hartwell.

See AREA On Page 10A

Heavy rains cause mine sediment overflow

CHARLESTON, W.Va. (AP) Heavy rains across the southern region of West Virginia caused a sediment overflow at a Mingo County mine Saturday.

A sediment ditch at the White Flame Energy Inc. mine near Ragland overflowed, spreading mud and debris into the yards of two nearby homes, said Department of Environmental Protection Mining and Reclamation Director Matthew Crum. A nearby business was also surrounded by the debris.

Crum said mud and debris two to four feet deep had piled against a wall of one of the homes.

Harold Ward, Environmental Inspector with the DEP in Logan County, estimated that between 2,000 and 10,000 yards of material flowed out of the sediment ditch and into the surrounding area. He said that because of the nature of the overflow, it is hard to provide a narrower estimate.

The DEP was notified by nearby residents of the overflow at about 10:30 a.m. Ward said residents also called the mining company.

Crum said the flood is under control, and both White Flame and DEP workers are still at the site. He said the company would at minimum be issued a notice of violation for offsite violation.

Floods, snow, ice hit state

By JOHN RABY
Associated Press Writer

CHARLESTON, W.Va. (AP) — Gov. Bob Wise declared a state of emergency Sunday after floods hit the south, nearly 2 feet of snow fell in the mountains and a dangerous mix of ice and sleet blanketed the rest of West Virginia.

The storm cut power to at least 50,000 customers and was blamed for at least one death in the state.

The disaster declaration allows utility crews to work additional overtime, enables state agencies to assign workers to flood relief, including overtime and weekend work, permits the state to perform emergency contracting and authorizes the use of National Guard troops for flood cleanup.

"The roads through West Virginia are extremely dangerous," Wise said during a news conference at the Capitol. "Unless you have a very serious situation, please do not go out on the roads."

A Cabell County woman was presumed drowned when she tried to drive across a road flooded by the Lower Mud River.

The car driven by Cathy A. Davis, 45, of West Hamlin, was swept into the river, overturned and sank at about 8:15 a.m., said state police Sgt. A.L. Cummings in Huntington.

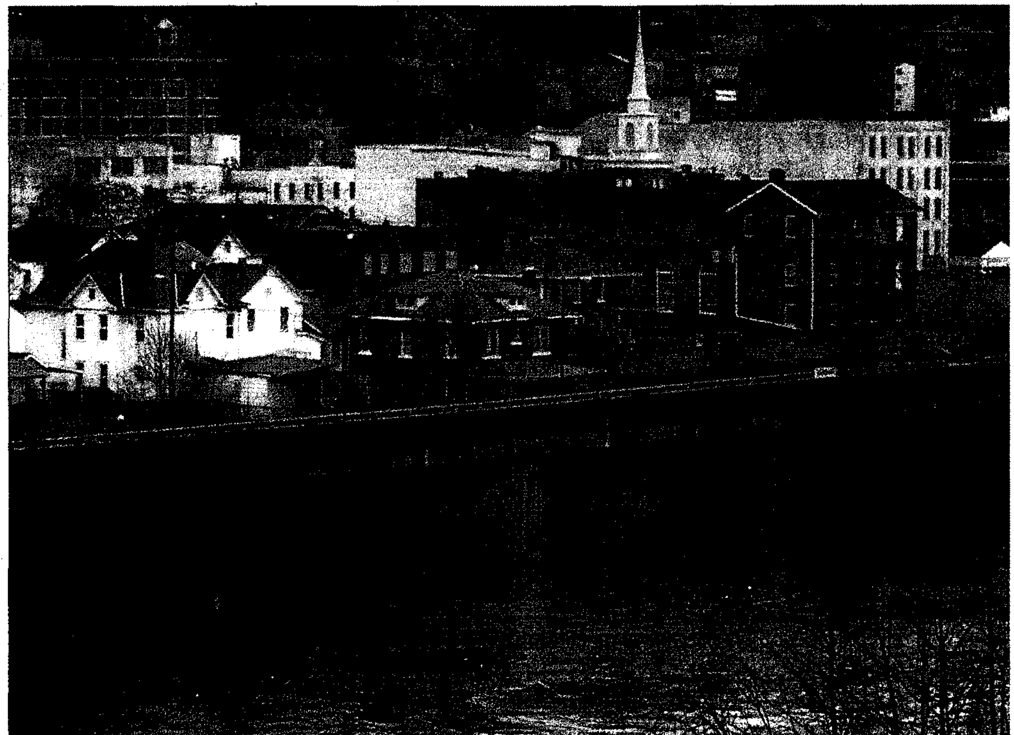
Divers had not recovered the body or the car by Sunday night, Cummings said.

Temporary shelters were opened up in seven counties for residents whose homes

See STATE On Page 10A

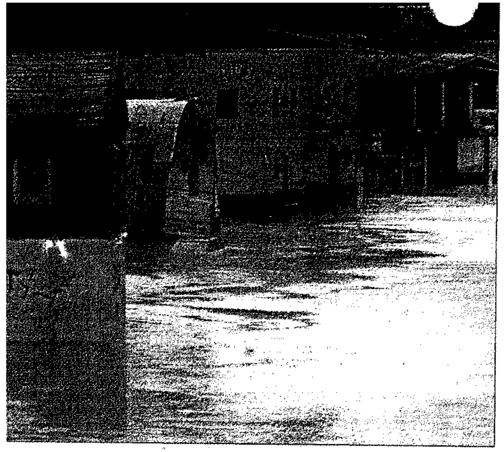
Page 12A - Logan E Mon., Feb. 17, 2003

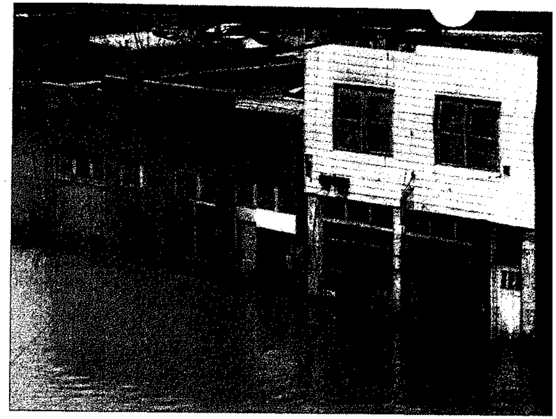
Frozen and floode



The city of Williamson was saved from another devastating flood Sunday morning, as flood waters were kept out of the city by the flood wall surrounding it. The flood wall was constructed by the U.S. Army Corps of Engineers to prevent another destructive flood like the 1977 flood, which nearly washed away Mingo County's county seat and its other towns and communities. This view was from the South Williamson, Ky., side of the Tug Fork River, which was expected to crest three feet above the flood stage.

Banner photos by Michael Browning

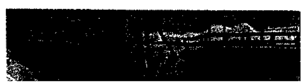


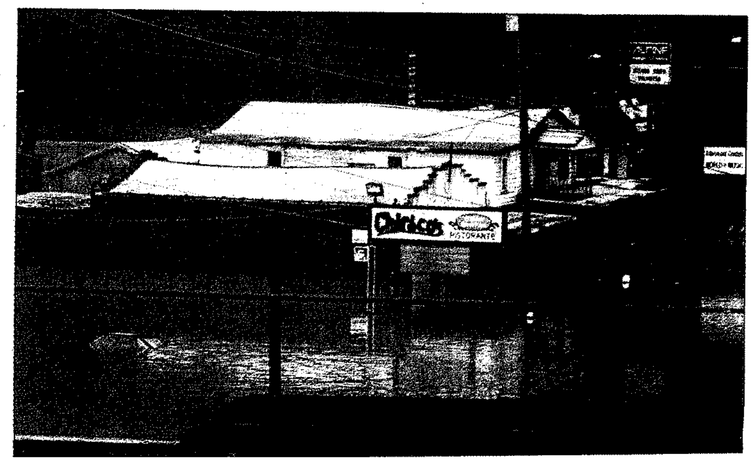


Buildings in the Mud Fork community, at left and above, were up to their doors in water Sunday afternoon.

Banner photos by Jerry Fekete

red roads all across Logan and Mingo counties y afternoon, as a winter storm covered the state ow and water. Below, heavy rains caused sever- passes and roads to be blocked, such as the ss at Rum Junction.





ENCLOSURE 2

ENCLOSURE 2

INTERVIEW SUMMARIES

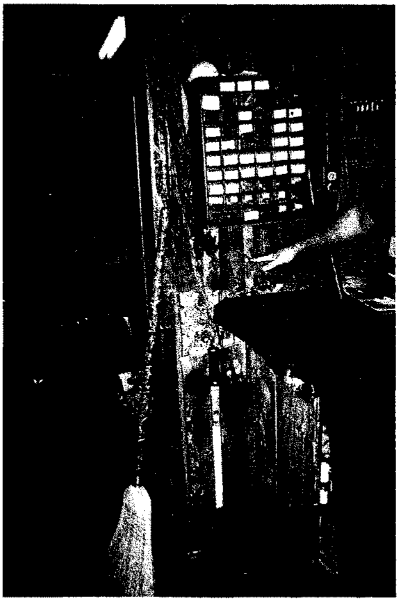
AND

PHOTOS

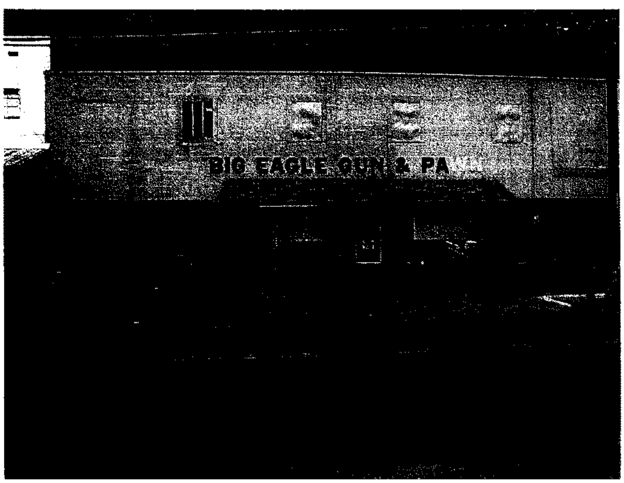
Map of Project Area and interview summaries follows – includes the information from business owners and employees interviewed in August 2003 by Sherry Adams, Project Manager and Julie Bush, Planning team member concerning the history of flooding in the Island Creek area.


GUYANDOTTE RIVER
N
2-STEREO VIDEO
UNLIMITED
CAR AUDIO
GUN AND
ELLIS ADDITION
3-CHEVRON
7-ADKINS SAFE & ALARM
8-LOGAN HYDRAULICS
WHITES ADDITION
MOUNT GAY
5-KEEFERS
KAWASAKI
6-WVDEP
CHERRY TREE
9-SAM TILLER

1. Big Eagle Gun & Pawn



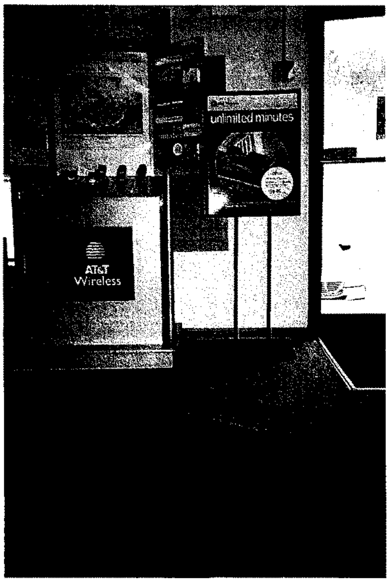
The interview team interviewed the owner of Big Eagle Gun & Pawn, Kent Bragg on 15 August 2003. He indicated his business was flooded approximately 4 ½ feet over first floor in 1996 inside, which is shown in the photo above. The flood waters frequently cover the parking lot, which is elevated above the road.

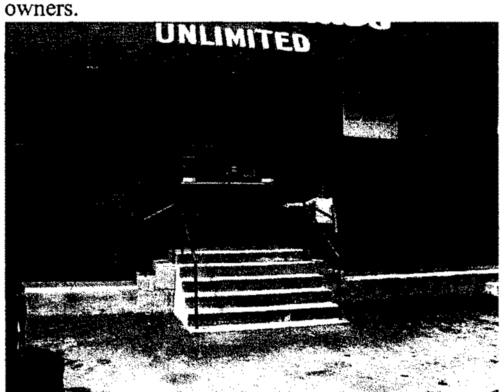


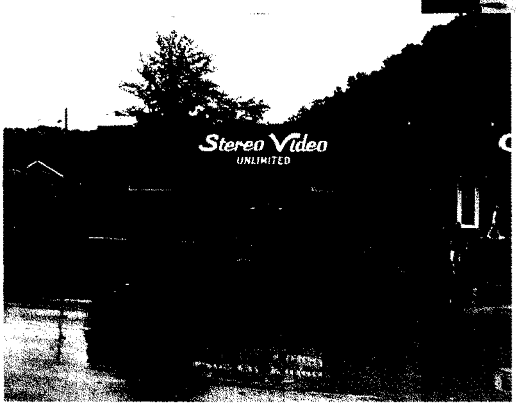
2. Stereo Video Unlimited
Owner – Jessie Queen
Phone – (304) 752-2265

Sherry Adams, Project Manager and Julie Bush Planning Team Member interviewed the owners' wife and sister on 15 August 2003. This business is located in one of the lowest areas of the project. Flooding occurs on a frequent basis, at least annually and some years more often. In February 2003 the building had approximately 3 feet of water inside as indicated in lower-right photo. They were closed from 16 February to 28 March for remodeling. This required a complete renovation of the walls and flooring.

In 1996 this structure had approximately 9 feet of water inside the building. The contents inside the building were completely destroyed. They have National Flood Insurance. Premiums continue to rise with each flood event. The bottom photo shows receding waters from 4 September 2003. The business was not flooded, but there was the threat of flooding, which usually requires evacuation of inventory, causing costs to be incurred by the owners.







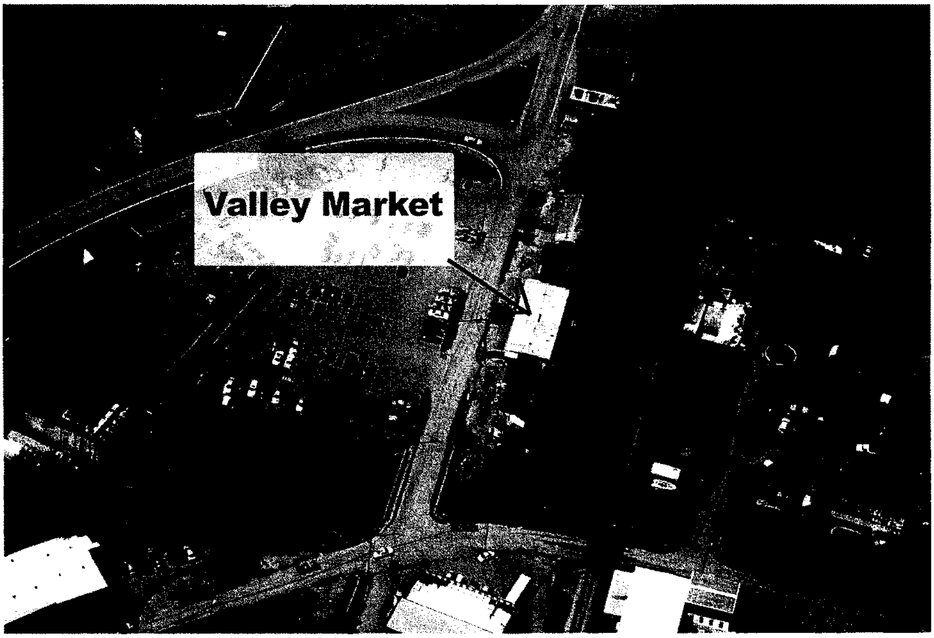
3. **Chevron Station**

The interview team interviewed an employee of the Chevron Station, located at the confluence of Island Creek and Copperas Mine Fork. The employee stated that this structure is flooded approximately two times a year. In February 2003 (see photo below) the garage section (lower end) of the building received 2 ½ feet of water and approximately 1 foot in the store (upper end). In 1996 the floodwaters were approximately 15 feet high and reached the canopy in front of the building, as shown in the upper left photo.

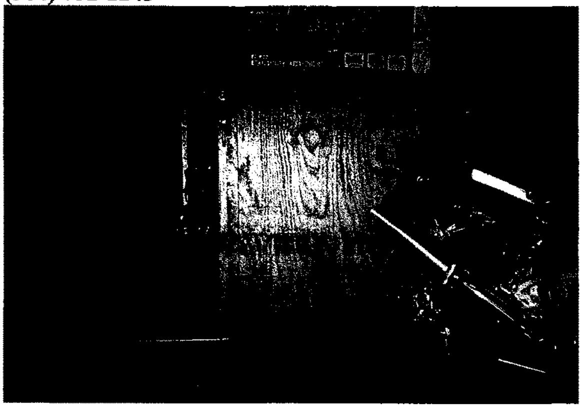
Several automobiles were submerged under flood waters at Mount Gay Sunday afternoon. A winter storm dumped rain and ice on the area, causing flooding and bad road conditions. The bad weather conditions closed roads in many areas and schools in many of the coalfield counties, including Logan, Mingo, Lincoln and Boone.

4. Valley Market Owner: Bernie Sidebottom
(304) 239-2100

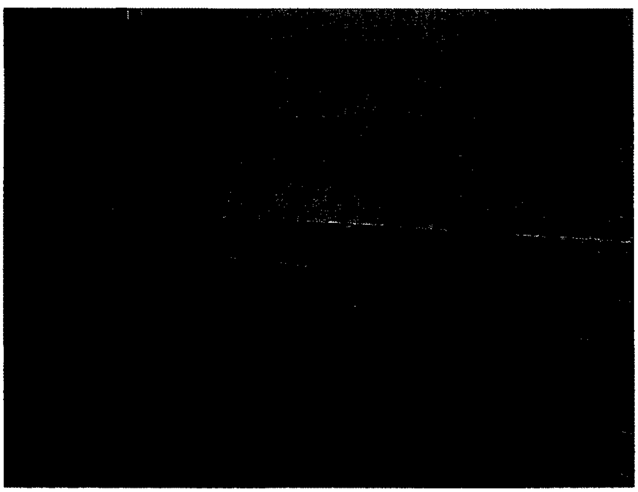
The interview team interviewed Bernie Sidebottom, owner of Valley Market a small local grocery store. He indicated that this structure has been flooded four times in one year in the 1970's. In 33 years they have experienced flooding on 17 occasions. When interviewed on 15 August 2003, the last time this structure had been flooded was 1996 when he had 5 – 5 ½ feet of water inside structure. On 4 September 2003, however, there was heavy rain in this area and the business received water in the building. The above photos were taken hours after the rain had stopped and the flood waters had receded. Mr. Sidebottom indicated on average that every two years there is 3 – 5 feet of water inside his business. In 1996 the business sustained approximately $400,000 in damages. He indicated they were only insured for $200,000. After a flood event of this magnitude they will usually remodel the entire business, otherwise they do little remodeling or maintenance of business due to threat of flooding. The Copperas Mine Fork stream is located behind this structure (see below photo taken 5 September after flooding on 4 September). The owner has seen tractor and trailers floating downstream into his building knocking out cinder blocks causing the structure to lean. This required the owner have it shored up in the back to prevent the building from collapsing. This is a family owned business that has existed for the last 33 years. The father owned it prior to the son now having ownership.



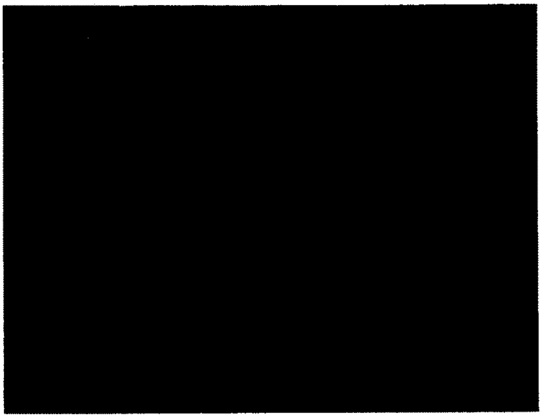
5. Keefer's Kawaski & Suzuki of Logan   Owner: Eddie Keefer
500 Tiller Street
Logan, WV 25601
(304) 752-2245



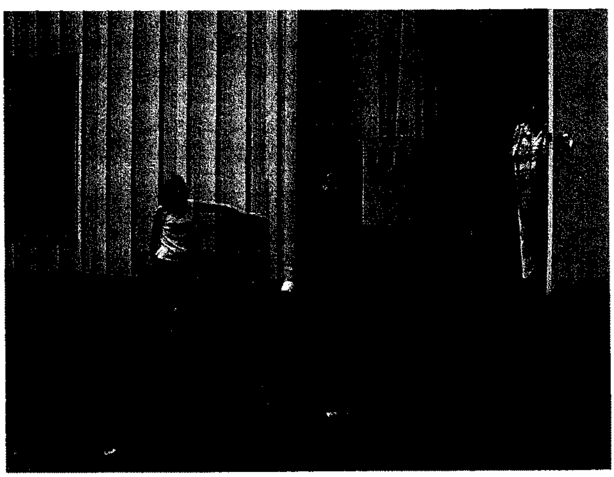
The interview team interviewed the owner of Keefer's Kawaski & Suzuki of Logan, Eddie Keefer. This business was last flooded in 1996. The high water mark in the photo above is from the 1996 flood. The owners stated that historically, at least once a year flooding threatens this structure. Water rises to the first or second block on the downstream side of the building. Twice in the year 2002 the owner had a 15 man crew move inventory due to the threat of flooding thus incurring expenses. February 2003 water was on second block of this building.



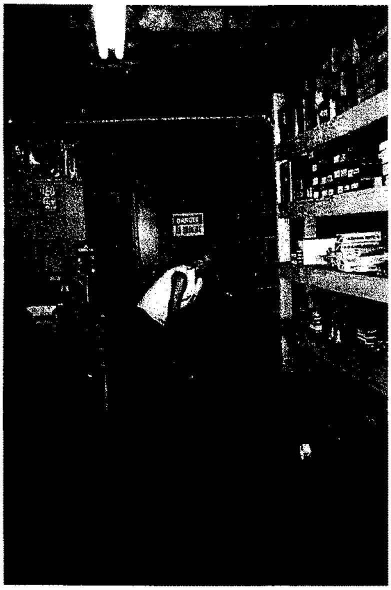
6. WV Department of Environmental Protection (DEP)

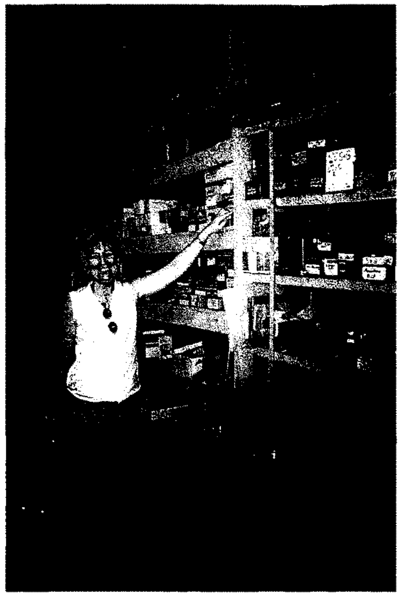


On 21 August, Sherry Adams, Project Manager interviewed the local DEP manager Haskell Boytec and the officer manager, Francis. The officer manager indicated that the only time the WV DEP building had been flooded was in 1996. The above photo shows a high water mark approximately 1 ½ feet on the first floor. The photo below was taken from the outside of the building and shows the same elevation at approximately 3 ½ feet. There are two separate agencies housed in this structure with approximately 70 employees. The WVDEP agency has 60 employees.



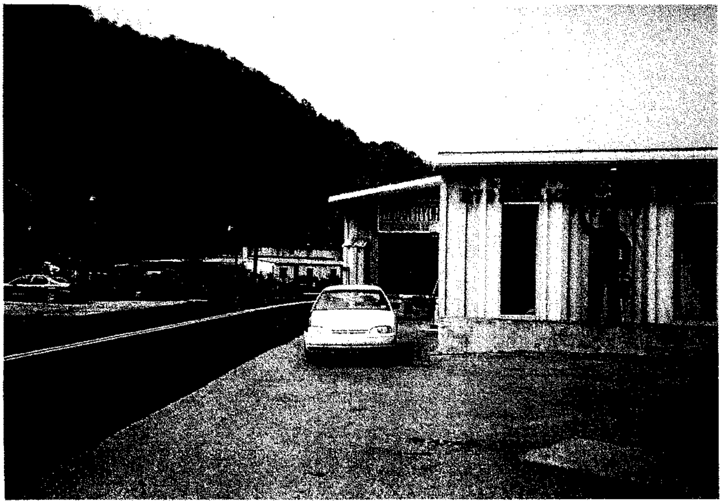
7. Atkins Safe and Alarm Service
106 Tiller Street
Logan, WV 25601
(304) 752-7971





The owner of Atkins Safe and Alarm was interviewed on 15 August 2003. This structure is flooded approximately every year. In the 1st floor of the business, where inventory is stored has high water marks at approximately 2 feet. In 1996, the high water mark as shown in the above photo on the right is approximately 6 feet. Damages occur to inventory items on the first floor.

8. Logan Hydraulics & Mining Equipment
9. Sam Tiller Residence



The interview team interviewed the owner of Logan Hydraulics and Coal Mining Equipment, Sam Tiller. Mr. Tiller has multiple properties along Island Creek in the Cherry Tree and White's Addition both of which are within the project area. He stated that these businesses and storage buildings receive flooding every two or three years. In 1996 the flood waters were within one foot of entering the building shown above. Mr. Tiller indicated that approximately every five years the water gets very close to this Logan Hydraulic property but doesn't enter the building. This structure is located on one of the highest point in the Cherry Tree area.

Mr. Tiller also stated that when it rains people in this neighborhood get nervous. His neighbor is selling his house and moving into the City of Logan because his wife is "literally losing her mind for fear of flooding."

Mr. Tiller's other properties aren't as fortunate as the Logan Hydraulic building. In 1996 he had several buildings in the Cherry Tree area that were damaged by the flood water; both personal property and his business inventory were damaged. He also lives in the Whites Addition area of the Island Creek Basin and in 1996 he and his wife had to evacuate the area and his home and garage both were flooded.

CELRH-PM-PD-F 23 July 2003

MEMORANDUM FOR

SUBJECT: RE - Island Creek Logan, WV –Economics

This memorandum is in response to a memorandum dated 30 April 2003 subject, Island Creek Logan, WV –Economics from ASA(CW) office sent to the District as attached files in an e-mail message dated the same from Edmund Price (HQ) to Theodore Brown (LRD) and then to Mike Worley (LRH). The original memorandum and spreadsheet are attached with this document.

Issue Response:

1. The ASA(CW) memorandum documented two issues with the Island Creek report. The first issue was the dollar damages calculated in the report, especially for the 1-year and 5-year events, and secondly, the frequency analysis with regard to the water elevations for the most frequent events.

2. Potential issue resolution options were outlined in the ASA(CW) memorandum. Those items will be addressed later in the memorandum in the section titled Potential Issue Resolution Options. Since the hydrologic model directly impacts the economics, we will address that issue first. Paragraph number 2 states that the hydrologic model should be reexamined to determine if the water elevations associated with the most frequent events are accurate.

   To resolve this issue the HEC-2 model used to compute the water surface profiles was reexamined. The valley cross sections for the Island Creek project reach are very obstructed due to the extensive development of commercial and residential structures. The floodplain is also very obstructed as a result of highway construction across Island Creek. These obstructions in the study reach would produce more frequent flooding with lower frequency events. Therefore, our review supports the results of the H&H model

3. Paragraph 1 states that verification of damages is needed. The following items provide support to the validity of the economic analysis and the resulting justified project recommendation.

   - Given the validation of the hydrologic model, the economic damages and benefits are a direct result of the model. As stated above, the Island Creek project reach is very obstructed and therefore yields substantial depths of water even at the most frequent events.

   - Due to the lack of documented historic damages for the 1- year event, a sensitivity analysis was done in the economic appendix of the March 2002 report. The analysis appears on pages 16 and 17 of the Economic Appendix of the report. Tables 14 through 17 on the same pages display the economic results. The 1-year damages were deleted and the zero damage stage set at the 2- year water surface elevation. Under the modified scenario all three alternatives result in positive net benefits and benefit cost ratios greater than 1. The 80-Foot Channel was also the NED plan under this scenario.

- The values used for residential structures were conservative. In addition, using 50% for contents value is also conservative. It has been the experience in the Huntington District that lower value housing typically contains a greater percentage of value for contents. Based on this information, the benefits would likely increase if project specific depth damage relationships were developed. Undertaking the effort to develop project specific depth damage relationships would not change the result of a justified project. Residential expected annual benefits only account for $445,000 of the total $4.1 million in total expected annual benefits.

- The average annual damage to non-residential structures of $23,000 is reasonable based on the types of businesses in the project area. The project area has a high concentration of mining support and supply services. These types of businesses contain expensive machinery that is damaged at low levels of water. There is an American Electric Power facility and substation in the project area that would incur significant damage if flooded. Due to the steep topography of the area, business owners do not have many options for land located out of the floodplain. Non-residential damages should be accurate since depth damage relationships were developed from surveys with each business.

Potential Issue Resolution Options: The original memorandum offered some suggestions to help bring the damages in line with economic rationality. The previous section supports the validity of the damages as contained in the report. However, the District did do additional research as suggested and the findings are presented below.

1. Paragraph number 1 of this section asked for verification of damages and suggested three possible ways to improve the reporting of those damages.

   - "Phone interviews with a small number of property owners could be conducted to find out what their typical expenses/losses are under frequent flooding scenarios (like the 1-yr or 5-yr high-water event). This information can be used to make adjustments to depth-damage functions."

     - Personal interviews were conducted with each business owner to develop structure specific stage damage relationships. As stated above, the residential structure values are conservative as well as the contents value. The residential damages in the report are representative of what would occur at the low frequency events and could even be understated. Also the sensitivity analysis should further reinforce the project justification and recommendation.

- "Documentation from FEMA – National Flood Insurance Program (NFIP) Statistics and details from FEMA can be obtained by year to verify frequent losses. These can be requested by phone or on-line resources can be used. This information can be used as a comparison of the damages calculated with the model."

  - ❖ According to Gloria Prince of FEMA there are 5190 structures in Logan County that are located in the floodplain and only 18% of these have flood insurance. She further stated that this figure had increased in the past five years because of the new requirement that all properties receiving a loan from the SBA must have flood insurance if it has received prior flood damage.

    Using information from the West Virginia Statewide Flood Protection Plan due for publication in August 2003, there are approximately 2200 (42% of Logan County total) structures located in the floodplain of the Island Creek basin.

    A 1996 newspaper article[1] states that only 10% of West Virginia residents who live in high-risk areas have flood insurance compared to a 60% rate in other mid-Atlantic states (PA, MD, VA and DE).

    These statistics indicate that many structures in the Island Creek basin probably do not have flood insurance.

  - ❖ A study and article done by the National Wildlife Federation[2] presented an analysis of the National Flood Insurance Program's (NFIP) computer database of repetitive loss properties for the years 1978-1995. In that study Logan County is listed as one of the top 300 U.S. communities with significant flood loss histories. Logan County also ranks 76 out of 200 U.S. communities ranked by total NFIP losses paid for the repetitive loss properties in each community. Those payments totaled $5,703,777.

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[1] "State Lagging in Flood Insurance", Charleston Daily Mail, June 6, 1996, p. 5A.

[2] "Higher Ground: A Report on Voluntary Property Buyouts in the Nation's Floodplains, A Common Ground Solution Serving People at Risk, Taxpayers and the Environment", David R. Conrad, Ben McNitt, Martha Stout, National Wildlife Federation, Washington, D.C., July 1998 (Second Printing, June 2000).

Since many people do not have flood insurance, historical payments would not be representative of losses incurred in the basin.

- "Newspaper articles or other official documentation of past flood-related damages may be used to support damages as reported. Information should be obtained for specific events or for specific years."

    - Our research found many newspaper articles for the May 1996 event that document the human cost not the economic cost of the flood. The economic costs have been validated by information above. These articles document the loss of life, loss and damage to their homes, loss of irreplaceable belongings and their sense of safety. Frequent flooding takes a toll on people's sense of safety, pride in their homes and their emotional well being. Three articles have been attached with highlighted sections pertaining specifically to the Island Creek basin.

2. Paragraph 2 asked for the hydrologic model to be reexamined. That response has been provided above in the section titled Issue Response paragraph 2.

Conclusion: At the direction of the ASA(CW) memorandum, the District has undertaken additional analysis in an attempt to validate the economic damages and benefits in the report. Based upon those results, it is reasonable to state that given the same hydrologic information and costs that the project would still be justified. The information contained in this memorandum should validate that the economic results in the Island Creek report are economically rational. Finally, the expected annual benefits for this project would have to decrease almost $2.6 million for the recommended project to not be economically justified.

Attachments
1. Microsoft Word file – ASACW Rev Issue Resolution statement 4-30-03
2. Microsoft Excel file – ASACW Table Damages Per structure
3. Newspaper articles

4-30-03

Subject: Island Creek Logan, WV –Economics

Background: The document has received a full review at Headquarters and the calculation of the existing condition flood damages at the 1-year flood and the 5-year flood remains an unresolved issue. The attached table shows that for the 1-year flooding event damages have been calculated to be $10,900 per residential structure and $23,000 per non-residential structure. The report states that in Logan, the average value of residential structures is about $18,000. If 50% is added for contents, the value of the typical residential structure in Logan, including contents, is about $27,000. Average damages per residential structure for the 1-year event at $10,900 represents 1/3 of the total value of each residence incurred in damages each year. These damages are being incurred in a community with a $18,200 per capita income, which is about 62 percent of the average per capita income of the US[1] For non-residential structures the value of damages each year is estimated to be $23,000. This is also a very high cost for business owners to incur each year to continue to do business in a community with such a limited income.

The hydraulics and hydrology model and the economic methodology were discussed. Island Creek is not a gaged stream, but the H&H model was calibrated to allow for a variety of flow scenarios. The procedures used for collecting the structure inventory, the use of depreciated replacement value for structures, and the use of standardized depth-damage functions that were developed from empirical studies and post-flood evaluations to calculate floodplain damages, constitute sound methodology, and are in compliance with the Principles and Guidelines.

Issue: The dollar damages calculated in the report, especially for the 1-year and 5-year events are not economically rational, given the income of the community.
When the correct economic methodology is applied and the resulting dollar damages are disproportionately high, especially for frequent events, the damages should be

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[1]Source: US Dept of Commerce- BEA figures for 2000.

compared with the income of the community and/or verified using damage information about past flooding events. Adjustments may be necessary[2] to the depth-damage functions to reflect the actual behavior and expenses of property owners in a community experiencing frequent flood losses. The frequency analysis may also need to be reexamined to determine if the water elevations generated at the 1-year are correct or if these elevations are more representative of a range between the 1-year and 5-year event.

Potential Issue Resolution Options: An adjustment in the damages should be made to bring the damages in line with economic rationality, given the income of the community.

1. Additional verification of damages is needed. Some suggestions about how to improve the reporting of damages in this report are:
   - Phone interviews with a small number of property owners could be conducted to find out what their typical expenses/losses are under frequent flooding scenarios (like the 1-yr or 5-yr high-water event). This information can be used to make adjustments to depth-damage functions.

   - Documentation from FEMA – National Flood Insurance Program (NFIP) Statistics and details from FEMA can be obtained by year to verify frequent losses. These can be requested by phone or on-line resources can be used.[3] This information can be used as a comparison of the damages calculated with the model.

   - Newspaper articles or other official documentation of past flood-related damages may be used to support damages as reported. Information should be obtained for specific events or for specific years.

2. The hydrologic model should be reexamined to determine if the water elevations associated with the most frequent events are accurate.

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[2] When average damages per structure seem to be very high in relation to the income level in a community, the problem may be that the economic depth damage relationships applied to the structural floodplain inventory are not reflecting the damages that are actually incurred. For example, many people in flood prone communities take measures like moving contents to elevated floors to avoid damage, hose down first floors and basements, post-flood, and do a variety of minor repairs on their own after each flood to make their house or business viable again. These measures result in incurred damages that are lower than damages that would be calculated using a curve from past studies that relates water elevation to a percentage of overall content and structure value.

[3] Using info from the NFIP website http://www.fema.gov/nfip/10400209.htm the following information about Logan was obtained: The County **of Logan** reported a total 1,197 settled claims valued at approximately $12,285,000 from 1978 through 2002 and for the same period the **City of Logan** reported a total of 32 settled claims valued at approximately $97,500.

Island Creek
Logan WV

Total residential	174	**Value per Residential Stucture**	**50% content value**	**Total value per Residential structure**
Total non-residential	102	**$18,000**	**$9,000**	**$27,000**
Total Structures Flooded	276			
Total AAD	$6,866,960			
EAD per structure	$24,880.29			

	Number of structures			Damages					
Floodplain by year	Residential	Non-Residential		Residential	Damage Per Structure (Residential)	Non-Residential	Damage Per Structure (Non-Residential)	Total Damages at Stage	Damage Per Structure (total)
1-Yr	46	61	107	501866	***$10,910***	$1,403,699	***$23,011***	$1,906,000	***$17,813***
5-Yr	?		?	2119517		$7,633,821			
20-Yr	162	90	252	2973809	***$18,357***	$12,094,323	***$134,381***	$9,753,000	***$60,204***
50-Yr	167	95	262	3305566	***$19,794***	$14,691,730	***$154,650***	$15,068,000	***$90,228***
100-Yr	171	99	270	3529946	***$20,643***	$16,528,448	***$166,954***	$17,997,000	***$105,246***
500-Yr	174	102	276	3886609	***$22,337***	$21,293,683	***$208,762***	$25,180,000	***$144,713***

ATTACHMENT # 3

RAINS KILL 1, FORCE EVACUATIONS SEVERAL RESIDENTS MISSING AFTER RIVER, CREEKS

Publication: CHARLESTON DAILY MAIL
Published: 05/16/1996
Page: P1A
Headline: RAINS KILL 1, **FORCE EVACUATIONS** SEVERAL RESIDENTS MISSING AFTER RIVER, CREEKS
Byline: MARGIE MASON JONATHAN PRICE

OVERFLOW BANKS

DAILY MAIL STAFF

Heavy rains caused creeks, streams and the Guyandotte River to jump their banks in Logan County, killing at least one person and forcing the evacuation of hundreds of residents.

Several other residents were missing today after the extensive flooding occurred overnight, said Logan Police Chief Timothy Wiley.

Patricia Daugherty, 56, of Whitman, Logan County, was swept away and killed by flood waters after she tried to leave her home near Whitman Creek, an emergency official told The Associated Press.

"She was trying to get out of her house to higher ground. Evidently, the water took her legs out from under her and washed her away,' said Roger Bryant, deputy director of the county's emergency services office.

A hospital worker said she was waiting with a packed suitcase for emergency workers to get her out.

Bryant said another man from Bruno, Logan County, was missing.

"We've got people watching the water. As soon as it goes down enough, we'll get people in there to check,' Bryant said.

Chief Wiley said the Guyandotte River starting rising around midnight, and by 3 a.m. **evacuations** were under way. Currently, the only path in and out of town is U.S. 119 or Corridor G.

"It hasn't flooded like this in 20 years," he said. "The rains came so fast."

Wiley said the hardest hit areas are right on the edge of town. Omar, Whitman, Stollings and McConnell were a few areas heavily damaged by the raging waters.

Officials from the National Weather Service in Charleston expect more scattered thunderstorms in the upcoming days, but they do not predict anymore heavy flooding. The weather service's flood watch expired at noon today.

"There's a possibility of thunderstorms, but it most likely won't affect the river basin. It will only affect the small streams, and we'll keep an eye on the situation," said meteorologist Ken Batty.

"Southern West Virginia was giving up the cold (temperatures), but it wasn't giving up easily, and as a result it caused 2 to 3 inches of water to fall. It wasn't giving up its territory easily."

Batty said the water is expected to crest at 41 to 42 feet in Kermit this evening, but the flood walls are equipped to handle about 44 feet. Williamson and Matewan also can expect the Tug Fork river to rise, but Batty said no major flooding is predicted there.

Meanwhile, officials at the American Red Cross in Charleston said five shelters were opened in Logan County at the following locations: Verdunville and Holden elementary schools, the Salvation Army Church, the Man Church of God and the Island Creek Fire Department.

One evacuee staying at the Salvation Army, a construction worker at Chief Logan State Park, recalled the destruction as he fled the hotel where he was staying.

"The river is right next to the hotel, and you could see that it was rising quickly," said Bob Yuill, an employee with Steam Operations Corp. of Birmingham, Ala. "The ones that came later (to the shelter) said the hotel parking lot was under water. It was only 30 to 40 minutes later."

Yuill said as he left in his truck, he saw a burning house that rescuers were unable to reach, and he heard about a pregnant woman in labor, trapped by the water. Rescuers did eventually reach and transport the woman to Logan General Hospital. From there, a ground crew moved her to Cabell-Huntington Hospital for delivery.

Officials at Logan General said they've treated several flood victims experiencing chest pains and anxiety, but no seriously injured patients have arrived.

Many hospital employees were forced to work double shifts, because co-workers were unable to make it in. A nurse said at the flood's height, the water lacked about two feet of spewing into the main boulevard.

"The hospital sits on stilts in the river," said Yolanda Kubow, registered nurse. "It's receding a little bit, but we've had a lot of (workers) that can't get here. Travel is very limited in this area."

Hospital employees weren't the only ones having trouble maneuvering through the high waters. Rescue workers also were experiencing problems.

"We haven't been able to get into most of the areas that were affected," said Deputy Emergency Services Director Bryant.

Bryant said **rain** that fell for hours Wednesday evening intensified overnight, causing streams to quickly overflow. By 11 p.m. Thursday, he said, residents had begun to report local creeks overflowing their banks. The emergency services office was in operation by 1 a.m. today.

He said about 400 homes had been evacuated by early this morning, and that water from the Guyandotte River was already creeping up the parking lot toward the emergency services center in Logan.

Bryant said that if the river crests above its expected level of 28 to 29 feet, the office also will have to be evacuated. He said the river was at 25 feet, 2 feet above flood stage, about 7:30 a.m. today.

Although local National Guard personnel are trying to assist the county's efforts to discover the full extent of the flood's damage, Bryant said the armory at Monaville was completely blocked by water early today.

"Hopefully, they'll be able to get in there sometime this morning," he said.

A spokesman for Logan's state police detachment said all 17 troopers that work from that location would likely be called out today.

The Logan County areas currently affected by the flooding are: Bruno, Whitman, Holden, Mount Gay, Whites Addition, Monitor, Monaville and various locations along Island Creek.

Flood waters wreaked havoc through several other southern counties. A few **evacuations** were reported in Raleigh County, and flooding also was reported in Boone County.

In Mingo County, access to the town of Williamson was blocked this morning. Trooper J.J. Miller of the state police detachment there said he hoped the roads would reopen by morning.

Miller said city officials were preparing to close floodgates there, which could endanger Williamson's water supply since the town's water plant is located outside the flood wall.

Still, he said other utilities had not been affected this afternoon, and he said no injuries had been reported.

"I think the fact that it's coming up during the day means people saw it coming," he said.

Reporter Martha Jackson also contributed to this story.

CAPERTON TOURS FLOOD-DAMAGED AREAS

Publication: THE CHARLESTON GAZETTE
Published: 05/18/1996
Page: 01A
Headline: **CAPERTON TOURS FLOOD**-DAMAGED AREAS
Byline: JACK MCCARTHY

The sun shone clear and beautiful as two Huey helicopters topped Rich Mountain in Randolph County Friday. But on the other side, Tygart Valley lay engulfed in water as far as the eye could see.

For the second time this year, **flood** waters rising across West Virginia - from Elkins to Marlinton in the North to Logan and Williamson in the South - drove thousands of people from their homes.

Gov. Gaston **Caperton** and other officials toured some of the damaged areas in the helicopters Friday, as federal officials weighed how much aid to send to the state.

Two people were reported dead in Randolph County as more than three inches of rain fell.

Caperton added seven northern counties to the eight southern counties already declared in need of emergency assistance. Randolph, Barbour, Tucker, Lewis, Upshur, Pendleton, Pocahontas counties joined an emergency list that already includes Logan, Mingo, McDowell, Mercer, Boone, Wyoming, Wayne and Lincoln counties.

West Virginia National Guard units mobilized, along with some units from Kentucky.

Caperton said he would ask the Legislature for funds to pay for the cleanup. The Legislature will conduct interim meetings next week.

"You get a real sense of disaster here," **Caperton** said as he toured flooded sections of Elkins. "This is as bad as I've seen anywhere. The people here are devastated. We'll need help from the Legislature."

Residents were quickly removing personal belongings from their homes as the Tygart River peaked Friday afternoon. Steve Woody loaded concrete blocks onto a rowboat so a family member could use them to raise the furniture in his water-covered living room.

"In the January **flood**, the water didn't get this far," Woody said. "There's nothing you can do about it, but start cleaning it up."

Betty Booth sobbed when **Caperton** offered his condolences, saying her home was also damaged in January. "There are things that just can't be replaced," she said. "I need to be strong, but twice in one year is just too much."

The Tygart River remained above **flood** stage, although it began falling Friday evening, said Eddie Whitehead, a National Weather Service forecaster. Philippi crested at 27.6 feet, the highest level since 1985. A **flood** warning was lifted at 6 p.m. for Marlinton and Buckeye.

At a command center at the Elkins-Randolph County Airport, county Emergency Services Director Russ Doerr briefed the governor and State Public Safety Secretary Joe Skaff. He said 200 people were evacuated from Parsons.

Water was in the streets of Philippi and Marlinton Friday, and about

100 homes in Belinton were evacuated.

In Cassidy, Roxanne Robinson, about 85, and her daughter, Rosalie Smith, in her 50s, drowned near their home. "We had 17 people on a roof," he said. "We couldn't get help to them. When we finally got to the area, two were dead.

"I don't have any idea how many homes were damaged," Roerr said. "We haven't been able to get out and do an accounting."

"These guys will help you in any way they can," **Caperton** said, gesturing to National Guard officers, "The Department of Highways will help in any way they can. Let's go at it quick and fast. My experience is the longer it sits there, the harder it is to deal with."

The Greenbrier River crested at five feet above **flood** level at 2 p.m. Friday. Mayor Doug Dunbreck said about 250 residents were evacuated starting at 3 a.m. Friday. The business district was hardest hit, with about six inches of water on Eighth Street.

"People were more responsive about the **flood** alert this time," he said, referring to the January **flood** that devastated the town.

The National Guard was sending a detachment Friday evening.

Dunbreck said the **flood** caused considerably less damage. The newly rebuilt water and sewer systems were still working.

Earlier Friday, **Caperton** visited Logan, where torrential rains that fell Thursday devastated several outlying sections of the city.

From the air, traffic could be seen backed up along mud-soaked roads leading into and out of the city. About 2,000 homes were damaged, said National Guard Lt. Col. Bill Raney.

In the neighborhood of Whites Addition along Island Creek, residents put out their soaked furniture to dry in the their yards. Mud had replaced streets and grass.

"I didn't believe it when I saw it," said Jeanetta Walker, standing on her front porch. "The creek was up all day yesterday and it just reached the living room."

"I'm so sorry," **Caperton** said.

Verna McCallister, a special education teacher at Logan High School, said, "I saved my computer. Somebody will give me a bed."

Caperton talked with Delegate Tom Rose Tomblin, D-Logan, who was sweeping out mud from his Dairy Delight store.

"You got hit hard, didn't you?" **Caperton** said.

"We'll need some small business loans, at low interest," Tomblin said.

Ron Van, the state liaison officer for the Federal Emergency

Management Agency, said he will evaluate the damage this weekend, then make a recommendation for federal aid.

Staff writer Linda Blackford contributed to this report.

SOUTHERN COUNTIES DEEP IN TROUBLE

Publication: THE CHARLESTON GAZETTE
Published: 05/17/1996
Page: P1A
Headline: **SOUTHERN COUNTIES DEEP** IN TROUBLE
Byline: RICK STEELHAMMER

YUMA - By the light of a used car dealership that exploded and caught fire next door to his home, David Neace spent the predawn hours Thursday watching cars, trees and major appliances float down W.Va. 44 toward nearby Logan and the Guyandotte River.

"It was like a dream," he said, as he took a break from clearing debris from his driveway Thursday afternoon. "The fire department couldn't get up here to put out the fire. The power was off, but the fire let you see all the cars and coolers that were floating by.

"It didn't seem real. In what seemed like just a few minutes, the road became a river. When you read about a flash flood, you think you have a few hours to get ready. I found out it doesn't work that way."

Neace was one of thousands of **Southern** West Virginians taken by surprise by the speed and fury of Thursday morning's flash **flooding**.

Two to four inches of rain fell on the already saturated hills and hollows of **Southern** West Virginia by midnight Wednesday, turning normally placid streams like Main Island **Creek**, which flows behind Neace's home, into raging rivers.

Across the ridge to the north of Neace's home, a torrent that swept down Whitman **Creek** claimed the life of 56-year-old Patricia Daugherty. She had packed a bag and was waiting to be evacuated, but apparently grew impatient and waded into the floodwaters, where she drowned.

To the south, at the Guyandotte River community of Bruno near the Mingo County line, emergency workers were trying to find a man who was missing and feared to be another victim of the **flooding**. He turned up unharmed Thursday afternoon.

The **flooding** prompted Gov. Gaston Caperton to declare a state of emergency for eight **counties**, allowing for the call-out of National Guard personnel, and allowing utility companies to let their employees work extra hours.

Counties included in the emergency declaration are Logan, Mingo, McDowell, Mercer, Boone, Wyoming, Wayne and Lincoln.

The National Guard dispatched 26 soldiers and 10 vehicles, mostly all-terrain Humvees, into Logan, McDowell and Mercer **counties** to help reach people trapped by high water and mudslides.

OASA(CW) November 25, 2002
Response: January 9, 2003

MEMORANDUM OF REVIEW

SUBJECT: Island Creek, Logan, WV

1. Project Description. The executive summary reports that length of project is 3,600 feet; report page 30 says the project is 4,500 feet long; August 8, 2002, CECW-PC project review states that the project length is 3,700 feet; while, the CELRH-PM-PD review memorandum says the length is 4,500 feet. Please advise on the total length of the channel modification, length of concrete channel, and location of the tributary sand bar to be removed.

The total length of channel modification is 3,700 feet. Upstream of the channel modification, there is a sandbar to be removed on mainstem Island Creek between 4,200 and 4,450 feet from the mouth. There is no concrete channel. The total project area begins at the mouth of Island Creek and continues 4,500 feet upstream.

Deleted: and the sandbar to be removed is located on mainstem Island Creek between 4,200 and 4,450 feet from the mouth.

2. Lands and Damages Costs. Lands and damage for the 80-feet plan cost about $2,310,000 less than the narrower 60-feet channel plan. The 80-feet plan requires the purchase and demolition of 4 fewer structures than the 60-feet channel. Need to understand the difference in the lands and damages cost estimates for the 60-, 80- and 100-foot-wide channel plans.

Although the 80-foot channel plan is wider than the 60-foot channel plan, it requires the purchase of fewer structures because the 60-foot plan included an upstream extension (beyond the upper limit of the 80-foot plan) that continued the channel modification to the mouth of Copperas Mine Fork. The total length of the 60-foot channel plan would be approximately 3,900 feet. Therefore the 60-foot plan required the purchase of additional structures and land to maintain the channel width.

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3. National Economic Development (NED) Plan. Based on our review of the reported differences in cost, benefits, and environmental effects between the 80- and 100-foot-wide channel plans, and in accordance with Army Corps of Engineers policy, concur that the 80-foot wide channel plan is the NED plan.

No response required.

4. Deferral of Nonstructural Measures. The report notes that due to a substantial increase in cost, some of the nonstructural elements of the authorized project are probably no longer economically justified, that the non-Federal cost share of the nonstructural portion of the project is beyond the fiscal means of the local sponsor, and that the sponsor does not want to sponsor that project element at this time. (GRR, page 5). Due to these reasons, these nonstructural elements are being deferred.

a. Please provide additional information on scope and results of the reanalysis. Need to assess the probability that the nonstructural measures might be economically justified.

OASA(CW)
SUBJECT: Island Creek, Logan, WV

A formal analysis was not performed. Based on the District's extensive experience in implementing nonstructural projects subsequent to the original Island Creek analysis, we applied our historic average cost per structure to the number of eligible structures in the Island Creek basin to yield an estimate that indicated that the nonstructural element was potentially infeasible. However, nonstructural methods of flood control are continuing to be studied and refined by the Huntington District and the National Floodproofing Committee. Although current nonstructural methodologies are infeasible, feasible methods may be developed in the future. It would not be prudent to deauthorize this project component. The sponsor is still interested in this project component, it is just unaffordable at this time. With the concurrence of the Division office, further reevaluation of the nonstructural component was deferred until a willing and capable non-federal sponsor is identified.

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b. Please provide information on whether the reanalysis of the justification of the nonstructural elements followed the legislative direction in Section 219 of WRDA 1999, regarding the calculation of flood nonstructural damages and benefits.

The informal analysis documented above occurred in 1991 prior to the WRDA legislation referenced. It has not been updated since 1991.

c. If the most recent analysis shows that some of the nonstructural measures are not economically justified, and the costs are beyond the ability of the sponsor to support them even if there were justified, why is the Corps recommending deferral? It would seem more appropriate for Army to modify the recommendations of the Corps and recommend deauthorization of those features of the authorized project. This would help reduce the project backlog.

It is the District's position not to recommend deauthorization at this time. While current nonstructural solutions may not be economically justified, there continue to be refinements and innovations in nonstructural methods that reduce the per structure costs. There may be a time in the future that the sponsor's intent and capability would change to allow them to participate in the program and a re-evaluation of the nonstructural element of the project could be justified.

5. Flood Damages and Benefits. It does not appear that economic questions raised in the July 9, 2002, Policy Compliance Documentation are resolved. There is still a significant lack of adequate support for the without-project condition flood damages, and as a consequence, project benefits and economic justification come into question. Average annual damages are estimated at $6,866,000, with single event flood damages of $1.9 million from the 1-year event, $9.8 million (5-year), $15.1 million (20-year), $17.9 million (50-year), $20.1 million (100-year), and $25.2 million (500-year).

OASA(CW)
SUBJECT: Island Creek, Logan, WV

Based on these assumed flood damages, a very large portion of average annual damages and benefits are assumed to result from very frequent flooding. About 60% of the total annual flood damages occur as the result of events equal to more frequent than the 5-year event. Need strong documentation to support such frequent flooding and significant repeated damages. However, neither the main report nor the Economic Appendix present much information on Island Creek flooding and damages to understand what is damaged and how such frequent flood damages can be afforded in the community.

The Economic Appendix reports that there are a total of 276 structures in the 500-year floodplain (174 residential and 102 are non-residential structures). The 174 residential structures are said to have an average value of $18,000, which would result in the total value of all residential structures of about $3,132,000. Content damages are assumed to be 50 percent of structural value, so the total structural and content damages to all residential structures would total about $4.7 million. Damages to 107 structures by the 1-year flood event average about $17,800, which is slightly greater than the $17,291 per capita income in Logan County. It is very possible that the average annual damages for the 1-year event ($17, 291) – which is an average annual value – is almost as expensive as the value of the residential property ($18,000). For all the properties in the 500-year flood plain (276), the average annual damages are about $24,900. Again, very high annual flood damage per structure.

In light of the demographics of the area, and the low value of residential structures, the data provided does not support the position that residences and businesses in the town of Logan would have sufficient disposable income to repair and/or replace such property so frequently. Now it may be that the extensive damages are to non-residential structures. However, the Economic Appendix does not present any information on the non-residential structures and damages to review. To complete the review, we will need data on how much of the total flood damages are to residential and non-residential properties.

Below is the requested output directly from HEC-FDA. The table displays the expected annual damage in $1,000s.

Plan Name	Plan Description	Damage Categories: Commercial	Damage Categories: Residential	Total Damage
Without	Without project condition	5387.66	1479.30	6866.96
60 Ft Channel		2112.73	1037.98	3150.70
80 Ft Channel		1852.87	1062.40	2915.27
100 Ft Channel		1654.41	978.15	2632.56

Will need information on the number of both residential and non-residential structures and damages to each, by flood event.

OASA(CW)
SUBJECT: Island Creek, Logan, WV

The four tables that follow show the damages to both residential and non-residential structures.

Existing Condition Damages						
	1-year	5-year	20-year	50-year	100-year	500-year
Residential	$ 501,866	$2,119,517	$ 2,973,809	$ 3,305,566	$ 3,529,946	$ 3,886,609
Non-Residential	$1,403,699	$7,633,821	$12,094,323	$14,691,730	$16,528,448	$21,293,683
Total	$1,905,565	$9,753,339	$15,068,132	$17,997,296	$20,058,393	$25,180,292

60-Foot Damages						
	1-year	5-year	20-year	50-year	100-year	500-year
Residential	$ 335,035	$1,434,469	$ 2,147,051	$ 2,937,464	$ 3,260,358	$ 3,721,898
Non-Residential	$ 352,497	$2,200,151	$ 6,925,194	$11,977,798	$14,329,189	$18,861,060
Total	$ 687,532	$3,634,620	$ 9,072,245	$14,915,262	$17,589,547	$22,582,958

80-Foot Damages						
	1-year	5-year	20-year	50-year	100-year	500-year
Residential	$ 335,035	$1,484,039	$ 2,298,715	$ 2,665,985	$ 3,111,185	$ 3,612,753
Non-Residential	$ 348,208	$2,120,765	$ 5,392,224	$ 8,363,149	$11,394,851	$16,826,678
Total	$ 683,242	$3,604,805	$ 7,690,939	$11,029,135	$14,506,036	$20,439,431

100-Foot Damages						
	1-year	5-year	20-year	50-year	100-year	500-year
Residential	$ 341,207	$1,382,374	$ 1,921,293	$ 2,237,077	$ 2,492,649	$ 3,305,107
Non-Residential	$ 374,923	$1,995,577	$ 4,389,687	$ 6,518,991	$ 8,530,273	$13,997,088
Total	$ 716,130	$3,377,951	$ 6,310,979	$ 8,756,068	$11,022,922	$17,302,195

To illustrate the numbers of structures affected by flooding, a sample table is provided below.

	Existing Conditions				80-Foot Channel			
	# of structures w/ water at or above 1st floor				# of structures w/ water at or above 1st floor			
	1-year	20-year	50-year	100-year	1-year	20-year	50-year	100-year
Residential	46	162	167	171	31	128	146	159
Non-Residential	61	90	95	99	21	66	79	89
Total	107	252	262	270	52	194	225	248

OASA(CW)
SUBJECT: Island Creek, Logan, WV

Based on the small number and value of residential structures in the 500-year floodplain, the lack of information on non-residential structures, and the assumed deep yearly flooding, my starting point would be to (1) obtain support for the value of and damages estimated for both residential and non-residential structures...

The process used to develop and update structure values is documented on page 8 of the Economic Appendix. Based on professional judgment, a review of the values indicates they are reasonable. However, as shown in the Economic Appendix (beginning at the bottom of page 16) since there was not strong documentation of historic frequent flooding, a sensitivity analysis was performed. For this, the 1-year event damages were deleted and the zero damage stage was reset at the 2-year water surface elevation. The results seemed more reasonable and indicated that the 80-Foot Channel was still economically justified and remained the NED plan.

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(2) determine the proportion of total average annual damages that are residential and non-residential structures and what the non-residential structures are...

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based on the output table from HEC-FDA presented above, the proportion of damages are as follows:

Plan	Commercial	Residential
Without	78%	22%
60-Ft Channel	67%	33%
80-Ft Channel	64%	36%
100-Ft Channel	63%	37%

(3) obtain support for the assumption of very frequent flooding and damages, this issue was addressed by the sensitivity analysis outlined above and (4) address how damages and benefits for those properties to be purchased and removed were considered in the analysis there were no benefits calculated for properties to be purchased and removed. Request a meeting with HQUSACE Planning Division, and persons who reviewed the calculations of average annual damages, to discuss what information the Corps reviewed, and, possibly, what other data might be available to complete the OASA(CW) review.

6. The benefit-cost analysis does not appear to include all post authorization costs. Specifically the $2.2 million of post authorization feasibility costs were excluded and considered a sunk cost. While the concept of a "sunk costs" economic analysis is acceptable, we will also have to present economic information, particularly the benefit-cost-ratio, with all post authorization costs included.

The post authorization feasibility costs were removed from the economic evaluation per Headquarter's comments dated 23 October 2001. See Comment #9 along with the District's final response dated 1 February 2002 located under the tab labeled "Legal Certification, ITR (2), HQ Comments/LRH Response" in the March 2002 report.

OASA(CW)
SUBJECT: Island Creek, Logan, WV

7. Interest During Construction (IDC). The IDC may be low, and would like further explanatior of how it was calculated. Page 25 of the Economic Analysis shows the calculation of IDC for the recommended 80-feet channel plan. The total cost is shown for the capital outlay at $18,812,000. However, page of page 16, shows that the capital outlays are $21,522,000, with all post authorization costs included. Page 33 of the main report, indicates that the acquisition of real estate will take 42 months. Like to see how this schedule was accounted for in IDC.

The IDC calculation was computed using the baseline cost estimate for each channel plan. The cost estimate is based on the project schedule and does reflect the 42 months needed for real estate as well as all project component schedules. The cost estimates can be found in the March 2002 report under the "red" tab labeled "ETA-Tab VII Cost Estimate" in Section D. Each year's baseline expenditures were totaled and divided by 4 (quarters). Then the 6 1/8 percent discount rate was applied accordingly. These calculations are shown on pages 24-26 of the Economic Appendix. The difference between $21,522,000 and $18,812,000 reflects the prior year expenditures and the dollars scheduled to be spent during FY 2002 as well as a small difference due to rounding in the cost estimate worksheet.

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
WASHINGTON, D.C. 20314-1000

REPLY TO
ATTENTION OF:

CECW-PM

SEP 17 2002

MEMORANDUM FOR THE ASSISTANT SECRETARY OF THE ARMY (CIVIL WORKS)

SUBJECT: Island Creek Local Protection Project, Logan, West Virginia, General Reevaluation Report (GRR) (May 2001, Revised March 2002)

1. PURPOSE: To transmit the final General Reevaluation Report (GRR) on the subject project for your approval and to seek Office of Management and Budget (OMB) clearance of the project for construction.

2. DISCUSSION:

a. The subject project was authorized by Section 401 of the Water Resources Development Act of 1986 (PL 99-662). The authorized project addresses flooding adjacent to a total of about 19 miles of Island Creek (10.4 miles), Copperas Mine Fork (5.1 miles), and Mud Fork (3.9 miles). The plan includes both structural and non-structural components. The structural component of the plan provides for a channel with a 100-foot wide bottom on Island Creek for a distance of 0.7 miles upstream of its confluence with Guyandotte Creek. The lower 1,000 feet provides for a concrete-lined channel. The project area adjacent to remaining 9.3 miles of Island Creek, and both Copperas Mine Fork and Mud Fork, would be treated with a variety of non-structural measures. Non-structural plans call for raising over 1,200 residential structures, flood proofing about 80 non-residential structures in-place, and relocating over 500 other structures to flood-free housing and community development sites. The project was authorized at a cost of $86 million (October 1984 Prices). The current GRR only addresses the 0.7-mile long authorized structural feature and a basin-wide flood warning system (FWS). Reevaluation of other authorized non-structural features is being deferred to a later date.

b. The enclosed GRR documents the results of the reevaluation of the authorized project features and documents the National Economic Development plan. The GRR recommends the structural component (0.7-mile of channel modification) as a separable element and the FWS as non-structural component. At the request of the local sponsor the evaluation of the other nonstructural components of the authorized project have been deferred.

c. The estimated initial cost of the project is $21,522,000 at October 2001 prices. This amount includes $7,152,000 for land, easements, rights-of-way, relocations, and disposal areas (LERRD) and $227,000 to implement the proposed FWS. Based on a 6.375 percent discount rate and a 50 year period of economic evaluation, equivalent annual benefits are cited as $3,830,000. Equivalent annual costs are estimated as $1,690,000, including $73,000 in

CECW-PM
SUBJECT: Island Creek Local Protection Project, Logan, West Virginia, General Reevaluation Report (GRR) (May 2001, Revised March 2002)

equivalent annual operation, maintenance, repair, replacement and rehabilitation costs. Indicated equivalent annual net benefits are $2,140,000. The resultant benefit-to-costs ratio is 2.3 to 1.

d. The proposed project would reduce expected annual damages by about 59.5 percent within the study area. However, the study area associated with this separable feature is small—encompassing the 500-year floodplain adjacent to Island Creek, from its confluence with the Guyandotte River to a point about 9,000 feet upstream. The project would improve approximately 3,700 feet (0.7 mile) of the stream. Performance statistics indicate that with the improvements in place, the risk of flooding would be 1 chance in 11 in any year. There would be a 62 percent chance that the project would contain a flood with a 10 percent chance of occurring in any year (10-year event). Similarly, there would be a 0.3 percent chance that the stream improvement would contain the 100-year event. The GRR contains a letter from the non-Federal sponsor acknowledging the "level of flood protection" that would be provided by the proposed improvements.

e. The Policy Compliance Documentation Memorandum and an Addendum to the GRR revised report (July 2002) is in compliance with current policy.

3. RECOMMENDATION: That the enclosed GRR with Addendum be transmitted to OMB to obtain Admininstration clearance and allow the Corps to budget for construction of the project.

FOR THE COMMANDER:

Thomas F. Caver, Jr.

THOMAS F. CAVER, JR., P.E.
Deputy Director of Civil Works

4 Encls
1. GRR (March 2002)
2. Addendum to GRR (July 2002)
3. Policy Compliance Documentation
4. Proposed Draft Letter to OMB

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

REPLY TO
ATTENTION OF

Honorable Mitchell E. Daniels, Jr.
Director
Office of Management and Budget
Washington, D.C. 20503

Dear Mr. Daniels:

In accordance with Executive Order 12322, I am submitting for your review a draft letter to the President of the Senate. A similar letter will be provided to the Speaker of the House of Representatives. The letter expresses the views and recommendations of the Secretary of the Army on whether to support construction of the Island Creek Local Protection Project, Logan, West Virginia.

The project for flood control was authorized by Section 401 of the Water Resources Development Act (WRDA) of 1986, at an estimated total cost of $86 million. The authorized project includes a 0.7-mile long structural component and non-structural features within the 500-year floodplain adjacent to about 9.3 miles of Island Creek, 5.1 miles of Copperas Mine Fork, and 3.9 miles of Mud Fork. However, the current General Reevaluation Report (GRR) only addresses the 0.7-mile mile long authorized structural feature and a basin-wide flood warning system. Reevaluation of other authorized non-structural features is being deferred to a later date.

The proposal is described in the GRR dated March 2002 (revised July 2002). A copy of the report and other supporting data are enclosed. Please advise this office whether the recommendation contained within the GRR are consistent with Administration policy.

Sincerely,

Dominic Izzo
Principal Deputy Assistant Secretary of the Army
(Civil Works)

4 Enclosures

We plan to implement the project through the normal budget process. The Office of Management and Budget advises that there is no objection to the submission of the reports to Congress.

Sincerely,

Dominic Izzo
Principal Deputy Assistant Secretary of the Army
(Civil Works)

Enclosure

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

REPLY TO
ATTENTION OF

DRAFT

Honorable J. Dennis Hastert
Speaker of the House
of Representatives
Washington, D.C. 20515

Dear Mr. Speaker:

In response to Section 401 of the Water Resources Development Act (WRDA) 1986, this is my report on Island Creek Local Protection Project, Logan, West Virginia. Section 401 of WRDA 1986 authorized the flood control project, at an estimated total cost of $86,000,000, in accordance with the Report of the Chief of Engineers, dated April 25, 1986.

The authorized project includes a 0.7-mile long structural component and non-structural features within the 500-year floodplain adjacent to about 9.3 miles of Island Creek, 5.1 miles of Copperas Mine Fork, and 3.9 miles of Mud Fork. However, the current General Reevaluation Report (GRR) only addresses the 0.7-mile long authorized structural feature and a basin-wide flood warning system. Reevaluation of other authorized non-structural features is being deferred to a later date.

The proposed project would improve approximately 3,700 feet (0.7-mile) of the stream. There would be a 62 percent chance that the project would contain a flood with a 10 percent chance of occurring in any year (10-year event). Similarly, there would be a 0.3 percent chance that the stream improvement would contain the 100-year event. The GRR contains a letter from the non-Federal sponsor acknowledging the "level of flood protection" that would be provided by the proposed improvements.

The estimated initial cost of the project is $21,522,000 at October 2001 prices. This amount includes $7,152,000 for land, easements, rights-of-way, relocations, and disposal areas and $227,000 to implement the proposed flood warning system. Based on a 6.375 percent discount rate and a 50-year period of economic evaluation, equivalent annual benefits are cited as $3,830,000. Equivalent annual costs are estimated as $1,690,000, including $73,000 in equivalent annual operation, maintenance, repair, replacement, and rehabilitation costs. Indicated equivalent annual net benefits are $2,140,000. The resultant benefit-to-costs ratio is 2.3 to 1.

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

REPLY TO
ATTENTION OF

DRAFT

Honorable Richard B. Cheney
President of the Senate
Washington, D.C. 20510

Dear Mr. President:

In response to Section 401 of the Water Resources Development Act (WRDA) 1986, this is my report on Island Creek Local Protection Project, Logan, West Virginia. Section 401 of WRDA 1986 authorized the flood control project, at an estimated total cost of $86,000,000, in accordance with the Report of the Chief of Engineers, dated April 25, 1986.

The authorized project includes a 0.7-mile long structural component and non-structural features within the 500-year floodplain adjacent to about 9.3 miles of Island Creek, 5.1 miles of Copperas Mine Fork, and 3.9 miles of Mud Fork. However, the current General Reevaluation Report (GRR) only addresses the 0.7-mile long authorized structural feature and a basin-wide flood warning system. Reevaluation of other authorized non-structural features is being deferred to a later date.

The proposed project would improve approximately 3,700 feet (0.7-mile) of the stream. There would be a 62 percent chance that the project would contain a flood with a 10 percent chance of occurring in any year (10-year event). Similarly, there would be a 0.3 percent chance that the stream improvement would contain the 100-year event. The GRR contains a letter from the non-Federal sponsor acknowledging the "level of flood protection" that would be provided by the proposed improvements.

The estimated initial cost of the project is $21,522,000 at October 2001 prices. This amount includes $7,152,000 for land, easements, rights-of-way, relocations, and disposal areas and $227,000 to implement the proposed flood warning system. Based on a 6.375 percent discount rate and a 50-year period of economic evaluation, equivalent annual benefits are cited as $3,830,000. Equivalent annual costs are estimated as $1,690,000, including $73,000 in equivalent annual operation, maintenance, repair, replacement, and rehabilitation costs. Indicated equivalent annual net benefits are $2,140,000. The resultant benefit-to-costs ratio is 2.3 to 1.

We plan to implement the project through the normal budget process. The Office of Management and Budget advises that there is no objection to the submission of the reports to Congress.

Sincerely,

Dominic Izzo
Principal Deputy Assistant Secretary of the Army
(Civil Works)

Enclosure

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

REPLY TO ATTENTION OF:

DAEN-CWP-A

April 25, 1986

SUBJECT: Island Creek Basin, West Virginia

THE SECRETARY OF THE ARMY

1. I submit for transmission to Congress my report for flood control in the Island Creek Basin, West Virginia. It is accompanied by the reports of the Board of Engineers for Rivers and Harbors and the District and Division Engineers. These reports are in response to a resolution adopted on 2 June 1976 by the Committee on Public Works of the United States Senate. The Committee requested the Board of Engineers for Rivers and Harbors to review the report of the Chief of Engineers on the Ohio River published as House Document No. 306, 74th Congress, and other pertinent reports, to determine the advisability of providing flood protection for the Island Creek area of Logan County and the City of Mullens in Wyoming County.

2. The District and Division Engineers recommend authorization of a flood protection project which includes both structural and nonstructural measures. The first 3,700 feet of Island Creek would be structurally modified by widening the stream channel. The remainder of the project area would be treated non-structurally. Buildings in the floodway would be removed and those in the fringe of the floodplain would be either raised or floodproofed. Provision of a housing program would also be included to accommodate those who would have to be relocated. Day use recreation facilities would also be developed as part of the proposed plan. First cost of the recommended plan, based on October 1985 price levels, is $86,030,000. Average annual charges, based on an 8-5/8 percent interest rate and a 50-year period for economic analysis, are $4,580,000. Average annual benefits are $7,463,000 and the benefit-cost ratio is 1.6.

3. The Board of Engineers for Rivers and Harbors concurs in the recommendation of the reporting officers. The Board notes that the recommended plan deviates from the plan which maximizes net National Economic Development (NED) benefits. However, based on the rationale provided by the reporting officers, the Board believes that the recommended plan is appropriate. The Board recommends the plan with such modifications as in the discretion of the Chief of Engineers may be advisable, and subject to cost sharing and financing arrangements satisfactory to the President and the Congress.

DAEN-CWP-A
SUBJECT: Island Creek Basin, West Virginia

4. I note that the Mud Fork increment of the plan maximizes net NED benefits at a 20-year frequency as compared to the 100-year frequency level of protection for the remaining reaches. However, the additional cost to provide 100-year protection for Mud Fork is estimated at only $1.8 million or approximately two percent of the total project cost, and the benefit-cost ratio for the overall Mud Fork increment is greater than unity. Implementation of the NED plan would leave significant numbers (34 percent) of residents along Mud Fork within the post-project 100-year floodplain. Provision of equal protection to all residents of the Island Creek Basin has the potential to reduce further net subsidized reimbursements for flood losses and has local acceptance. Accordingly, I concur in the findings, conclusions and recommendations of the Board.

5. The recommendations contained herein reflect 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. Accordingly, I acknowledge that the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and/or implementation funding.

E. R. HEIBERG III
Lieutenant General, USA
Chief of Engineers

DEPARTMENT OF THE ARMY
BOARD OF ENGINEERS FOR RIVERS AND HARBORS
KINGMAN BUILDING
FORT BELVOIR, VIRGINIA 22060

REPLY TO
ATTENTION OF:

BERH-PLN

23 JUL 1985

SUBJECT: Island Creek Basin, West Virginia

Chief of Engineers
Department of the Army
Washington, DC 20314-1000

Summary of Board Action

The Board believes that flood protection improvements in the Island Creek Basin, West Virginia, are economically feasible and warranted in the interest of national and regional economic development and social well-being. The reporting officers' recommended plan consists of both structural and nonstructural measures. The lower 0.7 mile of Island Creek would be structurally modified by widening the stream channel. The remainder of the project area would be treated nonstructurally. Buildings in the floodway would be removed and those in the fringe of the floodplain would be either raised or floodproofed. Project construction cost is estimated at $86,030,000, of which $19,572,000 would be non-Federal based on traditional cost-sharing policies. The benefit-cost ratio would be 1.7. The Board recommends the plan subject to cost-sharing and financing arrangements satisfactory to the President and the Congress.

1. Authority. This report is in response to a resolution adopted on 2 June 1976 by the Committee on Public Works of the United States Senate. The committee requested the Board of Engineers for Rivers and Harbors to review the report on the Ohio River with particular reference to providing flood protection for the Island Creek area of Logan County and the city of Mullens in Wyoming County. The resolution is quoted in the District Engineer's report.

2. Description of study area. The study area is within the Island Creek subbasin of the Guyandotte River basin. Three major streams in the subbasin are Island Creek, Copperas Mine Fork, and Mud Fork. The subbasin drains about 105 square miles of rugged, mountainous terrain, with narrow, deep-cut sinuous valleys. Rugged terrain has severely hampered economic growth and development of Logan County. Approximately 90 percent of the area has slopes greater than 25 percent which is generally too steep for extensive development. Nearly all developable land in the county is being used. Forests cover approximately 90 percent of the

study area, and the majority of woodland consists of relatively low value hardwoods. Extensive deposits of high grade coal have fostered the development of a large mining industry.

3. Wildlife habitat is good in most areas of the basin except where impacted by mining operations; however, wildlife populations are limited due to illegal hunting, free-roaming dogs, and wildfires. Water quality throughout the basin is usually only poor to fair. The major receiving stream, Island Creek, is badly degraded because of acid mine drainage, sedimentation from surface mining and logging activities, and untreated domestic sewage. Trash and litter are regularly discarded along stream banks.

4. Economic development. Bituminous coal is by far the most important natural resource within the Island Creek Basin and creates much of the region's economic base. Wide fluctuations of population in Logan County and the region over the last 50 years can be attributed to the economic condition of the coal industry. Logan, an incorporated city and the largest community in the middle and upper Guyandotte Basin, is known as the center of the Logan Coalfield. The population of Logan reached its peak in 1950 when 5,166 persons lived there. Since then the population has declined to 3,029 in 1980. The population of the study area was estimated to be about 12,186 in 1978, which was about 24 percent of the total county population. Logan County population increased from 46,269 in 1970 to 50,511 in 1980.

5. Existing and authorized improvements. R.D. Bailey Lake, a multipurpose reservoir on the Guyandotte River approximately 35 miles south of Logan, was completed by the U.S. Army Corps of Engineers in 1980.

6. Problems and needs. Flooding along Island Creek and its tributaries is a continuing problem. The maximum flood of record occurred in March 1963 during which time residences, commercial-industrial establishments, and other properties were flooded to depths up to 15 feet. Other major floods occurred in 1957, 1967, 1974, and 1977. A recurrence of the 1977 flood, which had an estimated average return frequency of 100-years, would cause damages to 1,626 residential structures and 240 nonresidential buildings. The total damages would be about $57.5 million. Average annual damages estimated for the study area are $11.8 million.

7. Improvements desired. Study area residents have expressed a desire for improvements in several water resources categories; however, the main emphasis was placed on the need for flood reduction measures.

BERH-PLN
SUBJECT: Island Creek Basin, West Virginia

8. Alternatives considered. Structural measures considered as potential solutions to the flooding problems included floodwalls and levees, reservoirs, channel modifications, and diversions. Nonstructural measures included floodplain evacuation, zoning, raising structures in place, and structural floodproofing. Evaluation of the various measures indicated that the most efficient way to achieve flood damage reduction would be by a combination of channel modification and nonstructural measures. The following major alternatives were included in the final array of plans considered.

a. Alternative A is the no-action option. No additional Federal involvement in the study area would be planned. This is the condition expected to exist in the absence of any project, and provides a basis for comparison of proposed action alternatives.

b. Alternative B is a nonstructural approach. This plan would require complete evacuation of a designated floodway along the watercourse. Residential structures in the fringe area adjacent to the floodway would be raised-in-place above the 100-year-frequency flood level. Nonresidential structures would either be raised or floodproofed as applicable.

c. Alternative C is a combination of structural and nonstructural measures. Approximately 10 miles of channel would be structurally modified to permit more efficient passage of floodflows. Channel improvements would be supplemented by nonstructural measures similar to those described for alternative B.

d. Alternative E is also a combination of structural and nonstructural flood damage reduction measures. However, the structural component of this plan would consist of only 0.7 mile of channel modification near the mouth of Island Creek. Nonstructural measures described for alternative B would be implemented throughout the remainder of the study area.

9. Plan of improvement. The plan recommended by the District Engineer, plan E, would provide protection from floods having an average return frequency of once in 100-years along Island Creek, Copperas Mine Fork, and Mud Fork. Elements of the proposed project are as follows:

a. Structural. Approximately 3,700 feet of stream channel along Island Creek from its mouth to the confluence of Copperas Mine Fork would be straightened and widened. The modified channel would have a bottom width of 100 feet and the initial 1,000 feet would be concrete-lined. Where practicable, widening would be accomplished only on one side of the stream, and natural channel bottoms would be disturbed only as necessary.

b. Nonstructural. To improve flow conditions, a floodway would be created along the stream channel by the removal of all structures and restriction of future land use. Residential structures in the fringe area adjacent to the floodway would be raised above the 100-year-frequency flood level and nonresidential structures would either be raised or floodproofed. Implementation of these measures would require relocation of 146 families and 116 nonresidential structures, raising of 1,226 homes, and structural floodproofing of 77 businesses. In addition, 149 mobile homes would have to be relocated.

c. Recreation. Day use recreational facilities would be developed as an integral part of the plan. These facilities would include play areas, trails, and tot lots. Eight of these facilities would be located throughout the project area on evacuated floodplain land.

10. Economic evaluation. Based on October 1984 price levels, the first cost of the recommended plan is estimated at $86,030,000, of which $66,279,000 would be Federal and $19,751,000 would be non-Federal. Average annual charges, reflecting a 50-year period for economic analysis and an interest rate of 8-3/8 percent, are $4,458,000. Average annual benefits are estimated at $7,463,000, and the benefit-cost ratio is 1.7.

11. Project impacts.

a. Environmental quality. Implementation of the recommended plan would have a net positive impact on the environment. While specific components of the project do result in negative environmental impacts, the net result would be a gain in aquatic and terrestrial habitat values. Floodway evacuation would result in significant gains in both terrestrial and aquatic habitat. Floodway rehabilitation would return urban/industrial habitat to an early/old field condition and would provide a greenbelt barrier strip to protect riparian habitat.

b. Regional economic effects. Implementation of the recommended plan would contribute to the regional economic development. Most of the construction would be labor intensive and would provide significant employment opportunities. The extensive work involved in raising and floodproofing existing structures and in building new homes would result in substantial purchases of building materials from local and regional suppliers. The long-term effect of project development would be

BERH-PLN
SUBJECT: Island Creek Basin, West Virginia

positive because funds previously allocated to offset flood damages could be more productively used.

c. Other social effects. Relocation of 146 families is a significant impact. While there would be disruption, the end result would be a great improvement in social well-being for both those who would be relocated and those whose homes would be raised.

12. Recommendation of the reporting officers. The District Engineer recommends authorization of flood protection in the Island Creek Basin in the vicinity of Logan, West Virginia, generally in accordance with the plan described in his report and subject to cost-sharing and financing arrangements satisfactory to the President and the Congress. The Division Engineer concurs.

Review by the Board of Engineers for Rivers and Harbors

13. General. The scope of the Board's review encompassed the overall technical, economic, social, and environmental aspects involved in improvements proposed by the reporting officers. The Board considered the report's conformance with the Water Resources Council's Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies and compliance with other applicable administrative and legislative policies and guidelines. The Board also endeavored to assure that the general public has been afforded adequate opportunity for input and comment.

14. Responses to the Division Engineer's public notice. Six letters were received in response to the Division Engineer's public notice dated 30 March 1984. The letters were from local citizens, a State agency, a United States Senator and Congressman from West Virginia, and the Governor of West Virginia. All were in support of the proposed project.

15. Findings and conclusions. The Board of Engineers for Rivers and Harbors concurs in the findings and recommendations of the reporting officers. The recommended improvements are economically justified, engineeringly feasible, and have net positive environmental impacts. The recommended plan would provide flood protection from the 100-year frequency flood event for residents along Island Creek, Copperas Mine Fork, and Mud Fork. Improvements would reduce financial losses, health hazards, and risk to human life and safety associated with the existing flood problem. The plan is enthusiastically supported by local interests.

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16. The recommended plan was selected from a wide range of structural and nonstructural alternatives. Separable increments of the recommended plan are justified. The Board notes that the Mud Fork increment would realize maximum net benefits at a 20-year-frequency protection level as compared to a 100-year-frequency level of protection for the remaining reaches. However, the reporting officers find that the additional cost to provide 100-year-frequency protection for Mud Fork is estimated at only $1.8 million or approximately 2 percent of the total project cost, and the benefit-cost ratio for the overall Mud Fork increment is greater than unity. Implementation of the national economic development (NED) plan would leave significant numbers (34 percent) of residents along Mud Fork within the post-project 100-year floodplain. Also, provision of equal protection to all residents of the Island Creek Basin would have the potential to further reduce net subsidized reimbursements for flood losses. On this basis, the Board believes that the recommended plan is appropriate.

17. The Administration's policy on water project financing and cost sharing is that all Federal water development agencies will continue to seek out new partnership arrangements with the states and other non-Federal interests in the financing and cost sharing of the proposed projects. Each such agency will negotiate reasonable financing arrangements for every project within its respective area of responsibility. In addition, prior commitments to individual states with regard to water development within their borders will be considered and shall be a factor in negotiations leading up to project construction; and consistency in cost sharing for individual project purposes, with attendant equity, will be sought. Project beneficiaries, not necessarily governmental entities, should ultimately bear a substantial part of the cost of all project development.

18. Recommendation. The Board recommends that flood control and related recreational improvements in the Island Creek Basin, West Virginia, be authorized for Federal implementation generally in accordance with the reporting officers' plan, with such modifications as in the discretion of the Chief of Engineers may be advisable, and subject to cost-sharing and financing arrangements satisfactory to the President and the Congress. This recommendation is made with the provision that, prior to implementation, local interests will, in addition to the general requirements of law for this type of project, agree to comply with the following requirements:

a. Provide without cost to the United States all lands, easements, and rights-of-way required for the project, including borrow, ponding, and disposal areas necessary for implementation of all elements of the structural channel modification;

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b. Hold and save the United States free from damages due to the construction works, not including damages due to the fault or negligence of the United States or its contractors;

c. Maintain and operate the project after completion and participate in operation of a flood warning system, in accordance with regulations prescribed by the Secretary of the Army;

d. Accomplish without cost to the United States all alterations and relocations of buildings, transportation facilities, storm drains, utilities, and other structures and improvements made necessary by the construction of all elements of the structural channel modification;

e. Provide the applicable cost sharing for the project first cost assigned to nonstructural flood damage reduction measures, including cost incurred in compliance with provisions of Public Law 91-646 and amendments thereto, in accordance with section 73 of the Water Resources Development Act of 1974 (Public Law 93-25);

f. Prescribe and enforce regulations or other floodplain management techniques to prevent encroachment on floodplain storage areas, channels, and rights-of-way, necessary for proper functioning of the project;

g. Publicize floodplain information in the areas concerned and provide this information to zoning and other regulatory agencies for their guidance and leadership in preventing unwise future development in the floodplain and in adopting such regulations as may be necessary to ensure compatibility between future development and protection levels provided by the project;

h. Accept transfer of title to any project lands acquired by the Federal government and prohibit any use of such lands which interfere with flood control features of the project;

i. At least annually, inform affected interests regarding the limitations of the protection afforded by the project;

j. Bear at least one-half the first costs of the recreational features of the project; and

k. Operate, maintain, and replace, without cost to the United States, all recreational facilities and assure access to the recreational facilities to all on equal terms.

BERH-PLN
SUBJECT: Island Creek Basin, West Virginia

19. The recommendations contained herein reflect 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/or implementation funding.

FOR THE BOARD:

N. G. DELBRIDGE, JR.
Major General, USA
Chairman

CERTIFICATION OF LEGAL REVIEW

The General Reevaluation Report for the Island Creek Local Protection Project at Logan, West Virginia, March 2002, has been fully reviewed by the Office of Counsel, Huntington District, and is approved as legally sufficient.

Norman R Spero
Norm Spero
District Counsel

3 April 2002 (Date)

CERTIFICATION OF INDEPENDENT TECHNICAL REVIEW
ISLAND CREEK LOCAL PROTECTION PROJECT

The District has completed the General Reevaluation Study of the Island Creek Local Protection Project . Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project, as defined in the Quality Control Plan. During the independent technical review, compliance with established policy principles and procedures; utilizing justified and valid assumptions, was verified. This included review of assumptions; methods; procedures, and material used in analyses; alternatives evaluated; the appropriateness of data used and level of data obtained, and reasonableness of the results; including whether the products meets the customer's needs consistent with law and existing Corps policy. The study was accomplished by a District team and the independent technical review was accomplished by an Independent District Technical Review Team. A listing of the ITR team comments and production team resolutions is attached.

Independent Technical Review Team

Arden Sansom Arden Sansom SPK-PD Economics	4/4/02 Date
Karen V. Miller Karen Miller PD-F Formulation	4-4-02 Date
Jonathan Aya-ay PD-R Environmental	4-4-02 Date
Charles D. Barry Charles Barry EC-DC Civil Design	4/4/02 Date
Russell Craddock Russell Craddock EC-TC Cost Estimates	4-4-02 Date
Ralph Ackerman Ralph Ackerman RE-PP Real Estate	4-4-02 Date
Michael Presley Michael Presley OR-E Operations and Maintenance	4-4-02 Date

Island Creek ₹
"March 20u2·
ITR COMMENTS per A.K. Sansom, Economist

Comment Number	Reviewer	Document/ Page #	Comment	Resolution
1	A K Sansom	Throughout Main Report	Suggest devoting one section to historical information. Confusing as to which study area description and or dollar figures pertain to original authorized project and which pertain to current analysis. Not saying to delete historical story, but make a cleaner differentiation between history and the "project" (alternatives) now being considered.	Concur, text added to provide clarity.
2	A K Sansom	Throughout Main Report and Economics Appendix	Numerous examples where dollar figures do not match between the Main Report and the Economics Appendix pertaining to both Cost calculations and Benefits. Note: Some of these may be the result of the mixing of "authorized" project numbers with "currently under analysis" alternatives. Some fix on comment 1 may spill over to helping resolve this comment.	Concur, text added to provide clarity.
3	A K Sansom	Main Report-p. 8 Econ Appendix – p. 7	Example of comment 1 and 2: main report summary reads, "…occurrence of 100-yr event…would inundate approximately 950 residential structures and 225 commercial structures…"; econ appendix reads, "…500-yr floodplain…includes 174 structures…and 102 non-residential structures…"	Concur, text added to provide clarity.
4	A K Sansom	Main Report-p. 15, Table 1 & 2 on p. 16	Updated damages for the 100-yr event do not match the damages reported for the 100-yr event in the Econ Appendix.	Non-concur, the figures referenced are for two different study areas. Text was added for clarification.

5	A K Sansom	Econ Appendix Without Project Frequency-Damage Table (resulting from H&H data)	This comment is directed both at the study economist, planner(s), and the H&H engineers. The 1-year event shows that there are roughly $2 million worth of damages. First, does this make common sense to the H&H modelers? Is the overbank flooding that deep for the 1-yr event? For the economist, does historical damages support this claim? This figure needs to be verified by some empirical evidence. Over the last, say, 10 years has there been **significant** damages to this area whenever the 1-yr event hit? I think that an HQ Economist/Planner may have serious qualms of accepting this rather large 1-yr damage amount without historical accounts to back it up.	H&H does not assign dollar figures to any of the events. The 1-Year is not shown out of banks until it reaches station 107 or 13 which is approximately 2600 feet upstream of the mouth. From this point to the upstream limits of the study, the 1-Year is approximately 4 feet above the top of bank.
6	A K Sansom	H&H Section of Appendix A and H&H Appendix	There is a discussion of historical floods contained in the H&H write-up with regards to stages reached. There are not, however, probability events attached to these events (the last event mentioned was something greater than a 100-yr, but that's as specific as it gets. Attaching probability events (i.e., this event was estimated to be a 10-yr event) would help in backing up the claim that millions of dollars of damages occur at very frequent events (1-yr and 2-yr)	H&H typically does not assign frequency to an event. If the flow frequency is recalculated in 10-20 years, it most likely would change. Therefore large magnitude floods are referred to as exceeding the 100-Year event. There are no recording gages on Island Creek and any reference to frequency would have to be correlated to the Logan gage on the Guyandotte River upstream of Logan WV.
7	A K Sansom	Main Report and H&H Appendix	The H&H write-up references Table 6 in the Main Report numerous times. Table 6 in the Main Report is now a Plan Matrix for the 60-ft Channel alternative.	Concur , reference corrected.
8	A K Sansom	Main Report Table 10	Without Project Total Average (Expected) Annual Damages ($6.5 mil) don't seem to match WO EAD in Econ Appendix.	Concur, figures in Table 100 corrected to match the strucute and contents damages.
9	A K Sansom	Main Report p. 26	Under Project Benefits, last line: $3.9, $4.1, and $4.4 mil don't appear to match figures in the Econ Appendix (or vice versa).	Concur, change made.
10	A K Sansom	Main Report Table 13	EXCELLENT!!!!!! :')	No response necessary.

11	A K Sansom	Main Report p. 37	Plan Accomplishments: This section needs to be crosschecked with the Econ Appendix regarding the dollar figures presented. This would be an appropriate place to report on the reliability statistics that result from the FDA program with regards to project performance (although in my humble opinion those statistics do not paint a pretty picture; more on that below).	Concur, sections checked and corrected to match. The reliability statistics are reported in the Economic Appendix.
12	A K Sansom	Econ Appendix, p. 3	Under Methodology: the base year should be the first year that project will 'come on line", i.e., begin creating flood reduction benefits. That cannot be 2002, since construction has not begun. Note: this does not affect the analysis. I have recently had such a comment directed to me. You should re-label the years in your Interest During Construction table. But price levels, interest rates, etc. are unaffected. This just acknowledges in what year the project will begin to work.	Concur, change made to reflect when the project would begin to accrue benefits - FY03. IDC tables reflect the correct years.
13	A K Sansom	Econ Appendix, p.8	GOOD EXPLANATION IN THE METHODOLOGY SECTION OF LINKING THE UNIX PROGRAM AND FDA!!!!!!!	No response necessary.
14	A K Sansom	Econ Appendix	You may want to provide an explanation as to why you have not included a table that shows a breakdown of structures in each of the modeled floodplains. I recently received a HQ comment requesting such information.	Concur, text added to include the number of structures in several different floodplains.
15	A K Sansom	Econ Appendix p. 12	At the beginning of the appendix, you use period of analysis (YIPEE!). Here on p. 12 you use project life (BOO HISS).	Concur, change made.
16	A K Sansom	OH OH!!	I just realized that some of the dollar figures in the Main Report apparently pertain to Structures & Contents benefits. Here in the Econ Appendix (p.15), you report Benefits as Structs & Contents benes AND FWS benes. Maybe you should clarify that in the main report as opposed to changing all of those tables (if this is indeed the case).	Concur, figures adjusted in the main report to include all benefits and text clarification added.

17	A K Sansom	Econ Appendix, Section G.	You may want to add a bit of explanation for Table 14. This tells you what the Expected (or Average) Annual Benefits (Structures & Contents only, not FWS) are for each alternative. Then, for example, you *could* point out that the results indicate that (worst case example) there's a 75% probability that the benefits for the selected 80 ft plan are at least $3,064; and do the same for the 50% probability and 25% probability. This is a tool that enables you to do a sensitivity analysis between plans or different benefit levels within an alternative.	Concur, text added as suggested.

18	A K Sansom	Econ Appendix, p 17-19	You may want to explain this in year-events to match the remainder of the report. What this table basically tells you is the following: Under W/O project conditions there is a 99.9% chance that in a given year, Island Creek will have overbank flooding (no event attached to it, but the target stage is indicative of the stage where significant damages begin. In this case, it's the 1.001001001 -year events, according to the freq-damage curve resulting from the water surface profiles). With the 60ft plan, the folks can expect a 5.5555…-yr flood in any given year (5.55555…=1/18% or 1/.18). With the 80ft plan, the probability of overbank flooding is 9%--corresponding to an 11.11111…-year event and so forth. The long-term risk table again just reports probability of some type of overbank flooding over the next 10, 25, or 50 years with no specific probability event attached (e.g., 1%=100-yr flood). The last column in Table 15 says that "Given that a 10%, 4%, etc., chance event occurred, what is the probability of the target stage—in this case the elevation of the natural riverbank—WILL NOT be exceeded. For the 80ft plan, there is a 62% chance it will contain the 10-yr flood, 6% chance that it will contain the 25-yr flood, 1% chance of containing the 50-yr flood, etc. Not very encouraging reliability statistics, to say the least.	Concur, text added to describe the details regarding the levels of risk.

19	A K Sansom	Appendix A, p. 16 (H&H)	Under R&U Analysis: This paragraph explains that R&U was not done because this is a GRR. Recently, HQ has told Sacramento District that GRRs older than 3 years or so ARE NOT "grand-fathered." Given the fact that HQ has already demanded R&U for Econ, suggest you either double check this claim (potential can o' worms) or re-word this paragraph. Up to you. Same case on p. A-II-12. Also, bottom of this page incorrectly references Table 6 in the Main Report (at least first occurrence). Inundation maps for ALL modeled events with floodplain depths would help tremendously in allowing Economics to calibrate/double check frequency-damage calculations.	H&H concur: As far as I know the Huntington District has not been mandated to complete Risk and Uncertainty. Correct reference made to table in main report. Inundation mapping is not readily available and since the valley is narrow, virtually all structures are affected at most all events only different depths of water. Therefore, in the interest of time and money these maps will not be prepared at this time.
20	A K Sansom	Appendix A, Tab II-2	None of the major storms have probabilities (x-yr events) attached. Such information would help in cataloging historical damages and help justify claims of $2 million of damages for the 1-yr event.	Same as # 6 These calculations change with time. Based on stage, the event could be referenced to current frequency. Normally large events exceed the 100-Year About half of the project reach is inundated by the 1-Year by as much as 4 feet.
21	A K Sansom	Flood Profile Exhibits in H&H Appendix	Is it possible to include the elevation(s) of the stream bank on these exhibits? Again, this would provide Economics with at least H&H modeled justification of reporting such large damages at the 1-yr event. These exhibits show water surface profiles for the events and the streambed, but not for either bank.	Putting bank station on the profile makes it extremely difficult to read. HEC-RAS will plot any variable on the profile, but the Island Creek profiles were generated using HEC-2 and a 41p plot program. Therefore, in the interest of time and money these items will not be prepared at this time.

Comment Number	Reviewer	Document/ Page #	Comment	Resolution
1	KV Miller	General	According to ER 1110-2-1150, there is no report titled Engineering Technical Appendix but instead instructs an Engineering Appendix be prepared. Suggest clarification.	Noted. The report authors have chosen to keep the original ETA name for this report since it does not effect the quality of the information.
2	KVM	General	Why is the ETA referred to as Appendix A? Should consider renaming the various appendices listed with A, B, C and D. It is further confusing to read of the Appendices associated with the EA. Those could possibly be re-labeled as Tabs as they are in the Engineering Appendix to avoid confusion.	Partially concur. Labeled divider sheets have been added to aid the reader in finding the referenced sections.
3	KVM	GRR I. Purpose & Scope Pg 1	Last sentence states report is intended to eliminate need for General Design Memorandum. Check to see if GDM's are still being prepared. Correct term might be Detailed Design Documentation (DDR) phase.	Concur, sentence corrected to properly state the information.
4	KVM	GRR II. Authoriziation	The sub-area of "Study Area" seems out of place under the heading of Authorization. Suggest making it a major heading III.	Concur, change made.
5	KVM	GRR VIII. Reevaluation Efforts, B. Formulation Pg 14, 1st full parag.	Suggest changing sentence from "Primary emphasis was placed on identifying a channel alignment alternative that would provide reductions…" to "Primary emphasis was placed on re-examining channel alternatives that would provide reductions…" so that it is understood that you were re-looking at previously identified alternatives.	Concur, change made.
6		GRR VIII. Reevaluation Efforts, C. NED Pg 14	Change "in the Plan Formulation section of this report" to "in Section IX. Plan Formulation of this report."	Concur, change made.

7	KVM	X. Recommended Plan H. NED Plan and Project Economics pg. 36	Add impact to commercial development into the reasons for selecting 80-ft channel. Could make it reason 3) and move locally preferred plan to 4).	Concur, change made.
8	KVM	XII. Plan Implementation, B. Division of Plan Responsibilities Pg. 37	Add the word "financial" to the sentence that states "with support from the WVSCA".	Concur, change made.
9	KVM	Economic Appendix G. Risk and Uncertainty Pg. 17	Suggest the need to add a discussion of risk and uncertainty methods or procedures at the beginning of this section instead of immediately showing the results.	Concur, text description added.

Island Creek G. .2)
"March 2002"
ITR COMMENTS

Comment Number	Reviewer	Document/ Page #	Comment	Resolution
1	Jay Aya-Ay	EA, Section 2.6	Under Section 2.6 Permits and Other Environmental Compliance. Omit Section 2.6.5 Labeled Cultural Resources Requirements. This discussion should be included in the affected environment and consequences of alternatives section. The discussion currently in the Affected Environment Section should be omitted.	Concur, Section 2.6.5. has been removed and the corresponding text is included in the affected environment and consequences section.
2	Jay Aya-Ay	EA, Section 3.2.5.2	Under Section 3.2.5.2 Preferred Plan. Make reference to USFWS correspondence letters received to date.	Concur, the correspondence with the USFWS has been cited in Section 3.2.5.2.
3	Jay Aya-Ay	Main Report Table 13	In the Major Category **PROJECT DESCRIPTION**, Aquatic and terrestrial <u>mitigation features</u> should be changed to Aquatic and terrestrial environmental <u>design measures</u>. This change is necessary in all three of the channel width columns.	Concur, change made.
4	Jay Aya-Ay	Main Report Table 13	In the Major Category **ENVIRONMENTAL** subcategories **Water Quality** and **Fishery Resources**, the word <u>mitigation</u> should be changed to <u>environmental design measures</u>. This change is necessary in all three of the channel width columns.	Concur, change made.
5	Jay Aya-Ay	Main Report Table 13	In the Major Category **ENVIRONMENTAL** subcategories **Wildlife Resources**, the sentence, "Extensive riparian losses, however lost habitat will be mitigated," should be changed to "Extensive riparian losses, however lost habitat will be replaced with native vegetation." This change is necessary in all three of the channel width columns.	Concur, change made.

Island Creek G (2)
"March 2002"
ITR COMMENTS

Comment Number	Reviewer	Document/ Page #	Comment	Resolution
1	Charles Barry		I have no comments	No changes needed.

Island Creek G (2)
"March 2002
ITR COMMENTS

Comment Number	Reviewer	Document/ Page #	Comment	Resolution
1	R. Craddock	ETA Tabs	Can pages be numbered within individual Tabs? It appears they are numbered in some and in others they are not.	Noted. Yes, this suggestion would improve ease of use of the ETA, however due to time and resource limitations changes will not be made.
2	R. Craddock	ETA TAB VII Table 10.1	Assuming table 10.1 is correct, it is suggested that the reference to the 31 account which is assumed to be the same for all three alternatives be deleted from the last paragraph on the page.	Concur, change made.
3	R. Craddock	ETA TAB VII Table 10.1	It would be good to either in the table or in the narrative identify which of the plans was selected for the 60-ft, 80-ft, and the 100-ft channels.	Concur, change made.
4	R. Craddock	ETA TAB VII Section F	Can you write a sentence or two to explain that the alternatives for the 60-ft, 80-ft, and 100-ft were done in an older MCACES version and updated by Factors to PL 1 Oct 01 and then new quantities were used for the 80-ft channel to develop a BCE? This would help explain what you have in the tables and how they relate to the BCE and/or proposed plan.	Concur, text added.
5	R. Craddock	ETA MCACES Title Page Documentation of Estimate	In item 4 where it states "--- escalation is not included in this estimate.", can it be written to state that "--- fully funded escalation is not included in this estimate.". I think it needs to be clarified that the escalation shown in the estimate is for bringing the estimate to a certain price level.	Concur, change made.

Island Creek ((2)
"March 2002
ITR COMMENTS

Comment Number	Reviewer	Document/ Page #	Comment	Resolution
1	Ralph Ackerman		I have no comments	No changes needed.

Island Creek C (2)
"March 20U2
ITR COMMENTS

Comment Number	Reviewer	Document/ Page #	Comment	Resolution
1	Presley	9	"Component" is misspelled in the last sentence	Concur, change made.
2	Presley	NA	How much sediment will have to be removed per year?	In the engineering Appendix (page A-16) it was estimated that there would need to be approximately 1,500 CY per year (average) of dredging required to maintain the channel.
3	Presley	NA	How many CY of sediment from annual maintenance can be placed at the spoil site?	Based upon the new 2001 mapping, the proposed spoil site design will have right at 100,000 CY of spoil capacity to maintain the project. (See Drawing 06/03 in the ETA. It delineates area for construction and maintenance purposes.) Based upon the answer to #2 above there is enough volume at the spoil site for 67 years.
4	Presley	NA	Will state agencies inspect the riffle structures on a periodic basis?	It is not anticipated that the state agencies would need to inspect the riffle structures because if they are swept downstream, it will just create roughness areas within the stream.
5	Presley	NA	Have annual O&M costs been discussed with the local sponsor?	Yes, the sponsor is aware of the O&M responsibilities.
6	Presley	NA	Does the Logan County Commission have its own Work Force or will maintenance be contracted out?	As long as the sponsor signs the PCA they have agreed to the O&M responsibility and therefore it doesn't matter who would perform the task.

CECW-PC

23 October 2001
Final Response: 1 February 2002

HQUSACE POLICY COMPLIANCE REVIEW COMMENTS

ISLAND CREEK LOCAL PROTECTION PROJECT
LOGAN, WEST VIRGINIA

GENERAL REEVALUATION REPORT
(May 2001)

1. BACKGROUND.

a. Study Area Location. The Island Creek Basin is about 105 square miles of rugged mountainous terrain located in southwestern West Virginia. Three major streams drain the basin—Island Creek, Copperas Mine Fork, and Mud Fork. The study area encompasses the 500-year floodplain of Island Creek at the community of Logan, Logan County, West Virginia.

b. Problem. The project area has experienced numerous damaging floods in the past. A flood with a 1-percent chance of occurring in any year on the 10.4 miles of Island Creek originally under study would inundate approximately 950 residences and 255 commercial structures. Under present conditions, flood damages that would be caused by the 1-percent chance event would exceed $40.5 million (October 2000 prices). The current report focuses on the 500-year floodplain adjacent to Island Creek upstream of its confluence with the Guyandotte River. The GRR cites expected annual damages in the current study area of $6,500,000 under existing conditions.

c. Authorized Project. The project was authorized by Section 401 of the Water Resources Development Act of 1986 (PL 99-662). The authorized project addresses flooding adjacent to a total of about 19 miles of Island Creek (10.4 miles), Copperas Mine Fork (5.1 miles), and Mud Fork (3.9 miles). The plan includes both structural and non-structural components. The structural component of the plan provides for a channel with a 100-foot wide bottom on Island Creek for a distance of 0.7 miles upstream of its confluence with Guyandotte Creek. The lower 1,000 feet was to be a concrete-lined channel. The project area adjacent to remaining 9.3 miles of Island Creek, and both Copperas Mine Fork and Mud Fork, would be treated with a variety of non-structural measures. Non-structural plans call for raising over 1,200 residential structures, flood proofing about 80 non-residential structures in-place, and relocating over 500 other structures to flood-free housing and community development sites. The project was authorized at a cost $86 million (October 1984 Prices).

d. Study Authority. The project was authorized by Section 401 of the Water Resources Development Act of 1986. PED was initiated in 1989. It was found that the non-structural costs included in the project had been significantly under estimated in the feasibility phase.

CECW-PC
Subject - HQUSACE Policy Compliance Review Comments - Island Creek Local Protection Project, Logan, West Virginia, General Reevaluation Report (May 2001)

The inclusion of the non-structural features would have led to an uneconomical project; therefore, they were dropped from consideration. The sponsor, the Logan County Commission, subsequently concluded in 1993 that they were unable to financially support the project at that time; consequently, PED studies were suspended. In 1998, PED resume with the financial sponsorship of the West Virginia Soil Conservation Agency resulting in the current General Reevaluation Report and Environmental Assessment. The current report documents the reevaluation of the authorized project features to confirm economic feasibility and document the NED plan.

Clarification – During the early stages of PED (1990), it was determined that the actual costs associated with raising structures in place were significantly higher than those used during the Feasibility Phase to estimate project costs for the authorized project. This determination was based on the District's experience with other ongoing nonstructural projects. However, no detailed reevaluation or determination of economic feasibility of the nonstructural component of the authorized project was completed at that time because no qualified non-Federal sponsor who supported implementation of the nonstructural component had been identified. The decision was made to defer reevaluation of the nonstructural component until a future date when such updated information would be needed to make decisions regarding implementation of this component. There was recommendation to modify the authorized project at that time, and ORD concurred with the decision to defer this reevaluation.

The Logan County Commission had expressed interest in the implementation of the structural component (0.7 mile of channel modification) of the authorized project. PED efforts during this time period consisted of a reevaluation and preliminary design of the structural component of the authorized project. In 1993 the Logan County Commission formally notified the District that they were unable to financially support the project at that time and requested that project implementation be deferred until they could identify additional funding assistance. All PED activities were suspended at that time.

In 1998, at the request of the Logan County Commission with financial support from the West Virginia Soil Conservation Agency (WVSCA), PED activities were resumed. The WVSCA and the Logan County Commission requested that PED activities be directed towards the reevaluation of the structural component of the authorized project and that reevaluation of nonstructural measures continue to be deferred until additional funding sources could be identified. The current GRR presents a reevaluation of only the structural component documenting economic feasibility, optimization of project scope, NEPA compliance and minor design changes. The report concludes that the deferral of the reevaluation of the nonstructural component should continue and does not recommend any significant changes to the Island Creek Local Protection Project authorized in WRDA 1986.

CECW-PC
Subject - HQUSACE Policy Compliance Review Comments – Island Creek Local Protection Project, Logan, West Virginia, General Reevaluation Report (May 2001)

e. Recommended Plan. The recommended improvements are slightly smaller in scope than the project authorized by WRDA 1986. The recommended plan provides for trapezoidal channel with an 80-foot bottom width on Island Creek for a distance of 0.7 miles upstream of its confluence with the Guyandotte River. The ~~plan~~ channel configuration includes two discontinuous post and panel wall segments totaling 1,290 linear feet, to ~~protect specific commercial structures~~ minimize impacts to existing commercial development. An existing sand bar located approximately 400 feet upstream of the confluence of Island Creek and Copperas Mine Fork would be removed. Additional plan components include a flood warning system (FWS) and aquatic and terrestrial ~~mitigation~~ environmental design features. One commercial structure and an outbuilding on the property of an existing business would be removed ~~and another relocated~~ to accomplish the required channel widening. The total length of the project is about 4,500 feet. The report indicates that the channel widening would allow this stream segment to handle runoff from storms with an average recurrence interval of 10 to 20 years. Nine new gages and one upgraded gage would be associated with the proposed FWS. These gages would be located on Island Creek (4), Copperas Mine Fork (3), Trace Fork, Mud Fork, and the Guyandotte River. The Logan County Commission will serve as the non-Federal Project sponsor. The West Virginia Soil Conservation Agency will provide the non-Federal share of project costs.

f. Economic Evaluation. The estimated initial cost of the project is $20,774,000 at October 2000 prices. This amount includes $6,933,000 for LERRD and $227,000 to implement the proposed FWS. Based on a 6.375 percent discount rate and a 50-year period of economic evaluation, equivalent annual benefits are cited as $3,830,000. Equivalent annual costs are estimated as $1,690,000, including $73,000 in equivalent annual OMRR&R costs. Indicated equivalent annual net benefits are $2,140,000. The indicated ratio of benefits-to-costs ratio is 2.3 to 1.

2. **REVIEW SUMMARY**. The GRR does not comply with current policy in regard to employing analyses of risk and uncertainty for flood damage reduction studies. The basis of the flood damage reduction benefits claimed is not documented in the GRR. Additional review concerns include cost apportionment, plan formulation, environmental policy compliance, local cooperation and real estate.

3. **PROJECT DESCRIPTION**. Inconsistent descriptions of the project are cited throughout the GRR. Portions of the report indicate that two commercial structures would be "removed"; other sections cite one commercial relocation. The GRR should be revised to consistently describe the recommended plan throughout the report.

Response - The proposed project will require acquisition/removal of one commercial structure (Super 8 Motel) and a small outbuilding located near the stream on the

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property of an existing business (Baisden Hardware Store). Text will be revised throughout the report for consistency and to accurately describe commercial acquisitions.

4. **POST AUTHORIZATION CHANGES.** There is no evaluation of post authorization changes in the GRR; however, the recommended plan appears to have a significantly different scope, output, and cost from the authorized project, due to the elimination of the flood proofing and raising features and reduction in channel width from 100 to 80 feet. The Ohio River Division gave its approval to defer the evaluation of the uneconomical non-structural components in 1991. However, the revised GRR should present sufficient information to address the significance of the post authorization changes and to determine the appropriate authority for approval of changes, including the decrease in project costs relative to Section 902.

Response – The GRR does not recommend any significant changes to the Island Creek Local Protection Project authorized in WRDA 1986. The authorized project consists of both structural and nonstructural components. This report recommends implementation of the structural component (0.7 mile of channel modification) of the authorized project as a separable element and a flood warning system (non-structural). The structural component recommended in this report differs slightly from the original structural component identified in the Island Creek Feasibility Report dated March 1985. The design of the channel modification has been refined in response to changes in the project area and the availability of additional engineering data. Changes to the scope, costs and outputs related to the structural component are relatively minor and are primarily related to design refinements. At the request of the local sponsor and with the concurrence of LRD, the evaluation of the nonstructural components of the authorized project has been deferred. Any discussion of post authorization changes and appropriate authority for approval should be postponed until such time that entire project has been reevaluated and significant changes identified.

5. **RISK AND UNCERTAINTY ANALYSIS.** The GRR indicates that risk and uncertainty analyses as required by ER 1105-2-100 were not completed for the current proposal. The GRR should be revised to comply with current policy in regard to R&U analyses for flood damage reduction studies.

Response - The risk and uncertainty analysis required by ER 1105-2-100 will be performed for the current proposal and the results incorporated into the main report and the economic appendix of the GRR.

6. **ECONOMIC EVALUATION.** ER 1105-2-100, appendix G, paragraph G-9.h.(3) states the following: "Detailed economic data and any derivations from that data to support plan

formulation, forecasts, and detailed explanations of benefits should be provided. Describe the with and without project physical, biological and economic conditions of the study area and how each category of benefits was computed." The GRR does not include an economics appendix. There is only minimal information on the derivation of flood damage reduction benefits claimed. The main report provides some information about the substantially larger project area that was associated with authorized project. However, there is no information on the numbers and types of structures subject to flooding in the current evaluation. There is no information on structure and content value assumptions, etc. Absent this information, the reasonableness of the evaluation can not be assessed. Additionally, Table 10 of the GRR indicates that without-project damages are 9.7 million while table 12 indicates "base condition" damages as $6.5 million. Details of the economic evaluation should be included in the revised GRR.

Response - An economic appendix will be prepared to provide detailed information about the flood damage analysis. A summary of the economic evaluation will also be incorporated in the main report. Text will be added to the main report and the economic appendix to clarify the difference between the authorized project area and the area impacted in the current analysis. Table 10 results will be modified so that existing damages match with Table 12.

7. **POST AND PANEL WALL SEGMENTS**. Notes to the M-CACES estimate state that the two post and panel wall segments are included in the plan to avoid acquisition of two commercial structures on the left descending bank of Island Creek. The revised GRR should document that the cost of each wall segment is less than the cost of structure acquisition. Verify that the recommended plan is the NED plan.

Noted. The statement in the M-CACES is inaccurate and will be deleted. The recommended project (with the two post and panel walls) produces the greatest net benefits when compared to other plans with and without the walls as shown in Table 10. Clarification: Post and panel walls as presented in the report represent segments of the channel configuration not a flood wall type structure.

8. **FLOOD WARNING SYSTEM**. A flood warning system is included in the final array of alternatives leading to the selection of the recommended plan. However, it is not evident that there was an explicit analysis of the benefits and costs of the system or whether it would reduce the benefits attributed to the structural features by increasing the time available for temporary evacuation of damageable property from the flood plain. The GRR should demonstrate that the FWS is economically justified.

Response – The FWS will be considered a nonstructural component of the recommended project. An analysis will be prepared to demonstrate that the FWS is justified based on its cost and the estimated reduction to residual damages within the project area.

9. **SUNK PED COSTS**. The M-CACES estimate shows $2,000,000 assigned to "post feasibility studies." Verify that all past PED expenditures have been included in the estimate of total project costs to be apportioned. Note that sunk PED expenditures should not be included in the current economic evaluation of alternatives.

Response - The sunk PED expenditures will be removed from the economic evaluations and the correct results incorporated into the GRR.

10. **COST SHARING**. Since the project was authorized in WRDA 1986, cost sharing as specified in section 103(a) of this Act appears to be applicable. The project proposal includes both structural and non-structural components. Cost sharing requirements are slightly different for these components—the minimum 5 percent cash requirement is not applicable to non-structural flood control features. Verify that cost sharing shown in the report is correct.

Response – As stated in comment #8, the FWS will be considered a non-structural component and the appropriate language regarding cost sharing will be added to the text.

11. **ENVIRONMENTAL POLICY COMPLIANCE REVIEW.**

a. Mitigation Versus "Sound Environmental Design Practice." The report consistently points out that project will have minimal environmental impacts; however the Executive Summary also states that aquatic and terrestrial mitigation features will be constructed. In paragraph 2.5 (*Environmental Design Measures*), of the Environmental Assessment various "mitigation" elements such as riffle/pool complexes, planting of native vegetation, etc. are proposed. Several plates included in the EA identify "deciduous tree planting area for on-site mitigation" and "typical section" for riffle structures. These measures are proposed to mitigate for loss of riparian habitat, loss of upland and bottomland hardwoods, and for disturbance of aquatic and benthic life. How were these measures selected and what coordination took place to decide which measures would be appropriate? The remainder of the report (text, cost estimates, etc) is virtually silent on mitigation. Recommended mitigation features need to be fully justified. Such justification must be based on determination of significance of losses, incremental analysis, and cost effectiveness, etc. See ER 1105-2-100, Appendix C, paragraph e., beginning on page C-15. Based on the scant information provided in the GRR, in this instance, rather than mitigation, this appears to be a case of "sound environmental design". The report needs to be modified to both fully describe and justify any mitigation features or reflect that these features are simply sound environmental design features.

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Response - During 1993, the project recommended implementation of the structural component as a separate element and the non-structural element was deferred. The structural component consisted of construction of channel modifications along the 0.7 mile of lower Island Creek and a spoil area at Wilkinson. At that time, a draft EA was circulated to the resource agencies but was not completed with a FONSI. A planning aid letter (PAL) was received from the USFWS during this time.

In 2000, the project was looked at again and it was decided by the District that the impacts were not significant enough to warrant mitigation measures, but that environmental features, developed in cooperation with resource agencies, were incorporated into the design. Also, in late 2000, the decision was made to utilize an existing disposal site at Schoolhouse Hollow rather than using the Wilkinson site. This change decreased the environmental impacts of the project. The report will be changed to reflect that these features are simply sound environmental design features.

The EA will reference that the PAL and coordination letters may be found in Appendix C

b. Coordination. The report references (See FONSI and USFWS letter dated February 6, 2001) a December 1993 USFWS Planning Aid Letter (PAL). The PAL should be included in the report. On page 15 under Public and Agency Coordination, it is stated that agencies would receive documents. At this stage of project planning, coordination should be in its final or completed stages. Has a Public Notice (PN) gone out for public review and comment?

Response - The PAL will be included in the report. The tense of the sentence is incorrect. Public Notice (PN) may be found in Appendix A labeled as Notice of Availability (NOA). The NOA advised the public that the document was available for review and comment from January 5, 2001 through February 5, 2001.

c. Status of Environmental Compliance. Several statements are made on pages 7 and 8 of the Environmental Assessment (EA), dated May 2001, that coordination will or would be obtained for Water Quality Certification and the Fish and Wildlife Coordination Act. The EA also states that if significant historic properties are encountered then appropriate mitigation measures will be incorporated, and the Corps will fully comply with Section 106 consultation. Since this is the Final EA, coordination and compliance with appropriate agencies should be completed and not deferred to a later time. The Coordination Act Report from the US Fish and Wildlife Service should be included, as well as responses to recommendations resulting for Federal and state agency comments resulting from the coordination (see ER 1105-2-100, Appendix C, paragraph c.(1)(a), as an Appendix to the Final EA.

Response - Coordination with the US Fish and Wildlife has occurred since the beginning of this project. Please refer to the PAL (1993) and two supporting letters received by this district within the last year. A Coordination Act Report was not prepared by the USFWS since the project to be implemented was not found to significantly impact the resources. The PAL and the correspondence letters may be found in Appendix C.

The 404(b)(1) analysis has been completed and is located in Appendix B. The State 401 Water Quality Certification dated May 17, 2001, has been received and is included in Appendix B.

Coordination with the State Historic Preservation Office has occurred. The EA will have a reference to the location of the coordination letters dated January 31 and April 27, 2001 and the Cultural Resources Reconnaissance Report for the Island Creek LPP dated April 2001. All references are located in Appendix C.

The EA will be revised to reflect the completion of the compliance issues referenced in the comment.

d. Water Quality. Page 11 of the EA mentions that water quality is poor in the study area and that "Abandoned deep mines are a major source of acid mine drainage" and that "Untreated domestic sewage is a serious problem". These issues, as well as, siltation and turbidity concerns should be addressed for the Water Quality Certification. There is a statement that an erosion control plan would be prepared. The GRR should address the state of erosion control or other plans that have been prepared or that are in preparation.

Response - The WV Water Quality Certification was received by this district on May 17, 2001. The 404 (b)(1) Analysis addressed the issue of erosion control plans by using Best Management Practices. The EA will reference the location of the 404(b)(1) Analysis in Appendix B.

e. Endangered Species Act Compliance. Page 12 under Endangered Species, the EA mentions effects to the Indiana bat and its habitat "would have an infinitesimally small chance of resulting in direct or indirect take". Has a Biological Assessment been made, as required by ER 1105-2-100, Appendix C paragraph .c.(2)(a)(1) and has the US Fish and Wildlife Service issued a Biological Opinion, or a letter of concurrence with a finding of "no adverse effect" as described in paragraph c.(2)(b)(2)?

Response - The February 6, 2001 letter received from the Fish and Wildlife Service indicated in paragraph two that "We indicated that projects disturbing less than 17 acres of potential Indiana bat summer foraging and roosting habitat were considered by the Service to have a very small chance (at the 98% confidence level) of resulting in direct or indirect take." Also, in the third paragraph the FWS stated "Therefore, *the Service*

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considers the proposed action discountable and unlikely to adversely affect the Indiana bat. Therefore, no further Section 7 consultation under the Endangered Species Act (87Stat. 884, as amended; 16 U.S.C. 1531 et seq.) is required."

f. Cultural Resources. Page 12 under Sensitive Cultural Resources, there is no discussion. Page 14 under Cultural Resources, there is mention of a literature investigation. A literature search is only the beginning of the compliance process, further investigations are required to locate, identify and evaluate historic properties that will be impacted by project construction. This should include historic assessments and determinations of eligibility for the buildings and structures that will be removed or altered by project activities. The EA also states that, "If significant historic properties are encountered during construction, appropriate mitigation measures will be incorporated". The National Historic Preservation Act requires agencies to locate and evaluate historic properties and to mitigate for potential impacts before construction starts. The report should include documentation of concurrence of findings from SHPO.

Response - A discussion under Sensitive Cultural Resources will be written to explain briefly what is considered sensitive cultural resources.

The Island Creek Cultural Resources Report (located in Appendix C) was performed by this district in April 2001. Correspondence with WVSHPO indicated their concurrence with the findings of the report. Both entities concluded that two historically significant structures (Appalachian Power Company building and the CSX railroad bridge) were located adjacent to the project but will not be affected by the project. An April 27, 2001 letter from the WVSHPO concluded that the proposed activities would have *No Adverse Effect* on these two structures. The correspondence with the WVSHOP is located in Appendix C.

g. FONSI. The FONSI states under section 2.b. that "No archeological resources are recorded in the project area". As commented above, a literature search is only the beginning of the cultural resources compliance process. The appropriate investigations should be completed and coordinated with the State Historic Preservation Officer (SHPO). Under section 2.d. of the FONSI, reference to the proper citation should be Section 106 and 32 CFR Part 800.

Response - The proper documentation of investigation was recorded in the Island Creek Local Protection Plan Cultural Resources Reconnaissance Report. The report was provided to the WVSHPO and this district received a response concerning the Reconnaissance Report on April 27, 2001 that indicated no further action was necessary.

h. Cultural Resources. The Cultural Resources Reconnaissance Report does not mention the buildings and bridges that will be altered or removed, and therefore, impacted by project activities.

Response - The Super 8 Motel and the outbuilding on the Baisden Hardware Store property were not included in the Cultural Resources Reconnaissance Report because both building are less than 50 years old and are obviously not eligible for inclusion in the National Register.

12. **DISTRICT LEGAL REVIEW**. The subject report was submitted without evidence that the District Office of Counsel has certified it as legally sufficient. This certification is required in order for the Office of the Chief Counsel to complete its review. Certification of legal review should be submitted with the revised GRR.

Response - A signed certification sheet will be added to the GRR.

13. **MULTIPLE SPONSORS**. The report identifies the Logan County Commission, West Virginia as the local sponsor with financial support from the West Virginia Soil Conservation Agency. Current Corps policy places a high preference on implementing a project through a secure partnership with a single sponsor. It is not uncommon for sponsors to enter into cooperative arrangements or sub-agreements with other entities to enable it to provide all aspects of its required cooperation. However, the Corps normally prefers to avoid the additional burden of reviewing the capabilities and commitment of such third parties and relying upon cooperation among various parties during project implementation. If multiple sponsorship is deemed to be absolutely necessary, the report should document whether and in what manner any local cooperation requirements will be divided among multiple parties, including assignment of liability risk.

Response - A single agreement is anticipated with the Logan County Commission.

14. **ITEMS of LOCAL COOPERATION**. Pages 35 to 38 of the report contain an inaccurate and incomplete description of local cooperation requirements for the project. A complete and accurate list is required. The Office of Chief Counsel, HQUSACE offers the following draft list. The District should review this list carefully, with the assistance of its Office of Counsel, and revise it further as needed to address the needs or the current project.

a. Provide a minimum of 25 percent, but not to exceed 50 percent of total project costs as further specified below:

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(1) Enter into an agreement which provides, prior to execution of the project cooperation agreement, 25 percent of design costs;

(2) Provide, during construction, any additional funds needed to cover the non-federal share of design costs;

(3) Provide, during construction, a cash contribution equal to 5 percent of total project costs assigned to structural flood control;

(4) Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations determined by the Government to be necessary for the construction, operation, and maintenance of the project;

(5) Provide or pay to the Government the cost of providing all retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring features and stilling basins, that may be required at any dredged or excavated material disposal areas required for the construction, operation, and maintenance of the project; and

(6) Provide, during construction, any additional costs as necessary to make its total contribution equal to at least 25 percent of total project costs.

b. Give the Government a right to enter, at reasonable times and in a reasonable manner, upon land which the local sponsor owns or controls for access to the project for the purpose of inspection, and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the project.

c. Assume responsibility for operating, maintaining, replacing, repairing, and rehabilitating (OMRR&R) the project or completed functional portions of the project, including mitigation features without cost to the Government, in a manner compatible with the project's authorized purpose and in accordance with applicable Federal and State laws and specific directions prescribed by the Government in the OMRR&R manual and any subsequent amendments thereto.

d. 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 non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element.

e. Hold and save the Government free from all damages arising for the construction, operation, maintenance, repair, replacement, and rehabilitation of the project and any project-related betterments, except for damages due to the fault or negligence of the Government or the Government's contractors.

f. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project to the extent and in such detail as will properly reflect total project costs.

g. Perform, or cause to be performed, 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 USC 9601-9675, that may exist in, on, or under lands, easements or rights-of-way necessary for the construction, operation, and maintenance of the project; except that the non-Federal sponsor shall not perform such investigations on lands, easements, or rights-of-way that the Government determines to be subject to the navigation servitude without prior specific written direction by the Government.

h. Assume complete financial responsibility 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 Government determines necessary for the construction, operation, or maintenance of the project.

i. Agree that, as between the Federal Government and the non-Federal sponsor, the non-Federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and, to the maximum extent practicable, operate, maintain, repair, replace, and rehabilitate the project in a manner that will not cause liability to arise under CERCLA.

j. Prescribe and enforce regulations to prevent obstruction of or encroachment on the Project that would reduce the level of protection it affords or that would hinder operation or maintenance of the Project.

k. 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 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR part 24, in acquiring lands, easements, and rights-of-way, and performing relocations for construction, operation, and maintenance of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act.

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l. Comply with all applicable Federal and State laws and regulations, including Section 601 of the Civil Rights Act of 1964, Public Law 88-352, 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 Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), requiring non-Federal participation and implementation of floodplain management plans;

m. 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, in accordance with the cost sharing provisions of the agreement;

n. Participate in and comply with applicable Federal floodplain management and flood insurance programs;

o. Do not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is authorized.

p. Inform affected interests, at least annually, regarding the limitations of the projection afforded by the project.

Response - The GRR will be revised accordingly.

15. **REAL ESTATE.**

a. General. The Real Estate Plan submitted as a part of the General Reevaluation Report meets the requirements of Chapter 12, section of ER 405-1-12. The district has done a thorough job in determining the acquisition criteria for the project.

b. Relocations Assistance. Paragraph 8 of the Real Estate Plan refers to Public Law 91-646 Relocation Data. Although it would have been more accurate to title it "Relocation Assistance Data", the paragraph correctly describes the types of benefits that are available to persons displaced from businesses and residences. However, the summary version found in paragraph B of Page 30 of the main report is misleading. Residences are not relocated and neither are businesses. In the second paragraph, the sentences should read, "No residences are to be acquired. There is one commercial acquisition."

Response - The text in the main report will be revised as suggested.

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16. **DESIGN DOCUMENTS**. The text indicates that the reevaluation report contains sufficient detail to eliminate the need for a GDM and proceed with the preparation of project plans and specifications. Note that ER 1110-2-1150 replaces the General Design Memorandum with an Engineering Documentation Report (EDR), which is a living document that continues through the preparation of Plans and Specifications. The revised text should state that the PED will consist primarily of the preparation of Plans and Specifications and that documentation in the EDR would be minimized based on the detail contained in the GRR.

Response - Text will be revised to indicate that a Design Documentation Report (DDR) will be prepared. Upon approval of the design, we will proceed with Plans and Specifications and update the DDR as these develop.

17. **AUTHORIZED PROJECT**. The subject GRR makes many references to the "authorized" project. Recommend revising these references to the "original" project. Thus, the report will distinguish between the two plans as the original project and the recommended project.

Response – As previously stated, the GRR does not recommend any significant changes to the Island Creek Local Protection Project authorized in WRDA 1986. The report recommends implementation of the structural component of the authorized project (0.7 mile of channel modification) as a separable element and deferral of the implementation of nonstructural measures. The structural component recommended in this report differs slightly from the structural component presented in the Feasibility Report due to design refinements. The report will be revised to distinguish between the "original" structural component and the "recommended" structural component. A discussion of the changes will be included in the report.

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